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## Effective Technology Integration Strategies Supply Chain Managers Use to Enhance Profitability

Wayne Benson  
*Walden University*

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# Walden University

College of Management and Human Potential

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Wayne Benson

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2025

Abstract

Effective Technology Integration Strategies Supply Chain Managers Use to Enhance  
Profitability

by

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Research Project Submitted in Partial Fulfillment  
of the Requirements for the Degree of  
Doctor of Business Administration

Walden University

December 2025

## Abstract

Information technology (IT) supply chains need innovative technology integration strategies to create and maintain a competitive advantage. IT supply chain managers who lack effective technology supply chain integration strategies risk decreased competitive advantage and reduced profitability. Grounded in the Technology Acceptance Model, the purpose of this qualitative pragmatic inquiry project was to identify and explore the effective innovative technology integration strategies supply chain managers use to enhance profitability. Participants consisted of six IT and supply chain managers with at least 5 years' experience in integration of technology into supply chains. Data was collected through semi-structured interviews and a review of publicly available documents about their innovative technology integration strategies. Using thematic analysis, five themes emerged: using return on investment as a value metric, developing stakeholder engagement and buy-in, overcoming challenges in technology adoption, reducing employee resistance to technology and mitigating risk in technology integration. A key recommendation is developing strategic alignment and buy-in from value chain stakeholders and management. The implications for positive social change include the potential for business leaders and supply chain stakeholders to enhance operational efficiencies, which may reduce prices and expand access to IT products and services for low-income consumers, thereby supporting healthier, more financially stable, and more inclusive communities.

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## Dedication

I dedicate this dissertation to my wife, Anna, and my children, Marvin and Jostin. I thank you from the bottom of my heart for your patience and understanding. Your unwavering support and belief in me have been the foundation of this achievement, and I could not have reached this milestone without your support.

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## Section 1: Foundation of the Project

### **Background of the Problem**

Technology has become an essential catalyst in the business world, inspiring organizations' continuous process improvement and development to provide competitive advantage. Supply chains managers have recently encountered innumerable challenges and disruptions that have inhibited manufacturing and the timely delivery of products and services. Global pandemics and natural disasters have exacerbated the problem, making it increasingly challenging for businesses to maintain a stable supply chain and satisfy consumer expectations (Zhao et al., 2023). Understanding the internal and external factors that affect supply chain stability is the first step for developing effective strategies to minimize the impact of these disruptions.

Supply chain disruptions can be attributed to internal factors as well as external factors as technology becomes more ubiquitous. Internal factors, such as inefficiencies in production processes, mismanagement of inventory, or communication breakdown within the organization may contribute to disruptions in the supply chain (Fidelibus, 2024). Internal disruptions, such as equipment failure and poor contingency planning, can lead to delays that may cause businesses to incur significantly higher costs, leading to consumers experiencing unmet expectations and dissatisfaction (Hamidu et al., 2023). The volatile nature of a globally connected economy makes supply chains susceptible to fluctuating inflation and escalating costs of goods and services (Moosavi et al., 2022). While internal disruptions can significantly impact supply chains, it is important to note

that external economic conditions also play a role in affecting supply chain dynamics. External factors such as economic conditions, inflation and the subsequent increase in the cost of goods and services have forced many businesses to find alternative routes for deliveries, cheaper materials, and alternative suppliers to meet demand while maintaining profitability (Moosavi et al., 2022). The challenge for supply chain managers is to determine how to maintain profitability as they encounter disruptions and fluctuations in economic conditions. To address internal and external disruptions, managers must implement a robust risk management strategy and remain proactive and vigilant to anticipate problems prior to escalating beyond manageable levels (Steward, 2024). The use of cutting-edge technology and software can assist supply chain managers in accomplishing this task.

Technological advances have become ubiquitous, causing a transformation in how businesses operate and engage with customers. Currently, businesses have access to mass amounts of data via social media, mobile applications, loyalty programs, surveys, questionnaires, and website analytics to identify consumer expectations, preferences, and interests. To stay competitive, businesses are increasingly leveraging innovative solutions. Businesses have turned to technology to minimize the effect of disruptions, lower costs, and increase communication with stakeholders throughout the supply chain in real-time (Smith, 2024). The reliance on innovative technology has led to significant improvements in operational efficiency and strategic planning.

Reliance on innovative technology to mitigate disruptions requires at least some level of supply chain agility to quickly adapt to changing conditions, optimize resource allocation, and maintain optimal operations, even in the face of unforeseen challenges. The proliferation of innovative technology has permitted businesses to improve operations by providing real-time data, bolstering informed decision-making, and generating accurate forecasting, thereby enhancing supply chain agility (Zhang et al., 2024). Businesses have begun to use a myriad of technologies over the past five years to increase operational efficiency and supply chain stability. Technological advances such as artificial intelligence, blockchain technology, Internet of Things (IoT), robotics, drones, RIFD technology, augmented reality, high-speed mobile networks, cloud computing, and data analytics have revolutionized how business delivers goods and services (Reis et al., 2020). Finding the technology to best fit the needs of the organization is challenging and a daunting task to consider.

In the supply chain literature, there is no single technological innovation that universally applies to all business functions and all industries. The greatest challenge for supply chain managers is to determine which technology can be incorporated into their supply chain strategy to enhance functionality and profitability (Raj et al., 2022). To address the challenge of evaluating and selecting technologies aligned with business objectives, supply chain managers need to conduct thorough assessment of operational needs and goals. There are a variety of methodologies and strategies that supply chain

managers have at their disposal to determine the appropriate technology for their business.

When determining the types of technology needed to enhance supply chains, managers consider several key factors. Primarily, managers stay informed on emerging technology, utilize pilot testing, determine scalability of the current supply chain, perform a cost-benefit analysis and consider the applicability of the new technology before full-scale implementation (Sharabati & Jreisat, 2024). Some supply chain managers identify pain points and regions of the supply chain susceptible to bottlenecking, delays or high costs (Katwaliaki et al., 2022). By aligning technology investment with organization goals and objectives managers are better able to effectively address challenges while capitalizing on opportunities to drive growth and efficiency.

The extant literature on technology integration in supply chains emphasizes the importance of developing a comprehensive technology strategy, engaging stakeholders in decision-making, and establishing a pre-adoption plan. According to Smith (2024), by incorporating technology into facets of the existing infrastructure and the systematic coordination of activities via procurement, production, and logistics, operations become more cost-effective and more expedient. The purpose of this study was to identify gaps in the literature and suggest actionable strategies supply chain managers can apply to overcome technology integration challenges to enhance profitability.

### **Business Problem Focus and Project Purpose**

The introduction of a vast array of new technologies has created new opportunities to enhance business operations and profitability. Additionally, the COVID 19 epidemic created supply chain disruptions globally, causing businesses to reexamine current supply chain infrastructures to determine how to minimize the effect of external disruptions (Steward, 2024). Supply chain managers are faced with the challenge of determining how, when, and where technology can be incorporated to utilize new technology effectively, minimize risks, and generate high levels of profitability (Katsaliaki et al, 2022). An objective to effective supply chain management is to create a technology strategy that addresses internal and external disruptions to enhance profitability.

The general business problem that prompted me to research the topic is that some supply chain managers lack effective innovative technology integration strategies to enhance business performance and profitability. The specific business problem is that some supply chain managers lack effective innovative technology integration strategies to enhance profitability. The purpose of this qualitative pragmatic inquiry study was to identify and explore the effective innovative technology integration strategies supply chain managers use to enhance profitability. Supply chain strategies are provided in this research study to showcase success stories and identify a variety of best practices that enhance supply chain performance and profitability. The target population for this study included six supply chain managers who have been involved in incorporating innovative

technology into their supply chain. Each participant participated in a semi structured interview in the United State to allow to gather primary data. The conceptual framework for this study was the technology acceptance model (TAM) developed by Fred Davis in 1989.

### **Research Question**

What effective technology innovation integration strategies do supply chain managers use to enhance profitability?

### **Assumptions and Limitations**

#### **Assumptions**

Assumptions are the elements of the study that are out of the researchers' control but are essential to report to lend credibility and reliability to the research. The assumptions are deemed to be factual but are not verifiable in a study due to constraints in time, participant limitations, and cost (Kirkwood & Price, 2014). In this study, it was assumed that the results from the sample population were relevant, generalizable, and pertinent to the overall supply chain manager population (Johnson et al., 2020). The assumptions are necessary to ensure that the findings are applicable to real world issues and concerns.

In qualitative research, it is assumed that the information and data obtained from the interviews was accurate and reflects the events and practices reported by the participants. Assuming the information and data gathered accurately reflects the experience of the participants is useful for enhancing the trustworthiness of the findings

(Noble & Smith, 2025). This assumption is critical for ensuring the validity and reliability of the research findings (Kieu et al., 2025). By adhering to these assumptions, I ensured that the data collected helped to facilitate accurate measurement and analysis of the phenomenon.

Addressing the assumptions related to participant knowledge base is an effective means for ensuring the researcher can obtain reliable and rich data. The level of expertise of the participants can only be assumed after recruitment. As the researcher, I developed a recruitment letter with specific requirements to ensure that the pool of participants has the desired qualification. The assumption was that the participants had expertise and experience in supply chain management related to technology adoption. In this study, it was assumed that the participants responded without researcher bias or participant bias (Kieu et al., 2025). The process used to mitigate the effects of the limitations is discussed more extensively later in the study but includes adequate sampling, data saturation, and thick description of the data.

### **Limitations**

When conducting qualitative research, it is imperative to acknowledge the inherent limitations that can influence the outcome of the study. In qualitative research, limitations are the aspects of the study that are outside of the researchers' control (Ross & Zaidi, 2019). There are several constraints in this study that relate to the research methodology and design that was addressed. The constraints revolve around the limitations linked to research methodology, design, sample size, data collection

techniques, resources, or time issues (Yadav, 2022). The primary limitations that were discussed in this study involve anonymity concerns, as participants may have been hesitant to share sensitive information for fear that it could jeopardize their position with their company.

### ***Misinterpretation***

Language misinterpretation can significantly hinder comprehension and effective communication. Misinterpretation of this nature can lead to misunderstandings that can affect the accuracy and reliability of the data (Clark et al., 2025). To minimize misinterpretation, the interview questions were tailored to incorporate common business terminology related to supply chain management. To minimize the potential for misinterpretation, I employed these strategies to ensure that the data that were collected are both accurate and reliable.

### ***Lack of Experience***

Conducting interviews requires careful consideration and preparation to ensure the data is accurate. When conducting interview studies, the lack of experience conducting interviews can lead to valuable and pertinent data to be overlooked (Kohler et al., 2022). To prevent misinterpretation in qualitative research, several strategies can be employed including training preparation, pilot testing, use of clear and simple language, member checking, and triangulation (Clarke et al., 2025). These strategies were used to enhance the reliability of the data collected.

### *Addressing Bias*

In qualitative research, addressing bias is crucial to ensure the validity and reliability of the findings. The participants may give socially desirable responses that may not accurately mirror their experiences and outcomes. The researchers and participants' bias and desire to give socially desirable responses can influence subjective evaluation and points of view (Bergen & Labonté, 2020). The methods used to mitigate the effect of bias are discussed in detail, including methodological triangulation and transparency to identify questionable responses to use cross-verification of the data to enhance validity. By implementing these strategies, the impact of bias can be minimized to improve the quality of the research.

### **Transition**

Section 1 included a discussion of the background of the problem, the business problem, the focus and purpose of the study, the research question, the assumptions, and the study's limitations. Section 2 will include a review of academic literature, and the conceptual model used to ground this study. Section 3 is focused on ethical considerations in research methodology, the nature of the project, the sampling methodology, data collection techniques and procedures, a list of interview questions, data analysis, reliability, and validity. Section 4 will include a presentation of findings, implications for social change, recommendations for future research, and a conclusion.

## Section 2: The Literature Review

### **A Review of Professional and Academic Literature**

The integration of innovative technologies in the supply chains is central for enhancing efficiency and profitability. The implementation of new technologies requires a well-developed strategy that includes extensive planning, alignment with organizational objectives, and acceptance from employees and stakeholders (Phadnis, 2024). A well-designed technology strategy will provide a roadmap to enable managers to anticipate potential risks and manage internal and external disruptions (Chatha et al., 2024). A coherent technology strategy also aids in providing a strategically congruent organizational alignment ensuring that all nodes and departments work together to achieve a common goal (Liu et al, 2022). An in-depth analysis of the research on technology adoption is presented to identify common strategies used by supply chain managers.

The following literature review constitutes a rigorous analysis and synthesis of the sources, articles, dissertations, and pertinent data related to my project. Various academic databases assessable via the Walden University Library were utilized in the analysis. The databases used for the literature review include IEEE Xplore Digital, APA PsycInfo, Complimentary Index, Computers & Applied Science Complete, Information Science & Technology Abstracts, Science Direct, Intelligent Technologies Application, and Medline. The key words used to research the topic were *Supply chain management*,

*supply chain, technology, innovation, profitability, supply chain strategies, efficiency, sustainability, blockchain, and innovative supply chain strategies.*

The literature review is divided into 11 subsections. The first subsection is a description of the TAM, which served as the theoretical foundation of the study that was used to understand the factors that influence technology implementation and user acceptance. The second subsection is an exploration of the strategies that supply chain managers employ to align the technology strategy with primary business objectives and goals. Subsection 3 includes the methods supply chain managers use to develop a pre-adoption technology strategy to assess readiness, identify potential risks, and develop a clear roadmap for successful implementation.

Subsection 4 is a review and analysis of the challenges that supply chain managers face when adopting and integrating new technology. The obstacles related to technological integration, workforce adaptation, and resource allocation are explored to better understand how to meet challenges and develop a comprehensive supply chain strategy. The fifth subsection is an exploration of the methods employed by supply chain managers to mitigate disruptive events encountered in the supply chain. The focus is on strategies that help to maintain supply chain continuity and a higher level of resilience.

Subsection 6 involves the strategies that supply chain managers use to mitigate risks associated with implementing new technology into the supply chain. Risk assessment is discussed to identify proactive strategies to minimize potential adverse effects. Subsection 7 is an analysis of the many barriers to technological implementation

into existing supply chains. The section is an examination of the challenges that businesses face and highlights insights into overcoming obstacles. Subsection 8 is an exploration of the importance of flexibility and adaptability when integrating new technology into the supply chain. The subsection is an identification of the qualities that help supply chain managers to respond to unexpected disruptive events and capitalize on new opportunities to improve supply chain stability. Subsection 9 is an exploration of the application of blockchain technology into the supply chain. This subsection is a discussion of how blockchain technology can enhance transparency, security, and efficiency. Subsection 10 is an exploration of stakeholder collaboration pertaining to supply chain management.

Differing types of collaborative technology will be discussed. Subsection 11 is a review of conflicting perspectives on the implementation of emerging technology. The review helps to offer a balanced view of the differing viewpoints on the adoption of new technology into the supply chain. A comprehensive literature review was presented to establish an introductory framework for integrating innovative technology into the supply chain.

In this qualitative pragmatic inquiry, I explored supply chain strategies used by supply chain managers to integrate innovative technology to enhance profitability. Several themes and insights were discovered in the literature review related to technology adoption into the supply chain. The lack of research and analysis of the long-term impact of technology integration on supply chain performance and profitability will be

discussed. More research is needed to explore the contextual factors that influence successful technological adoption, including business culture and market conditions (Kalaitzi et al., 2024).

Scholars and practitioners emphasize the importance of adopting technology to enhance supply chain efficiency, increase sustainability, and mitigate disruption. There is a diversity of technological strategies that point to specific types of technology as effective means for creating a more efficient and reactive supply chain. The different types of technology were explored to determine which types of technology can be utilized for specific desired outcomes in improving supply chain efficiency, enhancing stability, and mitigating disruptions.

The adoption of advanced technology has become central for enhancing supply chain efficiency and achieving sustainability. In a study by Jahin et al. (2025), the need for adaptable strategies and contingency planning post COVID was reported as essential for creating a risk adverse supply chain. AI and Machine learning were shown to be pivotal for risk assessment for supply chains and contingency planning to ensure resilience and continuity. In a similar study by Ali et al. (2024), the complex interactions between supply chain resilience, digital supply chain, and sustainability were explored while also considering the role of supply chain dynamics. A positive relationship between supply chain resilience and sustainability provided support for an enhanced resiliency strategy.

Many of the studies emphasize how technological adoption into the supply chain can reduce waste to generate resiliency when adopted incrementally. In a study on Industry 4.0 technology, Nakandala et al. (2023) found that capabilities were directly and positively impacted by supply chain resilience when innovative technologies were implemented incrementally. Expanding on the theme of technology adoption in supply chains, Naghshinehineh (2023) explored the additive effect of such technology on supply chain agility when added incrementally adopted. It was found that additive manufacturing technology enhanced supply chain agility, enabling businesses to respond quickly to dynamic market environments and supply chain disruptions.

In contrast, the following research by Goel et al. (2024) revealed the negative impact that rapid adoption of digital technology leads to higher energy consumption, increased e-waste, and a significant amount of raw material extraction. It was stressed that the adoption of a digital supply chain must be balanced with the adoption of energy-efficient practices, integrating renewable energy, and implementing circular economy principles to balance technology with environmental sustainability (Goel et al., 2024). Supply chain managers must carefully weigh the benefits of digital innovation over the environmental costs to achieve a higher level of sustainability and responsibility.

The extant literature is lacking in studies on how technology innovation enhances supply chain performance. Liu et al. (2022) explored the impact of supply chain planning on overall performance. The researchers focused on the mediating role of agreement on the supply chain vision and goals and the influence of IT usage on buyers and suppliers.

The researchers found a positive correlation between supply chain planning and innovative technology performance.

In a similar study, Khoa et al. (2024) stressed that integrating technology across internal and external nodes positively influences innovation speed, efficiency, improves delivery times, and performance. Supply chain planning was shown to improve agreement on supply chain vision and goals, promoting a willingness to share knowledge and information internally and externally (Khoa et al., 2024). A collaborative approach is further enhanced by the integration of cloud-based technology, which helps to facilitate sharing and coordination across the supply chain.

While embracing a more holistic supply chain strategy that integrates innovative technology and collaborative practices, it is also important to explore the specific methodologies that guide effective technology implementation. Developing a comprehensive strategy in supply chain management is a method used by some businesses to enhance efficiency and mitigate risk. In a doctoral dissertation by Rudolph S.M.R. Smith (2024), an exploration of manufacturing strategies that supply chain managers use to enhance operation efficiency and mitigate risk was performed. Smith emphasized the importance of a wholistic approach to supply chain strategy that includes operations, infrastructure, HR management, operations, and procurement. These findings are further supported by Jiang et al. (2025) in a study of a maritime company, which found that prioritizing management system upgrades, green technology, emission

reduction, and continuous improvement of employee and customer satisfaction enhanced overall performance.

The results of these studies support a technology strategy that integrates strategic transformations and continuous upgrades in management systems for achieving a sustainable supply chain and addresses the evolving demands of consumer expectations and evolving markets. To further ground the research presented in this literature review, the TAM was presented to better understand why some business managers are reluctant to commit to a technology enhancement strategy to increase profitability.

### **An Introduction to Technology Acceptance Model**

The TAM is a widely used conceptual framework in studies that explore determinants of acceptance of new and innovative technology in business. The framework was originally developed by Fred Davis (1989) and has since become instrumental in investigating why some organizations and business managers adopt innovative technology and why some are reluctant to pursue an innovative technology strategy. The TAM is based on the concept that social influences and cognitive instrumental processes influence perceptions and beliefs pertaining to perceived usefulness and ease of use. Social influences are regarded as precursors to an individual's behavior shaped by other influencing norms and expectations (Tirpan & Bakırtas, 2024). For example, suppose colleagues and coworkers express the opinion that a particular technology should be utilized and proclaimed to support the incorporation of the new

technology. In that case, an individual will likely support the adoption of specific technology due to social influence.

The TAM was used in this study as the framework to ground the research. The TAM framework is the basis for exploring how technology adoption is viewed and analyzed for relevance and practicality from the perspective of technology users and practitioners (Fatemeh et al., 2024). Peer-reviewed articles, dissertations, and conferences were synthesized to comprehensively explore the most current issues and complications related to supply chain technology integration. The criteria guiding the differentiation of technology that supply chain managers use to determine the best fit for their organization were explored. The TAM framework is discussed in more depth later in the Conceptual Model section to explore how change is perceived by employees and stakeholders.

The body of literature related to the integration of new technology into supply chains details several positive outcomes including operational efficiency, responsiveness to market trends and demands. Business managers can maximize the use of a data-driven strategy for improved decision-making (Zhang et al., 2024). There are strong arguments for technologically driven innovation to assist businesses in generating competitive advantages, automating processes, reducing errors, and lowering operational costs (Wei et al., 2024). The literature is inconclusive regarding the types of technology that are generalizable to all industries and functions.

The general literature, related to supply chain management, lacks adequate information on how to best adopt innovative technology effectively, incorporate

processes seamlessly, and where to use devices such as RFID tags and other types of monitoring technology. There is a need for additional studies that provide industry-specific guidelines and best practices. This study is an exploration of specific types of technology utilized by businesses, detailing how, where, and why various devices and technologies are applied. The information gleaned from this study and the related literature review will permit business managers to consider implementing innovative technology to determine the best fit for their business.

Despite widespread recognition of the potential benefits of innovative technology, it is important to understand the challenges associated with technology implementation. Managers might understand that technology can enhance a variety of functions but question the current data related to successful supply chain implementation outcomes and corresponding increases in profitability (Dadswena, et al., 2024). There is a lack of standardization regarding technology implementation (Womba et al., 2020). Without a concrete framework, there is no standardized approach to implementing and measuring supply chain management practices (Kumar et al., 2023). This lack of standardization makes it difficult for businesses to benchmark their performance against industry standards or best practices. Supply chain managers may feel that there are insufficient data and predictive insight to make well informed decisions pertaining to specific types of new technology (Kallmuenzer et al., 2024). Other managers may not have a clear understanding of the types of technology that would align with their vision and goals, creating resistance to change.

Resistance to change on the part of both employees and stakeholders is a common concern for supply chain managers (Manzoor et al., 2024). It is important to understand how, where, and why new technology can create long-term profitability to reduce resistance. A lack of understanding of the types of technology that are available, and a general discomfort with change can inhibit the application of technological advancement. Understanding the TAM framework may help supply chain managers address the fears and concerns related to the apprehension to implement new technology (Kumar et al., 2023). Supply chain managers can work to enhance the perception that the new technology is useful and easy to use. A comprehensive analysis of current technology adoption strategies in supply chain management, the TAM framework, the identification of key barriers to technology implementation, and an examination of the risks associated with the adoption process were explored.

### **Aligning Technology Integration with Business Mission and Goals**

Comprehending the ways in which technology can aid supply chain managers in navigating and optimizing their operations to align with business objectives is complex. In the absence of a comprehensive understanding of the relevant business objectives and challenges, implementation efforts may be compromised (Sharabati, et al., 2024). The implementation of new technology into the supply chain is a decision of significance and should be approached with targeted deliberation (Womba, et al., 2020). Before incorporating new technology innovations into current supply chains, managers need to ensure that the technology adoption strategy aligns with the broader business objectives,

supports supply chain strategic initiatives, and solves relative problems and pertinent issues to improve business outcomes (Chatha et al., 2024). An understanding of how the vision and mission can be supported by pairing with the appropriate technology is important for enhancing the effectiveness of the technology strategy goals.

According to Fiorini et al. (2023), managers should prioritize technical innovations to align with business objectives based on market demand and assess the current state of the supply chain to determine feasibility and applicability. Hamidu et al. (2023) investigated the role of technological innovation in supply chain resilience and performance. The authors found that supply chain technology adoption has an overall positive influence on supply chain resilience. The research by Hamidu et al (2023) revealed that if the supply chain technology integration process is managed properly and carefully to align with business objectives, there is a positive impact of technological adoption. Prior to implementation of the new technology supply chain, managers can review the TAM framework to identify technology that would be deemed useful and easy to use by employees and stakeholders.

Supply chain managers can utilize the Technology Acceptance Model (TAM) to assess whether the new technology will be perceived as both easy to use and useful. Incorporating TAM into a supply chain management strategy improves the adoption of new technology. Supply chain managers can better predict how new technologies will be received by their employees and top executives prior to implementation (Kumar, et al., 2023). Knowing how the technology will be perceived will help in selecting technology

that aligns with business objectives and ensures that the technology selected is both practical and beneficial (Ibrahim et al., 2022). When managers understand and address barriers to technology adoption, they can develop more effective supply chain strategies that align more closely with organizational goals.

### **Developing a Pre-Adoption Strategy**

Prior to implementing technology into a supply chain, creating a pre-adoption strategy can help managers understand and determine how the technology will fit into the current supply chain infrastructure. Hrouga (2024) examined some contingency factors that play a role in the pre-adoption strategy phase when implementing technology, along with a synopsis of how a pre-adoption strategy can be designed to reap positive results. The success of the pre-adoption strategy depended on how managers approached the problem, and the success of the pre-adoption strategy depended on employee proficiency, motivation, company culture, and business size (Hrouga, 2024). Similarly, Selensky (2022) found that influencing factors such as training, infrastructure development, a business culture of acceptance, and support for integrating innovative technology help firms tailor their technology pre-adoption strategies prior to implementation for a smoother transition. The complexity of the technology, criticality, competency level required, perceived change activities, availability of tools and methods, the process and criteria for decision-making, and market conditions are common determinants that managers use in their pre-adoption strategies that have been shown to be effective (Selensky, 2022).

Technology, supply chain structure, and the internal and external environment are elements that mediate supply chain innovation. Fostering an open and collaborative atmosphere and using communication and integration technology can assist firms in responding to external pressures more rapidly and efficiently (Smith, 2024). Aligning supply chain infrastructure with strategic objectives helps organizations improve overall performance and reduce lead times (Dinh et al., 2024). When firms integrate technology into their supply chain, it is important that they share information with stakeholders and employees, work more closely together, and share in the decision-making process to enhance performance (Schilling & Seuring, 2022). Ensuring that the new technology strategy aligns with the supply chain structure and overall strategy helps to facilitate technology adoption.

### **Overcoming Challenges in Technology Adoption and Integration**

Many businesses attempting to integrate innovative technology into existing supply chain functions often encounter significant resistance to change in all process phases. The lack of acceptance of technology, understanding of complexities, standardization, employee training, and lack of awareness, are barriers to blockchain adoption into the supply chains (Manzoor et al., 2024). Employee resistance is a primary concern that should be addressed prior to, during, and after the implementation of technology and procedures.

Implementing innovative technology into current business processes can lead to employees feeling skeptical about the efficacy and utility of innovative technology. One

strategy that can be used to address employee and stakeholder concerns is to engage employees in the decision-making process, provide comprehensive training, and demonstrate the tangible benefits that new technology can bring to their work to meet the mission and goals of the business (Oyetade et al., 2024). Similarly, the subsequent study by Brennan et al. (2021) explored shared governance to improved engagement and empowerment in the nursing field. The findings showed that nurses felt more involved in decision-making processes and were able to visualize their impact on patient care and outcomes. By including stakeholders in the decision-making process, resistance can be mitigated.

It is often the case that employees or managers resist adopting modern technology tools and processes due to their familiarity and comfort level with existing established policies and procedures. There are a variety of reasons that supply managers are reluctant to adopt new technologies. The high cost of technology is the primary reason supply chain managers refrain from incorporating technology (Zavisa, 2024). The cost of purchasing technology, training employees and labor costs contribute to the reluctance to technology implementation (Lagorio et al., 2022).

To address this technology adoption challenge, managers must effectively communicate the benefits of the new technology, provide comprehensive and direct training, and actively involve employees in the decision-making process (Faruquee et al., 2021). Effective communication fostering a culture of acceptance, technology training and involving stakeholders in the technology strategy ensures that the workforce is well-

prepared for adopting new technology into the supply chain to leverage the new tools and procedures for enhanced performance and productivity.

### ***Strategies for Mitigating Disruptive Events in Supply Chain Management***

Supply chains in the current business environment appear susceptible to several external market changes and disruptive events. Adaptability of the supply chain is rapidly becoming a value-inducing proclamation in existing literature. Sustainability and resilience are becoming increasingly difficult as supply chain complexity increases due to fluctuating demand, the expectation of speedy delivery, greater service expectations, and globalization.

The recent COVID epidemic caused existing supply chains to be disrupted globally. The cessation and disruption of the global supply chain exposed and brought attention to a range of systemic issues. There are six problems firms experienced before and after COVID-19. The six operational dimensions influenced by the global disruption of the supply chain were product traceability, demand planning, production management, purchasing, process planning, management support, stock management, and logistics operations (Kazancoglu et al., 2022). Each business experiences challenges that are unique to their business, requiring an industry-specific technology strategy. Emerging technologies such as blockchain and Industry 4.0 can be utilized to tackle some of the issues pertaining to disruptive events (Zhu et al., 2024).

Strategies to mitigate the effects of supply chain disruptions include the use of digital technologies to automate inventory management systems. Implementing advanced

tools such as artificial intelligence (AI), Internet of Things (IoT), machine learning, and blockchain can support data analysis and foster continuity among employees and stakeholders (Williams, 2024). An automated inventory management system can assist supply chain managers with tracking inventory in real time, forecast demand, and make better informed decisions (Naghshineh et al., 2024). The integration of digital technology into inventory management systems enhances the continuity and uninterrupted availability of products for consumers.

These technologies provide real-time data, enhanced traceability, and advanced analytics to supply chain managers. Williams (2024) argued that enhanced digital communication tools facilitate real-time information sharing, ensuring that all stakeholders in the operational nodes are well-informed and actively involved in events and decision-making processes. E-Commerce was purported to be another method for automating the sale and purchasing of products to ensure each node of the supply chain is on the same page regarding online transactions and delivery services. Digital supply chains were included in the study to further explore the role in enhancing overall supply chain resilience and sustainability.

A supporting study conducted by Ali et al. (2024) revealed that a digital supply chain was found to enhance sustainability through improved environmental controls and efficiency. It was found that supply chain dynamism moderates and strengthens the relationship between supply chain resilience and a digital supply chain leading to enhanced sustainability. The conclusions presented in this study are consistent with the

findings of Lee et al. (2024), who investigated the influence of digital supply chains on quality. A digital supply chain and smart technology are often used in conjunction to enhance forecasting and performance.

Smart technologies were found to act as a mediating role in strengthening the relationship between digital supply chains and operation performance metrics such as quality, productivity, and cost. Implementing smart technologies in the digital supply chain helped to reduce operational costs by improving inventory management and reducing logistics expenses (Schmidt, 2022). The adoption of a digital supply chain positively affected the quality of products by minimizing defects and enhancing customer satisfaction (Lee et al., 2024). There is a general consensus that adopting such technologies does not come without risks and challenges.

### ***Mitigating Risks in Supply Chain: Strategies for Implementing New Technology***

There are a variety of risk assessment tools that can aid supply chain managers in their quest to understand how innovative technologies can benefit a business. One tool used by supply chain managers to assess risk is the integration of communication technologies that helps to reduce errors, ensure accurate information exchange, reduce redundancies and facilitate product customization and quality (Chatha et al., 2024). Understanding the organization's risk tolerance is essential, as it helps managers determine which technologies provide the greatest benefit with acceptable risk tolerance levels (Smith, 2024). It is evident that managers need to proactively address and mitigate risk factors through planning and assessment to quantify risk.

Managers can create contingency plans to mitigate risk factors by performing risk assessments prior to implementation. Proactive risk assessment and resilience planning are fundamental for mitigating disruptions in the supply chains (Stewart, 2024). The task of quantifying risk includes understanding how modern technologies can be incorporated into the supply chain to create cost savings, enhance efficiency, and generate high levels of profitability (Smith et al., 2024). These findings are further supported by Fidelibus (2021) who studied the public utility supply chain to explore strategies for improving supply chain resilience and cost effectiveness. Fidelibus found that proactive risk assessment and resilience planning are important factors for mitigating disruption in public utility supply chains. Regular training, simulations, and extensive communication protocols with stakeholders are useful tools to develop a coordinated response to disruptions in the supply chain (Fidelibus, 2021). Vulnerabilities can be identified, and risk mitigation strategies can be developed regarding natural disasters, supply chain limitations, and cyberattacks to meet market demands and minimize the effects of disruptions.

Supply chain managers can remain ahead of market demands and meet consumer expectations by continuously evaluating and upgrading technology and monitoring devices via feedback loops (Zhang, et al., 2024). Logistics optimization is a methodology to reduce risk associated with disruptive events. A flexible and more efficient logistics strategy is an effective means for mitigating risk (Raj et al., 2022). Optimization of the

supply chain logistics involves determining the best route and contingency routes in case of external disruptions.

Supply chain digital technology can assist with logistical strategies to shorten delivery times and reduce lead time (Sytych et al., 2022). Transportation management systems (TMS) assist supply chain managers with transportation planning and execution. TMS software offers optimized transportation routes and shipment tracking to enable supply chain managers to reduce costs related to transportation. To successfully integrate technology strategies, support from leaders of the organization helps to reduce resistance to change.

Support from leadership is presented in literature as a precursor to effective technology implementation. In a study by Cortellazzo et al. (2019), the findings suggest that when leaders create an environment that supports collaboration, the business is better able to leverage digital tools to facilitate communication and coordination among team members. Managers should consider the technology's complexity level, determine how policies and procedures will change, and analyze market conditions before implementation (Chatha et al., 2024). Reviewing the existing organizational current competencies and the competencies that will be needed to be acquired after implementation can provide managers with additional data to base decisions on and create a technology strategy. To further enhance the decision-making process, supply chain managers can consider using scenario planning to evaluate potential risks and develop proactive measures to mitigate risk.

Scenario analysis was reported as another method that enables managers to evaluate worst-case scenarios and potential outcomes resulting from fluctuations in demand and supply chain disruption (Ryu et al., 2023). By performing multiple scenario analyses, a comparison between scenario outcomes can be extrapolated to determine the best course of action. Bralsford (2023) argued that by reviewing specific scenarios, managers can better anticipate potential issues and the impact of adopting innovative technologies into their supply chain. A strategy can then be developed to respond to potential issues and changes made accordingly. Strategies such as scenario analysis and pilot testing are used to mitigate risk and help facilitate technology integration.

Pilot testing is used to identify potential incompatibility issues, evaluate performance, and enable managers to address any issues prior to full-scale implementation. When pilot testing is utilized prior to the initial full-scale implementation phase, results have shown that the process is an effective method for mitigating risk by identifying technology adoption issues and root causes of problems supply chain managers might experience (Chatha et al.,2024). A modern supply chain is a complex web of interconnected nodes with many moving parts. Valuable insights are extrapolated from examining the unforeseen challenges of technology integration with the use of pilot testing prior to full scale implementation (Tremoulet et al., 2024). Pilot testing in the preliminary stages of technology adoption assists in determining whether modifications need to be made or if the technology will function within the existing supply chain structure.

A comprehensive technology supply chain strategy includes training on how to use new technology, infrastructure development to accommodate adoption, and foster a culture of employee acceptance. In scenario planning, transparency across all nodes is important to ensure visibility across all stages and nodes of the supply chain to enable stakeholders to make informed decisions and respond more rapidly to issues that arise (Bralsford, 2023). In a study by Tremoulet et al. (2024) involving the development and pilot-testing of a digital assistant tool (DAT), the IDEAS methodology was used to create a pilot study. The methodology is designed to allow for collaboration and iterative feedback from users. The tool is used to help create useful, usable, and acceptable technological solutions to identify and resolve issues.

The IDEAS methodology is an acronym for improvisation, design, experimentation, aesthetics, and strengths. The improvisation stage allows for real-time decision making on addressing complex situations. This stage allows decision makers to make modifications and identify patterns in the data. In the design stage, decision makers can identify solutions to resolve issues that occur during the process (Tremoulet et al., 2024).

The experimental stage is the testing phase to make changes in the prototype via the interactive process to determine the issues that need to be addressed and resolved prior to implementation. The aesthetics stage is to determine if the digital assistance tool DAT is visually appealing and useful. The strength stage is utilized to use the strengths of the team and usefulness of the technology (Santo et al., 2014). The team can then

determine the best solution for each scenario. Prior to adopting innovative technology, it is suggested that a risk assessment is performed to understand the variables at play and determine cost savings, efficiency, and profitability after implementation.

### **Barriers to Technological Implementation: An In-Depth Analysis**

There are a variety of purported benefits to technology implementation. Despite the reported benefits from scholars and practitioners, there are substantial challenges that are encountered prior to, during and after the decision is made to adopt new technology (Dadsena et al., 2024). Understanding the challenges and barriers helps to develop a technology strategy that can address issues effectively. Some of the barriers are related to organizational issues, technological incompatibility, financial constraints, social and environmental barriers (Oubrahim et al.,2023; Dadsena et al.,2024). Understanding the barriers to technology implementation and exploring the impact of digital transformation are methods that provide valuable insight into the challenges and opportunities supply chain managers face.

A digital transformation in conjunction with a digital training program to enhance capabilities and proficiencies among employees and all facets of the supply chain has been found to be instrumental in driving operational efficiency, fostering innovation and maintaining competitiveness (Oubrahim et al.,2023). The nature of the barriers to implementing digital technology into supply chain logistics determines which strategies added value to organizational performance (Gupta et al., 2022). Gupta et al. 2022 argued for a multi-faceted approach to overcoming barriers, emphasizing the need for

collaboration with a technical institution to equip managers with the essential skills needed to operate and utilize the new technology. The researchers argued that one of the primary strategies for removing barriers to digitalization is working with technical institutions to assist managers in learning the technical skills required to use and implement innovative technologies.

### **Developing Supply Chain Flexibility and Adaptability**

Operational flexibility is fast becoming a strategic necessity for business managers to enhance resiliency and react to ever-changing market conditions. Flexibility in the supply chain refers to the ability of supply chain stakeholders to adapt quickly to changes in market conditions and react to disruptive events in a timely manner (Yang et al., 2024). Incorporating flexibility into the supply chain strategy offers multiple benefits for enhancing capabilities. Szukalski (2022) investigated supply chain strategies that influence flexibility, the impact of new technology on supply chains, financial implications, management change, and customer experience. Szukalski discovered that investing in innovative technology positively affects quality, cost reduction, efficiency, and overall productivity. Supply chain adaptability is suggested in the research as a method for developing a strategy for addressing disruptive events and meeting consumer expectations in a dynamically evolving market.

To address the dynamic nature of the current business environment, integrating innovative technology is helpful to maintain adaptability while maintaining efficiency. New technology has made it possible to create and prepare alternative delivery routes,

institute logic planning technology, implement communication technology, install trackability devices, and adopt production monitoring devices (Szukalowski, 2022). Building strong partnerships and collaborations for optimal communication, risk sharing and information sharing are important strategies to establish an apparatus for identity and addressing problems quickly and effectively (Whitelocke, 2024). Mitigating risk factors can be accomplished by creating consensus from the stakeholders as to the best recourse.

Sharing risk collaboratively builds trust and encourages information sharing among stakeholders (Williams, 2024). In a qualitative study by Szukalowski (2022), questions were focused on how technology affects the supply chain, the financial impact, change management experience, and customer experience. Szukalowski's (2022) findings showed that investments in innovative technology positively influence quality, production, efficiency, and cost reduction. To find the most applicable technologies, stakeholders can provide experience-based perspectives and make suggestions to managers. Supply chain managers can then explore the technologies available.

When managers explore a variety of IT technologies for exploration and exploitation, they can better leverage external supply chain resources (Wei et al., 2024). Exploration and exploitation enhance ambidexterity, allowing managers to improve their success by adopting the appropriate IT capability (Wei et al., 2024). Adaptability has become one of the most important characteristics of a modern-day supply chain to enhance resiliency to endure disruptive events such as natural disasters, geopolitical events, and unforeseen market changes (Williams, 2024). When managers incorporate

adaptability into the supply chain, opportunities can be exploited to create competitive advantages at a more rapid pace.

It is important to respond rapidly to opportunities such as technological advancements, consumer trends, and economic conditions. This allows supply chain managers to be better equipped to meet demand, enhance efficiency, and sustain profitability through disruptive occurrences (Lussak & Darmawan, 2022). In a study by Lussak and Darmawan (2022), IT adaptability and organizational alignment significantly enhanced overall supply chain performance. A detailed adaptability strategy was found to enhance supply chain performance and allow businesses to be more competitive by forecasting and anticipating possible disruptive events. The organization can then develop a technological mechanism for meeting the challenges.

The innovative path theory was found in the research to be a method for evaluating capabilities. Zhang et al. (2022) presented the innovation path theory as a market-based model to determine the relationship between variables and differences in capabilities between company nodes in the supply chain. The model uses Bayesian estimations to determine the best pathway for innovation in the supply chain. Probability distributions are then assigned to each function, activity, and process (Ivanov et al., 2023). A detailed analysis to identify the practicality of innovative campaigns is presented to allow supply chain managers to utilize the information to make informed decisions on feasibility and applicability.

The innovative path theory breaks down individual nodes of the business into tasks and assets, and conditional probabilities are assigned to measure market demand and responsiveness. Innovative processes can then be assessed and prioritized. The model was designed to identify and minimize risk and response times, reduce costs, and determine the allocation of supply chain resources (Ivanov et al., 2023). The Innovative Path Theory is based on stakeholder alignment throughout the supply chain and assessing the urgency and difficulty of supply chain innovation (Zing et al, 2022). While achieving alignment within the nodes is an important endeavor, the spatial proximity of the nodes to the central decision-making hub also plays a role in understanding the impact of adopting new technology.

Centrality is a term used to describe the proximity of each node of the operation to the center of the operation. Firms can be centrally located near the supply chain or in a peripheral position. The theory of centrality pertains to a firm's geographical proximity to the primary decision-making node. It is a measure of the level of connectedness within the supply chain network. In the study of supply chain network centrality by Hong et al. (2024), supply chain centrality and technological innovation were studied. The firms or nodes that are in a peripheral position have fewer direct connections to the supply chain.

The nodes that have greater distance from the decision-making node have less influence on decision-making and overall input to guide innovation. The findings suggest that supply chain networks that exhibit centrality tendencies have a negative impact on innovation. Expanding upon the conclusions drawn, Cheng and Wu (2025) found that

firms that occupy central positions with the supply chain network face potential constraints that hinder innovation output. It was reported that higher levels of centrality were associated with higher transaction costs, more focus on short-term gains, less on long-term gains, and higher levels of operational risk (Hong et al.,2024). Each node of the operation must be connected to the supply chain network but also maintain some degree of independence to allow for pertinent innovative solutions. Streamlining negotiations with suppliers and customers can assist in lessening the complexities and costs associated with a more centralized structure.

The present-day business landscape is characterized by an inexorable change. The advancement of digital communication technology in recent years has generated immense interconnectedness, offering new opportunities for businesses to enter new markets. According to Aydina and Part (2024), IT capability enables supply chain exploration and exploitation. The authors reported that IT capabilities contribute to enhanced supply chain performance. Zavisla (2024) reported similar results, in that smart technologies in the supply chain optimize processes, enhance efficiency, build resilience, and mitigate disruptions. Innovative technology has allowed businesses leaders the ability to meet consumer expectations and needs faster by using real-time communication technology (Schilling & Seuring, 2022). To address the rapidly evolving market supply chain managers have pondered ways to create a more agile supply chain to meet demand. The types of technology supply chain managers use vary in scale, cost, type, and size, depending on how and where they are used in the supply chain. As the business

landscape continues to evolve, supply chain managers need to explore how innovative technologies such as artificial intelligence and other types of new technology can assist in overcoming some of the challenges of a modern-day supply chain.

Artificial intelligence (AI) is being used to automate repetitive tasks and reduce error. By automating repetitive tasks and reducing errors, businesses can streamline processes and allocate additional resources and focus more on value-adding activities (Jahin et al., 2025). One of the primary benefits of AI is enhanced forecasting capabilities. Predictive analysis provided by AI programs enhances demand forecasting and assists in inventory management (Atieh et al., 2024). By managing inventory effectively, businesses can optimize their supply chain operations and reduce costs. AI has not only become a tool for managing inventory but allows immeasurable amounts of data to be processed to ferret out valuable information that supply chain managers can use to enhance the supply chain. Schilling and Seuring (2022) emphasized that big data analytics, business design innovative systems, and enhanced learning can improve the processing of large amounts of data from differing supply chain stakeholders. Some businesses have adopted AI technology to automate processes, enhance decision making, and drive innovation in the supply chain.

Some supply chain managers are leveraging AI technology to create competitive advantages. AI technology provides real-time tracking and monitoring of shipments, inventory, and other critical assets, adding resiliency to the supply chain and helping to generate higher levels of resiliency (Reis et al., 2020). AI technology implementation

helps create a more resilient supply chain by providing the means to anticipate disruptions and enhance decision making by adhering to a more data-driven approach (Williams, 2024). The data provided by artificial intelligence is information used by supply chain managers to automate repetitive tasks and enhance demand forecasting (Atieh et al., 2024). This level of visibility assists supply chain managers in identifying and addressing potential issues before they escalate and results in costly disruptions in continuity (Chatha et al., 2024). Integrating these collaborative technologies allows supply chain managers to create a more resilient and responsive supply chain.

There are several collaborative technologies that allow for the sharing of data and information in a supply chain. Platform cloud-based technology is another technological innovation supply chain managers can utilize to coordinate all nodes of the business (Gammelgaard et al., 2024). Cloud computing enables supply chain managers to facilitate data collaboration and sharing across all nodes of the operation, enhancing scalability and responsiveness (Tirpan, et al., 2024). By using cloud computing technology, real-time data analysis helps supply chain managers make better informed decisions quickly and more efficiently (Partida, 2023).

Collaborative technology is one more tool used by supply chain managers to enhance the ability to predict and respond to market changes. Cloud computing has enabled supply chain managers to collaborate and share data across all network nodes and enhance scalability. The ease of scalability for cloud computing assists in recognizing and analyzing changing demands in real time. Takawira and Poee (2023)

reported that integrating ITC (Innovative Technology Communication) was critical in improving supply chain transparency, efficiency, and responsiveness. Along with the advancements in collaborative technology and cloud computing, the next pathway in supply chain innovation involves the adoption of digital twin technology.

Some businesses have begun to recognize the benefit of using digital twin technology. Supply chain managers use digital twins to create virtual replicas of the supply chain to enable businesses to predict and proactively address potential challenges proactively (Oeheschlager et al., 2023). A digital twin is a virtual representation of a system or process. The digital twin is continuously updated with real-time sensors and other types of sources that collect data or information. The supply chain is represented digitally to allow for simulation, modeling, or monitoring to analyze performance. Digital twins are used for predictive maintenance, optimizing functions, and scenario planning. Digital twin technology not only enhances predictive capabilities but also supports strategic decision making in supply chain management (Gammelgaard et al., 2024).

Digital Twin, created for supply chain management, is a virtual replica of the supply chain that uses real-time data and analytics to create a simulation to make predictions and identify possible challenges that need to be addressed. Data from IoT sensors and digital equipment are used in virtual replicas of the supply chain. According to Oeheschlager et al. (2023), digital twins enable businesses to efficiently and effectively meet the evolving needs of consumers by creating digital replicas. The use of digital twin and AI technology in supply chains raises concerns about data security and the potential

for breaches when sensitive information is transferred and stored requiring the need for robust cybersecurity measures.

It is important to note that the adoption of digital technology does not come without challenges. The challenges include the complexity of adoption, vast amounts of data that need to be analyzed from a multitude of sources, and the possibility of a data breach (Reis et al., 2020). Expanding the scope of this research, the next study by Morshed et al, (2012) found that their secure RFID (Radio-frequency identification) authentication protocol addresses the security weaknesses and inefficiency of previous schemes, offering better deployment prospects in terms of security and efficiency. Understanding the challenges and inefficiencies of the supply chain is the first step, once the decision is made to adopt technology. The subsequent phase involves a thorough examination of the practical application of current technological advances.

Managers can explore the types of technology available and determine how and where in the supply chain technology can benefit in respect to efficiency and cost savings. Businesses that incorporate IT exploration have a stronger impact on supply chain exploration, and IT exploitation has a stronger impact on supply chain exploitation (He et al., 2024). When selecting the appropriate technology, managers should evaluate the existing needs and challenges within the supply chain to identify the most suitable technological solutions (Aydin & Parker, 2018). Above all, it is important to consider long-term benefits to ensure that the cost of adopting the technology justifies the associated risk and return on investment (ROI).

Implementing technology can be carried out through a series of methodical steps designed to ascertain the return on investment and feasibility. A pilot study, as an initial phase of implementation, provides valuable insights and data that can guide subsequent stages of the technology integration process (Chatha et al.,2024). Initiating a pilot test in a controlled environment to determine whether the technology adopted will work within the current supply chain structure helps to identify potential issues, assess performance, and ensure seamless integration before full-scale implementation (Sekar et al., 2024). Evaluating scalability and integration to ensure compatibility and to confirm that new technologies can adapt to future business growth constitutes a critical component of the overall technology strategy (Chatha et al., 2024).

The next order of business is to choose reputable vendors that offer support and various services to help navigate the process. Next, employee training and a change management strategy can help address resistance to change and ensure that employees can utilize the new technology effectively (Manzoor et al., 2024). Supply chain managers need to continuously monitor and make improvements via feedback loops and performance metrics (Zhang et al., 2024). Following these steps should allow managers to make informed decisions while addressing challenges and meeting strategic goals.

Technology adoption is a big decision for any business searching for ways to utilize its supply chain to add value, enhance sustainability, and secure profitability for the long term. Managers must understand the inefficiencies in the current supply chain system and the challenges of adopting modern technology (Mulani et al., 2024).

Extensive planning and development of a technology strategy can mitigate the risks and remove potential barriers. In a study by Phadnis (2024), the authors found that supply chain performance and sustainability are enhanced by exploring successful strategies for reducing disruptions in the manufacturing and transportation industry. The complexity and cost of implementation come with a variety of risks and considerations that must be contemplated prior to and during the adoption process, followed by frequent monitoring to ensure the technology is serving its purpose.

Before incorporating modern technologies into the supply chain, a review of the organizational objectives, mission and goals is a critical step in developing and deploying a technology strategy. The organization's objectives will dictate the type of technology that is needed to achieve strategic goals. A flexible technology strategy can be formulated to address growing market demands, accelerate product development and delivery processes, enhance operational efficiency, and increase profitability (Dinh et al., 2024).

Expanding these findings, Phadnis (2024) discussed the importance of developing flexible strategies related to pricing and procurement to reduce volatility in the oil industry's supply chain. Firms can consider technologies such as blockchain, IoT, robotics, automation, cloud computing, and digital twins to enhance supply chain production to meet organizational objectives (Williams, 2024). These types of technology can be costly and may require substantial investment upfront, but may offer potential long-term savings, increased efficiency, and competitive advantage.

Understanding the return on investment (RIO) is imperative when considering the adoption of new technology into the supply chain. A cost-benefit analysis of adopting each specific type of technology will allow business managers to assess the risk and determine if the RIO is worth the perceived benefits (Hong et al., 2024). Szukalowski (2022) identified innovative strategies that supply chain managers use in mid-sized manufacturing firms to improve efficiencies and flexibility were explored. Szukalowski contended that supply chain managers need to evaluate innovative opportunities, seek input from employees and stakeholders, and evaluate deployed technological innovation for ROI. Szukalowski (2022) proposed that managing organizational culture and investment in analytics enhances efficiency, profitability, and competitiveness.

In a similar study Schilling and Seuring (2022), indicated that implementing sustainable supply chain management practices, such as communicating with stakeholders, monitoring, and certifying supply chain partners, enhances sustainability. Collaboration and data sharing provide a decentralized supply chain to give all stakeholders access to track the movement of goods and services, enhance accuracy, increase accountability, and create greater trust (Hong et al., 2024). Communication is a fundamental element of a collaborative supply chain, and blockchain technology has emerged as a method for enhancing communication processes

### **Blockchain**

Blockchain is a technology that is used to increase transparency, traceability, efficiency, and security. Implementing blockchain technology is costly, and the set-up

process can be complex, involving many supply chain nodes. Considering the complexity and cost associated with blockchain implementation, it is important to examine additional technologies that can further enhance supply chain performance such as Internet of Things (IoT) and RFID-enabled smart logistics systems. IoT technology utilizes interconnected devices and sensors to collect and exchange real-time data, thereby improving visibility and operational efficiency. IoT devices include GPS trackers and RFID tags to allow managers to consistently monitor the locations of products or deliveries and evaluate the condition of assets (Williams, 2024). Zhang et al. (2024) suggested that IoT and RFID smart logistics systems enhance supply chain transparency and real-time tracking. Enhanced visibility and automation provide additional data for more accurate decision-making and reduce waste.

Adopting IoT and blockchain technology presents several challenges, such as increased vulnerability to cyberattacks due to information transmission and the complexities of integration with existing supply chain systems. The complexities of organizing and analyzing the vast amount of data collected present challenges in determining which data sets are usable, valuable, and relevant (Zhang et al., 2024). The challenges of adopting Blockchain technology relate to the financial aspect of taking on such an endeavor and the technical adaptation limitation of the existing supply chain mechanism (Manzoor et al., 2024).

To Address these challenges, innovative technology-based solutions, such as blockchain technology are often employed to reduce the effects of uncertainty and

enhance supply chain operations. As noted by Chatha et al. (2024), blockchain technology is purported to provide additional transparency, traceability, efficiency, and security (Chatha et al., 2024). Using innovative technology to address challenges can be costly and present a high level of uncertainty that some managers may view as a significant risk to their operations and strategic goals.

A cost-to-benefit ratio is a method for evaluating how supply chain enhancements can be achieved more economically. Technology implementation can be costly and complex, nonetheless there are effective strategies some business managers have employed to counteract associated complexities and offset some of the costs related to blockchain technology (Wu et al., 2023). These strategies include leveraging consortium blockchain, optimizing smart contract designs, and integrating blockchain with existing systems to enhance efficiency and reduce operational costs (Lui et al., 2023). A blockchain consortium is a type of blockchain network where control and consensus processes are shared among a pre-selected group of organizations who collaborate to develop and manage a blockchain network (Fu et al., 2021).

Other studies focus on enhancing supply chain efficiency via monitoring and tracking devices at specific nodes of the operation. Some businesses have utilized these types of technology effectively, showing promising results (Alzahrani & Irshad, 2023). More specifically, the technologies that are being utilized include the use of Internet Things (IoT) devices, such as GPS trackers and RFID tags, and automation to collect real time data and monitor the supply chain (Zhang et al., 2024). Blockchain technology

allows for enhanced traceability from the beginning of production to the consumer's doorstep. This level of traceability facilitates quality assurance and product visibility for consumer tracking.

When developing a technology implementation strategy, supply chain managers can account for a variety of factors that facilitate the implementation process. Supply chain managers who employ a comprehensive strategy by evaluating innovative technology opportunities, obtaining input from employees and stakeholders, assessing return on investment, considering organizational culture, and investing in analytics are better positioned to implement technology initiatives effectively (Szulaowski, 2022). This multifaceted approach enhances alignment with strategic goals and supports sustained innovation. Managers will be able to effectively execute a supply chain strategy collaborating with stakeholders to leverage business opportunities for all nodes in the supply chain to increase profitability (Bralsford, 2023).

A study by Zhu et al. (2024) found similar results in an exploration of how supply chain strategies can be designed to incorporate blockchain technology for greater cooperation. The author examined how blockchain technology affects supplier market decisions in downstream markets. The researchers provided evidence that when the cost of employing blockchain technology is less than the specified threshold, blockchain technology provides positive results for the supplier and allows for greater communication at all levels of the supply chain.

Blockchain technology implementation exhibits both enablers and barriers to adoption. Manzoor et al. (2024) explored factors that can facilitate or hinder using blockchain technology (BT) to enhance supply chain resilience. The authors provided evidence that the benefits of blockchain technology are transparency, real-time data sharing, enhanced smart contracts with stakeholders, and operational efficiency to help leverage supply chain strategies (Manzoor et al., 2024). The findings of the study established a causal relationship between enablers such as transparency and real-time data sharing, and barriers. Some barriers inhibit the adaptation of blockchain technology, including employee resistance to new technologies and procedures, lack of standardization, and internal and external complexities (Dadsena et al., 2024). According to Benton (2019), having a strong collaborative relationship with stakeholders and advanced information-sharing policy between the firm, suppliers, and supply chain partners is essential for mitigating disruption.

### **Maximizing Performance Through Collaborative Stakeholder Engagement**

Technology has transformed business operations by interconnecting consumers, stakeholders, and the nodes of the supply chain. Business managers now have the ability to tap into consumer preferences, market trends, and purchasing trends in real time to develop products and services to meet demand in real time (Manzoor et al., 2024). Respective business operators have increasingly incorporated new technology into the supply chain to improve performance.

Schmidt et al. (2022) examined the impact of technology on supply chain performance and found that innovative technology can enhance various functions related to supply chain management. In the study, it was discovered that new technologies facilitate information flow, enhance stakeholder communication, support informed decision-making, and enhance profitability. These improvements have transformed the role of technology in supply chain management by allowing the incorporation of technology, such as blockchain-based smart contracts.

The adoption of smart contracts into blockchain technology is a recent phenomenon that helps to interconnect stakeholders in the supply chain. Smart contracts are an innovative process that is embedded in blockchain technology. The blockchain consensus apparatus ensures that all nodes in the supply chain network approve to the terms of the contracts in the blockchain agreement (Mulani et al., 2024). The contracts are self-executed automation processes that block the transmission of activities until all the contract conditions are met (Mulani et al., 2024). The smart contract is visible to all participants to track the terms and history of the contract to ensure accuracy and compliance. The automated execution of the terms of the contract reduces errors and inaccuracies. Smart contracts create cost savings by removing agents, record-keeping, and negotiating parties from the process (Khan et al., 2021).

The benefits of blockchain technology and smart contracts show potential for streamlining operations via automated payments, real-time tracking, and greater levels of security against record tampering. Smart contracts reduce the chance of falling into non-

compliance related to the laws and regulations of specific nodes in the supply chain (Santosh et al., 2024). The challenges of smart contract implementation are scalability limitations and more sophisticated contract development languages (Mulani et al., 2024).

The need for efficient inventory management becomes more apparent as demand increases, and supply chain managers struggle to deliver products and services while addressing disruptions to maintain quality. Forecasting tools and just-in-time software are used to reduce out-of-stock while keeping overstock at a minimum (Atieh et al., 2024). Logistics software and technology are available and used for demand forecasting and just-in-time inventory to direct supply chain activities and identify nodes in the supply chain that need to be upgraded or modified. QR (quick response) code technology in web-based inventory management systems enhances real-time tracking and boosts efficiency (Balaji et al., 2024).

The QR inventory management system has a cost-finding component that provides relative data, enabling managers to gain insights into information related to expenses and options for resource allocation (Balaji et al., 2024). Improvement can be made regarding retrieval speed, efficiency, and errors identification (Atieh et al., 2024). These developments in supply chain innovation play a role in evolving technologies, paving the way for differing perspectives on adoption and integration strategies.

### **Conflicting Perspectives on Technology Adoption**

The literature on innovative technology implementation is mixed with a spectrum of perspectives on the applicability and efficacy of technology adoption techniques and

processes. In this study, a gap in the existing literature on technology integration was identified and explored. The extent to which technological adoption strategies have impacted financial performance has not been adequately qualified in literature. The findings in this study contribute to the field of supply chain management by suggesting strategies to enhance profitability and offering a deeper understanding of the factors that influence technology adoption. The focus of the study was on practical applications and viable solutions that benefit businesses by offering strategies to navigate common disruptions and improve efficiency and competitiveness. The research goal was to provide supply chain managers with effective tools and techniques to generate leverage by adopting technological strategies that will increase profitability while enhancing sustainability.

Many academics and professionals in the supply chain industry have emphasized the potential of certain technology and devices, such as AI, blockchain, IoT, and RFID tags (Chatha et al., 2024). Other researchers highlight the significant barriers to technology adoption and emphasize that the mixed results and inconclusive implementation outcomes reveal that the associated risks should be carefully examined. Some researchers report that failing to address the potential risks of adopting new technology could prevent the realization of the benefits and lead to unacceptable costs and disruptions (Steward, 2024).

The high cost of the initial investment may be greater than the benefits for the short-term and long-term productivity of the supply chain. Due to the complexity of

technology adoption and time constraints, consultants might need to be hired to assist in the implementation process. There may be a lack of skilled employees working for a business that can effectively manage and use new types of technology. Managers must have confidence that the costs will justify the means.

In a study of AI adoption by Choi et al. (2020), results supported the concept that the adoption strategy and the industry determine the overall benefits of implementing AI technology for demand forecasting. The report suggests that the efficacy of innovative technology is only sometimes universally applicable to all businesses in terms of size and intended function. Hamidu et al. (2023) argued that budgets for technology implementation must account not only for the initial procurement costs, but also the expenses associated with training, integration, maintenance, and unanticipated issues that arise. Some business managers may not have the budget for technology projects or be unsure if there will be an adequate return on investment. There is general uncertainty that the return on investment will translate into long term profitability (Aydin & Parker, 2018). The context in which the technology is applied is an important determinant of the success of the technology strategy.

The applied research on supply chain management and technology has many variations in design, sample size, and metrics used in each study. The methodological variations highlighted in each study and the inconsistent results of multiple studies and outcomes are indications that more research is needed in supply chain management and technology innovation. The diversity of methodologies, implementation strategies, and

conflicting results is an indication that existing strategies have not been analyzed and evaluated enough to base conclusions that a specific strategy, one size fits all, is generalized to all industries and businesses both big and small (Kalaitzi et al., 2024).

### **Conceptual Framework**

The Technology Acceptance Model (TAM) served as the conceptual framework for this study to explore factors that influence technological adoption in supply chains. Davis (1986) developed the Technology Acceptance Model to address the need to understand why individuals accept or reject new technology. Davis (1986) suggested that perceived usefulness and perceived ease of use are the core determinants of technology acceptance. The TAM framework was used to identify and explore innovative technology strategies that supply chain managers use to enhance efficiency and profitability.

The perceptions of supply chain managers regarding innovative technology were examined to better understand the determinants that influenced their decision to implement certain types of technology into the supply chain. The TAM framework allowed for a systematic review of the data to better understand the intricacies associated with adoption of technology. The TAM framework was developed to predict users' attitudes toward new technology and identify influencing factors and intentions to use new technology.

The six parameters used to explore why individuals accept or reject new technology include behavior intention, perceived usefulness, perceived ease of use, attitude, complexity, and compatibility (Ashari et al., 2022). The logical connections

between the TAM framework presented in this study and the nature of my study include using the TAM to identify and explore the effective, innovative technology integration strategies the participants used to enhance profitability. The perception of operational managers toward new technology determines the types of new technology that will be included in a technology strategy.

The Technology Acceptance Mode has been used in several studies to determine how and why certain types of technology are more acceptable. Srivastava et al. (2024) utilized TAM to examine the role of blockchain technology in reducing the bullwhip effect on the supply chain. The author's findings suggested that focusing on the perceived usefulness of blockchain technology can create leverage for supply chain managers. The researchers found that perceived ease of use significantly influenced attitudes and intentions to use new technology. This research suggests that by focusing on the perceived usefulness of blockchain technology, managers can develop a strategy to incorporate blockchain technology into their supply chain to reduce the bullwhip effect. In a study by Oraman et al. (2024), the adoption of electric vehicles in last-mile deliveries was explored. The researchers found a significant and positive relationship between compatibility and the perceived usefulness of electric vehicles. A relationship between the intention to use electric vehicles and attitude toward such technology was reported as a mediating factor for adopting electric vehicles into their technology strategy. Perceived usefulness and ease of use are important factors to consider before technology adoption into the supply chain.

The Technology Acceptance Model has undergone expansion since the inception of the model by Davis in 1989. The two primary determinants of the acceptance of TAM technology, as presented by Davis, are perceived usefulness and perceived ease of use. In the year 2000, the TAM 2 model was introduced by Davis and Venkatesh to incorporate additional determinants of adoption that include social influence and cognitive instrumental processes (Venkatesh & Davis, 2000).

The cognitive instrumental process examination is directed toward understanding the perception of the functionality and practicality of adopting new technology. If an individual believes the technology is relevant to their job and applicable to their work, they are more likely to support the purported technology. According to Tirpan and Bakirtas (2024), the intent of the adaptation of the additional constructs to TAM is to understand and moderate the factors of social influences and cognitive instrumental processes to guide strategy development. Davis and Venkatesh (2008) argued that subjective norms, voluntariness, and image are social influencing factors that should be considered when developing a technology strategy.

When technology use is perceived as voluntary by employees, social influences have a stronger effect on the user's intention to adopt the technology policies and procedures (Ashari et al., 2022). The "image" determinant is predicated on the idea that technology use is viewed as beneficial to an individual's reputation (Sonmez et al., 2024).

When developing and incorporating new technologies, social influences and cognitive processes can be assessed and included in the analysis regarding social

acceptability, functionality, and ease of use, to promote the inception of the new technology. Businesses can guide training and support by including elements of technological relevance and addressing social norms and pressures. Since the development of the TAM framework, modifications and additional versions have been made, including TAM2 and TAM3. The TAM2 conceptual model includes factors such as social influence, cognitive instrumental processes, and computer efficacy and anxiety (Tirpan & Barirtas, 2024). The similarities and differences will be discussed in more detail to provide an overview of the framework.

TAM2 was developed to include the influencing factor of personal experience. The basis of the theory is that prior experience facilitates the perception of ease of use and perceived usefulness related to behavior intention (Srivastava et al., 2025). For example, computer anxiety often determines perception and intention to use technology. TAM2 includes experience as a determinant influencing behavior and intention. TAM3 incorporates perceived ease of use, usefulness, and computer anxiety as moderating factors influencing perception and behavior intention (Fatemeh et al., 2024).

The effectiveness of the TAM in certain contextual parameters was explored and includes blockchain technology and cloud technology. The determinants of technology acceptance were identified and explored in this study, including social influences and individual differences. The review of the literature included practical applications of the TAM framework for supply chain managers to consider a technology strategy to enhance productivity and profitability. How the determinants of technology adoption vary in terms

of technological contexts and industries were discussed. Challenges and strategies that supply chain managers use to address resistance to changes were reviewed. Barriers to technology adoption and resistance to change are explored in the literature review.

Technology adoption strategies necessitate consideration for encouraging positive perceptions regarding ease of use and compatibility. In this study, TAM was used as a construct to explore strategies that supply chain managers use to integrate innovative technology into the supply chain. An exploration of perceived usefulness and ease of use was the guiding principles that will allow for the investigation of the factors that influence technology adoption and profitability.

### **Operational Definitions**

*Bayesian Estimations:* Bayesian estimation is a statistical method that applies Bayes' theorem to update the probability for a hypothesis as more evidence or information becomes available (Rodrigues, et al., 2025).

*Blockchain Technology:* Blockchain technology is a decentralized transaction and data management technology that records transactions across several computers and networks that are confirmed by all nodes of all subsequent blocks and the consensus of the network (Yli-Huumo et al., 2016).

*Centrality:* The term centrality refers to the significance of a node within a network, measured by the number of connections it has or its influence on the network (Oldham et al., 2019).

*Consortium Blockchain:* A consortium blockchain is a blockchain where the consensus process is controlled by a pre-selected set of nodes within the supply chain (Chen et al., 2024).

*Cloud Computing:* Cloud computing is a technology that enables users and organizations to access data, applications, and resources over the internet (Ukeje et al., 2024).

*Communication Technology:* Communication technology includes the various tools and systems that facilitate the exchange of information and ideas across various platforms and mediums (Wallace et al., 2024).

*Digital Assistant Tool:* A Digital Assistant Tool (DAT) is defined as a software application designed to assist users in performing tasks efficiently and effectively (Leonarczyk et al., 2025).

*Digital Supply Chain:* A digital supply chain uses advanced technologies to improve efficiency, transparency, and responsiveness of supply chain operations (He et al., 2024).

*Digital Twins:* A digital twin is a virtual replica of a physical system or object, designed to mirror its real-world counterpart (Islam et al., 2025).

*Innovative Path Theory:* The Innovative Path Theory is the conceptual framework that proports that organizations and systems can deviate from existing paths of development and create new trajectories for growth and innovation. (Dobusch et al., 2017).

*Internet of Things:* The Internet of Things (IoT) refers to the complex network of physical objects embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems across the internet (Kumar et al., 2019).

*Radio Frequency Identification:* Radio Frequency Identification (RFID) is a technology that uses electromagnetic fields to automatically identify, and track tags attached to objects (Hua et al., 2025).

*Technology Acceptance Model:* The Technology Acceptance Model (TAM) is a theoretical framework that seeks to explain how and why individuals adopt and use new technology (Gayathri et al., 2019).

### **Transition**

Section 2 was a review of academic literature to offer ways supply chain managers can manage risk, ensure strategic alignment with business objectives, address barriers to technology implementation, and develop a pre-adoption strategy. The TAM conceptual framework was discussed in detail. Section 3 will include ethical considerations in research, the nature of the project, sampling method, data collection techniques, interview questions, data analysis, reliability, and validity.

### Section 3: Research Project Methodology

#### **Project Ethics**

Ethical behavior in academic research refers to the principles and established guidelines each researcher is to follow to ensure that the study is conducted with integrity and transparency. I obtained approval from Walden University's Institutional Review Board (IRB, approval no. 05-15-25-0167208) before conducting this study, including the selection of participants and the interview process. The guidelines of the *Belmont Report* underline respect for others, beneficence, and justice as critical elements for conducting research, which involves human participants (Metcalf, 2016).

My role as the researcher was to adhere to ethical standards when conducting the study by maintaining the dignity of the participants, the process, and the data. My responsibilities included designing data collection instruments, recruiting participants, obtaining informed consent, and conducting interviews. Bias in research is a primary concern that can confound the results and impact the quality of the findings. To reduce bias, I remained objective and acknowledged the presence of personal bias, document participant perceptions, to be cognizant of possible bias in the process, and respond to bias accordingly (Benton, 2019). To minimize bias, I allowed participants to express their views and beliefs freely without interruption of influence from my own ideology.

I adhered to the interview protocol (Appendix), designing the interview questions to avoid leading the participant to a particular expected response. I reviewed the transcripts and identified any evidentiary bias or suspected bias on either the

interviewer's perspective or the participants' perspective (Rapciewicz, 2022). All participants received the same questions to minimize variability and ensure that interviews are uniform. Member checking involves sharing the transcripts with the participants to verify that their views and experiences have been captured correctly by the interviewer. Misunderstandings or misinterpretations can be identified and corrected during this member checking process. Member checking provides participants with the opportunity to offer additional insights and provide feedback (Benton, 2019).

Regularly reviewing and revising the interview process to address any emerging biases enhances the credibility of the study. I ensured the ethical treatment of all participants involved in the research study. It involves protecting confidentiality, obtaining informed consent, allowing for voluntary withdrawal, and securely storing data to protect participants' rights and rights to privacy (Favaretto et al., 2020). To ensure the confidentiality of the participants, I employed rigorous ethical practices and robust data protection measures. The interview process was reviewed and revised to address any emerging biases. A continuous consent process was implemented, reminding participants of their rights and the purpose of the study throughout their involvement. All data were anonymized to prevent identification of the participants (Pietrkowski et al., 2021). The implementation of the continuous consent process, reminding participants of their rights, and the purpose of the study was presented to the participants. Pseudonyms were assigned to participants to protect their identity. Data were encrypted to protect digital data from unauthorized access (McKibbin et al., 2021). Each participant was required to

sign the confidentiality agreement to reinforce the importance of protecting participants' information.

Informed consent is the most critical factor in legitimizing this research by protecting the rights of the participants. Each participant was provided with a detailed consent form that outlined the study's purpose, the interview process methods, the potential risks and benefits of the research, and the right to withdraw at any time (Sutrop & Louk, 2020). Each participant was required to sign the consent form before the interview and prior to data collection. Participants were informed that their participation was voluntary, and they could withdraw from the study at any time without any penalty or negative consequences. The informed consent process ensured that the participants agreed to participate without coercion (Chatterjee & Das, 2021). If participants elected to withdraw, any data collected would be excluded from the study and deleted and destroyed. Incentives were not used in this study.

All data collected was kept confidential and stored securely in a safe to protect the confidentiality of the participants. Names or any information provided that would be identifiable would not be included in the final manuscript. The data will be maintained in a secure location for 5 years. After a 5-year period, the data will be securely destroyed.

### **Nature of the Project**

The specific research design was a pragmatic design structured interview inquiry to address the research question in this qualitative study. A pragmatic qualitative design structured interview inquiry is the best approach for this study because it allowed for an

in-depth exploration of the subjective, and nuanced complexities and multi-layered landscape that guides technology acceptance and adoption. The pragmatic inquiry assists the researcher in collecting rich and detailed data from the participants while providing context and detailed explanations.

Structured interviews allow for a greater level of organization and consistency in the questions used in the study. However, the researcher can still retain the flexibility of probing deeper by following up on responses pertaining to areas of significance to understand the experiences and challenges that supply chain managers face. Using the qualitative method enabled me to explore the complexity of responses and consider different perspectives (Lanka et al., 2021). The qualitative method can add to qualitative data by providing context, explanation, and unexpected findings. This pragmatic inquiry design approach is appropriate for my study because a structured interview allowed me to follow up on a predetermined set of questions to explore different facets of the research topic and develop insights (Borgstede & Scholz, 2021).

This study on supply chain technology is significant in that I can provide supply chain managers with strategies that can help to improve their supply chain productivity and profitability. When businesses can reduce costs by enhancing productivity, products and services can be offered at lower prices to benefit consumers, giving them more disposable income to purchase necessities such as food, housing, and education.

### **Population, Sampling, and Participants**

In conducting a study on supply chain management and technology, it is important to delineate the population, target population, and sample to ensure the validity and relevance of the research findings. The population encompasses all individuals who are involved in supply chain management and technology across various industries. The group of professionals in the population are from various levels and establish roles in the industry from logistics coordinators to supply chain analysts and technology implementers (Hennink et al., 2022).

The target population is in reference to a specific subset of the group that the researchers intend to focus on, including supply chain and technology managers within a particular industry sector or geographic region. This group of participants is selected based on characteristics that are most appropriate to the research objectives. The sample consists of individuals from the target population. In this study, six participants were selected to provide in-depth insights into supply chain management and technology implementation. The sample size of six participants is justifiable within the context of common qualitative research methodologies. In qualitative research, small sample size allows for a greater depth of understanding. Detailed information from participants is more feasible as opposed to generalizing data from large sample sizes. A smaller sample size allows the researcher to delve deeper into the experiences, perceptions, and attitudes of each participant. This is particularly important when exploring complex phenomena like technology implementation in supply chain management. According to Hennink and

Kaiser (2022), small sample sizes in qualitative research, such as six participants, can be sufficient to achieve data saturation to ensure the credibility and completeness of the findings.

Purposive sampling was used in this study targeting supply chains and IT managers. This type of selection process is a non-probability sampling technique used when the researcher selects participants based on specific characteristics and the objectives of the study (Subedi, 2021). This method relies on the researcher's judgment and aims to include individuals who have the most relevant experience or knowledge related to the research topic. This method, also referred to as judgmental, selective, or subjective sampling, differs from convenience sampling. The sample population for this qualitative pragmatic inquiry consisted primarily of supply chain and IT managers in the United States who have at least 5 years of experience in operations and have been involved in technology adoption within the supply chain. Purposive sampling ensures that the participants have the expertise and technology implementation experience to provide rich data and valuable insights into successful technology adoption strategies.

In analyzing the data, I worked to achieve data saturation. Data saturation was achieved via the iterative process of data collection and analysis until no new themes or information emerged from the interviews (Hennink & Kaiser, 2022). Data saturation implies that the data collected is sufficient to provide a comprehensive understanding of the topic of investigation. Achieving data saturation is crucial to ensure the completeness and reliability of the findings of the study (Guest et al., 2020).

I collected data from IT and supply managers on the effective innovative technology integration strategies they use to successfully implement to enhance their current supply chain. A list of 10 questions was presented to participants. My interview questions were informed by the extant literature, my conceptual framework, and my problem statement. The interview questions were developed from a comprehensive review of the existing literature on supply chain and technology. The questions were aligned with the TAM conceptual framework to elicit data on the technology strategies supply chain managers used to enhance profitability. The problem statement helped to guide the development of the interview questions.

Follow-up questions were utilized to allow me as the primary researcher to delve deeper into participants' initial responses to provide more detailed data. To clarify ambiguities, follow-up questions were used to fully understand the participant's response and perspective. Follow-up questions help the researcher to uncover new unexpected insights that might add a new dimension to the research.

The interviews were conducted via phone or virtual, such as Zoom meetings or Microsoft Teams platforms. The participants' virtual meeting program was an option if the reported venue was not feasible. The process of recruitment of participants will be an option if the reported venue is not feasible. The recruitment process of participants was used to identify business organizations from various industries and identify patterns that might be unique (Batt & Kahn, 2021). I utilized publicly available documents and supporting literature to provide valuable insights, evidence, and supportive data. I

integrated relevant information from reputable sources, including academic journals, books, and government agencies.

### **Data Collection Activities**

The specific research design was a pragmatic inquiry structured interview inquiry to address the research questions in this qualitative study. Using the qualitative method enabled me to explore the complexity of responses and consider different perspectives. The qualitative method can be added to the data by providing context, explanations, and findings (Fornaro et al., 2021).

Data collection activities included an in-depth interview and an investigation of existing literature and publicly available documents to explore the phenomenon and gather relevant information. The interviewer intended to gain additional insights presented by professionals in the field of supply chain management via personal experiences, challenges, and successes from the participants' perspective. The semi structured interview process provided the interviewer with the opportunity to ask for additional details for clarification to responses (Knott et al., 2022). This pragmatic inquiry design approach was appropriate for my study because a structured interview allowed the interviewer to follow up on a predetermined set of questions to explore different facets of the research topic to develop insights. A pragmatic inquiry design also allowed the researcher to capture the often subjective, and nuanced thoughts and opinions of the participants.

For my planned research design, I collected data from IT and supply chain managers on the effective innovative technology integration strategies they use to successfully implement to enhance their current supply chain. A list of 10 predetermined questions (Appendix C), were used to guide the interview process, ensuring consistency across all participants. The same set of questions were used for each interview, and any follow-up questions were recorded and included in the findings.

The interviews were conducted via phone or virtual, such as a Zoom meeting or Microsoft Teams platform. The participants' virtual meeting program was an option if the reported venue was not feasible. Interviews were recorded and transcribed verbatim to capture accurate and detailed information. Member checking was utilized to allow participants to review and confirm the accuracy of their transcripts to lend credibility and reliability of the data.

The process of recruitment of participants was to identify business organizations from various industries to identify patterns that might be unique. I utilized a range of publicly available reports and documents to provide valuable insights, empirical evidence, and supportive data. I integrated relevant information from reputable sources that include academic journals, books, and government agencies.

### **Research Question**

What effective technology innovation integration strategies do supply chain managers use to enhance profitability?

### **Interview Questions**

1. What specific technology innovations have you integrated into your supply chain, and what strategies did you use to implement them effectively?
2. What key factors influenced your decision to integrate innovative technology into your supply chain?
3. What strategic steps did you take to ensure smooth adoption and integration of the technology into your supply chain operations?
4. What challenges did you face during the integration process, and what strategies helped overcome these challenges?
5. How do you assess the effectiveness of your technology integration strategy in terms of profitability and operational efficiency?
6. What risk management strategies did you employ when integrating new technology into your supply chain?
7. How did you align your technology integration strategy with supplier and customer relationship management?
8. Did you develop a formal technology implementation strategy before integration? If so, what key components did it include?
9. What training and change management strategies did you use to ensure your team adapted successfully to the new technology?

10. Based on your experience, what best practices would you recommend to other supply chain managers seeking to integrate innovative technology successfully?

### *Strategic Intent of the Questions*

**Technology Innovation and Implementation.** Questions 1, 2, 3, 4, and 8 are designed to collect qualitative data on the specific technological innovations implemented, the decision-making processes, strategic measures, challenges encountered, and planning associated with technology integration. These questions were designed to elicit insights related to Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) by examining the technological innovations integrated into the supply chain. The questions were structured to identify the challenges faced and the strategies employed to overcome these barriers to providing a deeper understanding of the role of perceived ease of use in the technology adoption process.

**Effectiveness and Profitability.** Question 5 is an exploration of the relationship between technology integration and both profitability and operational efficiency, aligning with the research question emphasis on enhancing profitability and perceived usefulness. The question relates to the technology acceptance model which was used to explore how technological integration can impact job performance, productivity, and operational costs

**Risk and Change Management.** Questions 6 and 9 were designed to explore the components of effective technology integration, specifically focusing on risk management and change management strategies. The questions relate to the Technology

Acceptance Model by considering how potential risks and uncertainties are managed and how these strategies relate to the perceived ease of use and facilitate technology adoption.

**Stakeholder Alignment and Best Practices.** Question 7 is an investigation of the degree of alignment with suppliers and customers and how the technology is perceived by stakeholders. Question 10 was designed to identify best practices that make technology integration easier and more effective. Together, these questions provide insights into how stakeholder alignment and best practices influence the acceptance and ease of use of technology, one of the primary tenants of the TAM framework.

The interview questions were constructed to explore various elements of technology integration strategies and to align with the research question and the conceptual model. The questions were developed to delve into implementation processes, decision-making criteria, effectiveness, risk management, adaptation to change, and stakeholder alignment.

### **Data Organization and Analysis Techniques**

The data was organized systematically and analyzed in this qualitative pragmatic inquiry to explore how the theoretical framework relates to the topic and identify common themes present in the data collected. Research logs were used to maintain the research process, identify decisions made, report changes in direction, and identify evolving understandings of emerging themes in the data collected (Agrawal et al., 2021). Reflective journals were used to record personal insights and reflections. As the data is collected, any emerging biases were identified to provide additional insight. All data

obtained in this study, including the interview transcripts and notes, were cataloged and labeled systematically, with unique identifiers assigned to each data set for retrieval and cross-referencing purposes. In addition, all raw data will be securely stored for five years to ensure data integrity and compliance with ethical standards.

To analyze the data, I used Yin's five step process to define codes, create categories, and develop themes and findings. The five steps of thematic analysis that were used in this study were developed by Yin (2015). Thematic analysis is a process of identification, analysis, and reporting patterns or themes within the data. Step one involved the collection of all the data that was acquired including interview transcripts, observation notes, and all documentation. The information was then organized into a manageable format to allow for data analysis and more in-depth exploration. In step two, the data was disassembled by breaking down the information collected into smaller segments that provide some level of meaning or understanding. The data then became the guide that determined the direction of the research findings. In this stage, the data is coded by assigning labels to pieces of text that capture key ideas or concepts. This helped the researcher identify emerging patterns and insights.

In step three, the data was reassembled into groupings of the coded information into categories to identify similarities and relationships. As overarching themes begin to emerge, the codes and categories need to be refined to reflect the nuances within the data. The fourth step involved the examination of the relationship between themes; general ideologies and the general understanding of how the research questions were addressed.

During this stage, the theoretical framework was used to put the findings into context. This allowed the researcher to conduct a deeper analysis to explore meaning and the implications of the themes that emerge.

The final step included the synthesis of the themes into a coherent narrative that answers the search question. The key findings and elucidate connections between themes and the broader implications for practice or future research were presented to further address the research question and the implications of the findings. NVivo software was used to identify patterns and themes that emerged during and following the interview to code, catalog, sort and tag the data. During the study, I encoded each participant's interview transcript and secondary documents using fictitious name identifiers to secure participant confidentiality. The use of NVivo enabled me to systematically organize the data, allowing the researcher to retrieve and cross-reference data.

NVivo's analytical tools assisted in identifying relationships in the data and allow the researcher to draw significant conclusions from the data collected. The guidelines for the Walden University for participant confidentiality require the researcher to mask the identity of clients by assigning a generic name and/or code to the company, participants, and associated data. I masked the names of the participants by assigning code names, such as Participant 1 (P1), Participant 2 (P2) and continued until all the participants had been assigned a code.

## **Reliability and Validity**

### **Reliability**

One of the fundamental distinctions between quantitative and qualitative research is how the quality of the studies is evaluated. Quantitative research is dependent on a reliability standard using validity as one of the key measures. Reliability measures are utilized to ensure that the results of the study are consistent over time. The validity standard is confirmation that the findings accurately reflect the true state of the phenomenon under investigation.

### **Credibility**

Credibility in qualitative research is closely related to internal validity in quantitative research, which ensures that the study accurately reflects the relationship between variables without being influenced by external factors. In qualitative research, the establishment of credibility refers to the accuracy and truthfulness of the findings as representative of the participants' beliefs and experience. In quantitative research, ensuring internal validity is a requirement for establishing the accuracy and reliability of the findings (Yadav, 2022).

Member checking, prolonged engagement, data triangulation, and peer debriefing help to establish credibility (Yadav, 2022). Member checking grants the participants the opportunity to review their responses for accuracy. By allowing participants the opportunity to review and confirm interview transcripts, researchers can ensure that the data is an accurate representation. Using the criteria for establishing credibility, the

researcher can authenticate the responses to make the results more valid, reliable, and applicable to broader contexts (Stahl et al., 2020). Data triangulation involves using multiple data sources to investigate the phenomena (Anney, 2014). Prolonged engagement refers to the extended time that the researcher uses to gain a deeper understanding of the perspective, experiences, and context of the responses to the questions.

### **Transferability**

Transferability refers to the extent to which the findings of the study can be generalized or applied to other contexts or settings. Qualitative research is based on providing detailed insights that are generalizable or relevant to similar conditions. Transferability in qualitative research is equivalent to external validity or generalizability in quantitative research (Stalmeijer et al., 2024). In quantitative research, external validity refers to the extent to which the findings of a study can be generalized or applied to other contexts or settings.

In this qualitative study, transferability was demonstrated by meticulously adhering to the data collection and analysis techniques for my chosen design. Rigorous interview protocols were followed to ensure that data saturation was reached. Providing a detailed and transparent account of the research process will allow other researchers and practitioners to identify the context in which the study was conducted and determine the applicability of the findings to their own perspective (Driasko, 2025).

To demonstrate transferability, the thick description technique was utilized. Thick description is achieved by providing detailed contextual information (Younas et al., 2023). This technique allows researchers to assess the findings to determine relevancy and applicability to their own research. In qualitative studies, researchers generalize findings as opposed to quantitative studies which focus on providing rich, contextual insights. I do not claim that my findings are transferable, but thorough documentation of my methods allow other researchers to assess the potential relevance and applicability of the study to a variety of contexts.

### **Confirmability**

Confirmability refers to the neutrality and objectivity of the findings to verify they are based on the experiences of the participants as opposed to researcher bias. This concept is comparable to objectivity in quantitative research as it is achieved through audit trails, reflexivity, and triangulation (Ahmed, 2024). I used multiple data sources, such as interviews documents, and observations to confirm findings (Hennink & Kaiser, 2022). Enhancing confirmability involves ensuring that the results can be confirmed or supported by others (Driasko, 2025). Techniques such as probing during interviews and conducting follow-up member checking interviews. Questioning from different perspectives and utilizing triangulation are the methods I used to enhance confirmability. These strategies provided a more accurate and unbiased representation of the participants' experiences.

## **Dependability**

Dependability refers to the consistency and stability of the research findings over time to ensure that if the study were to be repeated under similar conditions, the results would be comparable. In qualitative research, this concept is closely aligned with reliability in quantitative studies. Dependability can be strengthened by employing strategies such as maintaining detailed records of the research process, conducting member checks for data interpretation, reviewing interview transcripts, and validating protocols for interviews (Ahmed, 2024).

To ensure dependability audit trails, code-recode strategies and peer debriefing were used. I keep detailed documentation of the research process to allow for replication (Stalmeijer et al.,2024). Some methods for enhancing dependability are data checking interpretation, transcript review, pilot testing, expert validation of interview questions and interview protocols, focus group protocols, and direct participant observation protocols. Reaching data saturation allowed me to ensure the dependability of the findings (Hennink & Kaiser, 2022).

For this qualitative pragmatic inquiry, it was imperative to establish credibility and trustworthiness by utilizing reliability measures and techniques when collecting and analyzing the data. The reliability measure that was used in this research study included methodological triangulation, member checking, and systematic transcript review (Qunitao et al., 2020). Data was collected via semi-structured interviews and related documents and literature on supply chain and technology.

Methodological triangulation was utilized to enhance the reliability and credibility of the data and results. Data gained from multiple sources, such as interviews, related documents, and literature, was analyzed to understand how technology has been used to enhance profitability. Member checking was used to improve the accuracy of the data collected by allowing participants to review and confirm the transcripts of their interviews to ensure the validity of the data (Coleman, 2021).

A systematic transcript review of the data was conducted throughout the process to enhance the dependability and reliability of the findings. Cross-checking the data collected from the various resources used in the study created additional levels of verification of the findings and established higher levels of reliability.

Finally, data saturation was essential for enhancing reliability. Data saturation is reached when no new themes or information can be extrapolated from the interview, and literature review. Data saturation was used to reinforce the validity and reliability of the finding. Additionally, evidence of saturation was provided from the analysis to report on how saturation was achieved. The strategy used to attain saturation was included in the study to give a greater degree of weight to the results.

Guest et al. (2020) proposed a range of strategies to confirm data saturation in qualitative data research. The authors listed iterative analysis, flexible metrics, bootstrapping, and setting up a new information threshold. The interactive analysis process is the continuous analysis of the data as it is collected, and no new information is gained. Flexible metrics allowed me to choose the level and degree of the assessment

criteria in terms of how saturation was achieved. The bootstrapping technique is a process by which data is continually resampled for any new themes or patterns that emerge (Guest et al., 2020). Each of these strategies was used to lend credibility to the findings.

### **Transition and Summary**

This qualitative pragmatical inquiry is an exploration of strategies supply chain managers use to integrate innovative technology to enhance profitability through enhanced supply chain performance. This study was grounded by the Technology Acceptance Model as the framework to explore the challenges of adopting technology into current supply chain processes and identify the successful adoption of specific types of technology.

Insights from peer-reviewed articles, dissertations, conferences, and related literature were gathered to identify and extrapolate actionable strategies to address disruptions, enhance efficiency, and prolong sustainability in supply chain management. The TAM framework was used to ground this study using the tenants of the model, including perceived usefulness and ease of use of technology. The TAM2 tenets of the model were utilized to recognize the role of social and cognitive influences in adopting new and innovative technologies.

The difficulties associated with adopting innovative technology in this study were identified as resistance to change, employee training, alignment of technology strategies, and stakeholder engagement. How innovative technology can improve information sharing, collaboration, decision-making, and efficiency was discussed. Section 4 is a

presentation of the findings of the study and provides an analysis of business contributions and recommendations for professional practice, implications for social change, and recommendations for further research.

## Section 4: Findings and Conclusions

The purpose of this qualitative pragmatic inquiry study was to identify and explore the effective innovative technology integration strategies supply chain managers use to enhance profitability. The data were collected from six IT managers who successfully implemented innovative technologies within the supply chain. The five themes that emerged from the data included using ROI as a value inducing metric, stakeholder engagement and buy-in, challenges in technology adoption, resistance to technology, and managing risk. As innovative technologies create new operational paradigms, business leaders must incorporate more adaptive strategies that are guided by a technology-driven transformative approach. The cumulative data from the interviews demonstrates that effective supply chain integration involves more than simply installing software and monitoring devices. Successful technology adoption is a multifaceted approach that incorporates strategic alignment, cultural acceptance, financial considerations, extensive training, leadership support, and stakeholder communication at all phases of implementation.

### **Presentation of the Findings**

The research question was “What effective technology innovation integration strategies do supply chain managers use to enhance profitability?” I conducted six semi-structured interviews with IT managers from various industries within the IT and supply chain sectors. To ensure anonymity, each participant was designated with a unique identifier ranging from P1 to P6. The sample included participants from a diverse range

of professional disciplines including agriculture, life science, manufacturing, and logistics. The TAM was the conceptual framework used to ground this study and to explore how perceived usefulness and ease of use shape technology adoption. A thematic analysis was performed using NVivo to identify and investigate recurring patterns, key themes, and underlying insights within the interview data.

The findings of this study substantiated many of the studies in the exhaustive literature review. Multiple cross-industry similarities in how managers approached technology integration were observed from the responses from participants. The findings reinforced the mindset that effective technology integration strategies are connected to vigilant monitoring of the process, stakeholder engagement, and risk mitigation. The reported strategies enabled participants to leverage data-driven insights, enhance decision-making, and allow the business to respond more quickly to market demands in real time.

**Table 1**

*Frequency of Themes*

Themes	Number of participants identifying the theme	Number of occurrences
Using ROI as a Value Inducing Metric	6	18
Stakeholder Engagement and Buy-In	5	15
Challenges in Technology Adoption	6	21
Resistance to Technology	4	10
Managing Risk	5	14

### **Theme 1: Integrating ROI and Assessing Technology Value**

Each participant provided a unique perspective on the role of RIO in technology adoption. ROI emerged as a fundamental and recurring theme throughout the interview sessions. Emphasis was placed on ROI as a rationale for technological implementation and as a strategic framework for guiding decision-making. Participants reported that demonstrating economic value to stakeholders and leadership was an essential precursor to gaining support prior to implementation. Quantifying projected returns and aligning them with business objectives enabled participants to demonstrate with reliable data that technology initiatives would deliver measurable value and mitigate risk.

Participants provided performance indicators to enable teams to contextualize technology initiatives as strategic investments. P1 explained that key performance indicators (KPIs) were used to demonstrate how improvements can be made to increase value and realize a ROI. Specific examples were presented that support value-driven technology tools such as electric milk meters, activity monitors, and in-line analyzers to allow targeted intervention, improved breeding efficiency, and reduced herd-wide treatments for illnesses. To measure efficiency, P1 reported utilizing KPIs to track results and compare them to expected baseline data, which allowed farmers to identify areas in the supply chain that needed improvement. P1 said, “We make sure we feel we can add value and improve those KPIs. And then we come back periodically, and we measure against those baseline indicators and demonstrate improvement.”

P1 indicated that ROI in the dairy industry was connected to early detection of health issues and activity levels. One of the devices used to detect health issues is a wearable sensor or “a Fitbit for a cow.” The device provides real-time data on reproductive health and activity levels of the animals. The device enables early detection of issues that would otherwise go unnoticed, allowing farmers to intervene early to proactively reduce losses at a range of approximately “\$200 dollars per cow.” MPIs were used to demonstrate the technology’s effectiveness in enhancing operational value leading to a ROI.

P1 emphasized ROI by collecting data for preventative measures, while P4 expanded on this concept by introducing a more formal, preemptive approach that connected ROI to people, strategy, and scope:

Hire the right people and tie every technology decision to the company’s strategy; scope projects into discreet, testable blocks with clear acceptance criteria and independent financial oversight so savings are measurable, and ROI can be validated over time.

P4 maintains that profitable and sustainable technology integration begins first with hiring talented staff for the implementation process. When hiring new staff, it is imperative to ensure their skills align with the strategic goals of the business. P4 reiterated the importance of assigning clear responsibilities to every role involved in the implementation process, including scoping and financial oversight to establish measurable ROI. According to P4, higher ROI can be achieved when technology

adoption decisions are strategically aligned with business objectives. Getting the right staff in the right places is the first step reported by P4. Next, P4 calculated risk by using a methodological approach to determine how the technology initiative adds value in terms of improved cost savings, productivity, and ROI.

P4 introduced an additional methodology that was used as a structured approach to ROI to determine technological efficacy and value. The methodology used by P4 is AQICC, which is an acronym for availability, quality, inventory, cost, and continuous improvement. The process allows managers to determine the financial feasibility and cost savings of innovative technology. P4 stated, "I always used AQICC as my five big metric categories. If it didn't affect those five, outside of safety, we would measure the impact on both our metrics and our return on our investment." P4 included the financial department in the technology initiative to validate and evaluate projected gains by instituting monthly financial reviews so managers can track performance. The information gained through the AQICC process gave leadership and stakeholders tangible data to support current and future decisions throughout the implementation initiative. Including financial professionals enhanced transparency and accountability. The continuous benchmarking of financial data and comparing it to projections helped to ensure that outcomes remained aligned with the established strategic objectives. P4 stated,

So, you need to have a financial person assigned to your project whose job it is to answer that question. Okay, at the end of the day, this project, here are our goals.

We expected this to reduce cycle time by 50%. We expected this to reduce inventory by 20%. We expect this to improve quality by X amount of percent.

And so, all these goals need to be remeasured, validated, and then presented after you've gotten running.

The metrics used by P4 helped to develop a strategy to set goals and identify where in the supply chain new technology could help reduce costs and enhance value. The implementation strategy included assigning a financial lead to technological initiatives to measure outcomes against established targets. This role also ensured consistent evaluation of progress to determine whether a change in course was needed or if the initiative remained on target.

P4 reported also used enterprise resource planning (ERP) systems to support “centralized tracking” across departments to align procurement with organizational needs. P4 emphasized that technology implementation managers must consider the direction that the business is pursuing to determine the appropriate technological need:

So, you invest in automation, you invest in systems to give you answers like MRP, but then we found out that's not enough. We need DRP because we're trying to serve the world. So, distribution requirements planning then that's not enough. We need an MES system. Because we want to be able to track, communicate and track process performance by operator, by time, by quality result through a process.

Investing in automation and utilizing multiple analytical tools in conjunction exemplified the need to be forward thinking to foresee future needs as opposed to only being

reactionary to current needs. P4 invested in automation to allow the supply chain managers to track the delivery of products, performance, and quality. A three-pronged approach to data analysis allowed P4 to enhance quality, communication, and performance to enhance profitability. The strategy enabled supply chain managers to maximize perceived usefulness and to influence leadership behavioral intention to adopt automation technology.

P6 provided an example of a technology that uses dashboard software to track and display real-time movement of operational activities within a hospital environment. This system allowed hospital administrators to visualize workflow efficiency and make timely adjustments to improve operational performance. P6 noted,

And we can give them all those metrics that are pretty good. And we have a dashboard that kind of shows who the leaders are, meaning who are the ones that are performing their moves at a faster average time, and then how many they're doing.

The software enabled hospital leadership to monitor staff performance and justify resource requests to enhance productivity, reduce redundancies, and reduce costs. Leadership was then able to make decisions based on real-time data as opposed to only historical data. Participants viewed technology as a strategic tool to enhance ROI by resolving issues, expanding operations, and directing the organization to new arenas of opportunity. The findings illustrate how data-driven tools provide visibility and accountability to improve productivity. Shifting decision-making from reactive to

proactive; participants were able to demonstrate how technology could drive efficiency and growth.

### ***Correlation to Literature Related to RIO***

Participants' responses indicated that innovative technology must be able to demonstrate it can provide value in measurable and quantifiable operational terms that guide the decision-making process and generate buy-in from all stakeholders. The findings of this study align with the findings of Moosavi et al. (2022), who reported that external economic pressures directly influence supply chain profitability underlining the need for technology that provides quantifiable benefits.

The participant insights discussed are supported by the study by Szulakowski (2022), who emphasized the importance of stakeholder input and using financial data to evaluate technological innovation progress and success. P3's experience during the COVID-19 pandemic exhibited how reacting quickly to external disruptions can be used to secure a RIO. P3 stressed that reacting quickly to the COVID-19 epidemic by stocking up inventory early enabled the company to avoid lost sales and remain operational, while competitors were shutting down their operations.

It wasn't necessarily increasing our profitability. We did; I would say that we were getting discounts because we were buying huge amounts. We were buying in bulk because we were stocking up like anywhere from 12 months to 18 months of supply at one time.

P3 stated that the financial gains were difficult to quantify directly, but the counter measures employed contributed to the overall financial resilience via sustained R&D and bulk procurement advantages. A proactive strategy was incorporated by P3 to counter the COVID disruption to the supply chain underlining the importance of maintaining continuity by prioritizing preemptive actions quickly. P3 demonstrated how strategic inventory management could serve as a safeguard against external disruptions.

P2 was able to ensure that the technology was co-developed, allowing for an all-inclusive implementation process to generate buy-in. Participants created a venue to allow stakeholders to express concerns and ideas prior to implementation. This type of collaborative approach exemplifies that RIO opportunities sometimes manifest from day-to-day operations. When stakeholders are in continuous communication, they are better able to evaluate the strategy to determine if the organization is headed in the right direction.

This type of strategic approach is supported by Sharabati and Jreisa (2024) who found that aligning technology investments with organizational objectives drives growth and efficiency. P2 emphasized the importance of immersive, stakeholder engagement through a type of mapping process of how technology needs to be structured and implemented. Involving cybersecurity departments, financial departments, and supply chain experts early in the development phase, P2 was able to identify how the new technology would contribute to RIO.

We took a week to every location. We sat down with them, and we said, walk us through your process. So, we tracked, we had experts, and we had cyber experts. We had the actual supply experts, all of them, the people who manage the system, financial experts. We had everyone there explain the process, what you're doing.

This response to supply chain disruption supports the study by Smith (2024), who found that some types of innovative technology enhance communication to reduce disruption to enhance profitability. Technologies that enhance communication include IoT, blockchain, cloud-based platforms, and AI. Effective communication software and devices allow for quicker responses to collaborative endeavors for comprehensive informed decision-making. IoT devices can transmit real-time data on inventory levels and shipment conditions. Blockchain technology ensures secure and transparent information exchange across multiple stakeholders' locations. Cloud-based platforms enable centralized communication to help reduce the silo effect and allow for synchronized planning and development. AI-driven analytics help anticipate disruptions before they occur, allowing businesses to preemptively develop strategies to counter these types of disruption.

Communication technologies help to build trust among stakeholders and create continuity to allow businesses to react quicker to internal disruptions and markets fluctuations. RIO was found to be a highly dynamic process that involves strategic planning, cross-functional collaboration, and continuous re-examination of the process to better understand how technology can affect profitability. Technology that can

demonstrate financial impact through cost savings, efficiency, and risk mitigation are more likely to be adopted and sustained (Raj et al., 2022; Shilling & Seuring, 2022). The emphasis on communication technologies directly connects to the conceptual framework, where perceived usefulness emerges as a primary determinant of technology adoption.

### ***Correlation to the Conceptual Framework Related to RIO***

The responses provided by the participants demonstrate how perceived usefulness and ease of use are the underlying motivation behind the decisions on the types of technology required and the overall design. P1 stressed this point by stating “It all comes back to a return on investment for the dairymen.” Technology acceptance for this population hinged on how operational performance can be enhanced to demonstrate a viable RIO.”

P1 reported that when cows were fitted with wearable sensors (a Fitbit for cows), dairy farmers were able to provide cost savings of \$200 dollars per cow by catching health issues early. The technology transition became a strategic advantage that directly influenced the decision to use the new technology. Once the technology was viewed as a contributor to RIO, the technology was perceived as useful. P6 reiterated that behavior intention is strengthened when stakeholders can observe the benefits of the new technology directly.

I think helping them understand the benefits of being able to see the data as it’s tracked, even though I think at the beginning sometimes they think that the new process is going to require extra work, it might slow them down initially, but then

as they understand how the software works and how the it's going to help their end users.

P6's evaluation process suggested that the cognitive instrumental concepts proposed by Venkatesh and Davis 2000 in the TAM2 framework had a role in technology acceptance. Cognitive instrumental processes are the user's evaluation of how well technology supports their workload. The collaborative planning and implementation strategy described by P2 is an example of how social influence plays a role in technology acceptance. The response from P2 illustrate how cognitive instrumental processes and social influence factors interact to shape behavioral intentions.

We had the actual supply experts, all of them, the people who manage the system, financial experts. We had everyone there explain the process, what you're doing. P2 used an inclusive approach to leverage peer support and approval to encourage buy-in. The strategy used by P2 is supported by Ashari et al.'s (2022) finding that social pressures strongly influence user intention when adoption is perceived as voluntary and inclusive. The stakeholders that will be utilizing the new technology are more likely to believe that the technology is useful and relevant to their job when they participate in the design and development phase.

The iterative tracking of key performance indicators (KPIs) by P1 and the transparent communication of trade-offs to leadership reported by P4 reveal that an ongoing feedback loop can influence positive attitudes toward the use of innovative technology (Davis, 1989). Participant responses demonstrate that ROI functions as

financial metrics and a strategy by managers to indirectly influence perceived usefulness and perceived ease of use via social influence and cognitive reinforcement.

### **Theme 2: Stakeholder Engagement and Customer-Centered Buy-In**

The successful implementation of innovative technology was reported by participants as an upgrade to the supply chain involving a multidimensional approach that involves input from multiple departments and stakeholders. Across all interviews, stakeholders and customer engagement were consistently cited as crucial determinants for success. Stakeholder and leadership engagement involves scoping the technology initiative project. As noted by P4, “unless the whole company is committed to the process it’s going to take longer.” Understanding stakeholder expectations and communicating trade-offs to executive leadership were also mentioned as essential for aligning the implementation strategy with business objectives. Successful technology implementation was viewed by participants as primarily dependent on creating a coalition.

Scoping in supply chain management involves establishing protocols and setting parameters for implementation. During the scoping process, those leading the initiative make determinations related to how technology will contribute to improving efficiency, reduce costs, and increase visibility across the nodes in the supply chain (Agidi, Ezeh, Lawal, & Sarder, 2024). Stakeholder and leadership involvement in the scoping phase was viewed by participants as critical to align expectations and create buy-in early in the process. Finding the right balance between technical capabilities, available resources, and

stakeholder expectations was described as essential by participants to ensure that the implementation strategy remained viable. P4 stated:

And what usually happens when your scope is too big is you get to your end point and then you start having to make hard decisions. You know, what functionality can I drop on this iteration and basically start another project to wrap it up? And that's never a pleasant thing to do. It's pretty common in the industry to have to do that.

Early scoping was reported to involve creating a map of existing processes and then identifying issues and inefficiencies. Once a map has been created and inefficiencies have been identified, the design phase or the technology selection process begins. Decisions are then made in terms of what is in scope and what is out of scope. Budgeting, resource allocations and timelines are then established to help mitigate scope creep (Agidi et al., 2024). Scoping was reported by P4 to include assessing stakeholder needs and documenting agreements to help align expectations.

So, we would sit with key stakeholders in manufacturing or R&D and go through the actual test cycle with them to make sure that, hey, this is how your people are going to be performing this transaction or this function inside of the system to make sure that like they were bought into it.

Another consideration in the scoping phase is to identify the risks associated with the technology initiative. Risks to contemplate are operational risks, financial risks, strategic risks, cybersecurity risks and compliance, and regulatory risks. P2 stated:

Okay, so essentially, when we're looking at this, of course we look at things like cybersecurity. How long is it going to take to transfer the data, who has control over said data? Where is it hosted? Do we get this up in time?

Risk assessment in the scoping phase was reported by participants to involve identifying challenges such as data security, integration issues, compatibility requirements, and regulatory requirements. A well-developed implementation strategy encompasses a careful examination of acceptable risks balanced with an extensive scoping of resources, stakeholder needs, and operational requirements.

#### ***Correlation to Literature Related to Stakeholder Buy-in***

The insights provided by the participants from this study suggest that stakeholder involvement is essential at every stage of the technological implementation of the lifecycle. Participants emphasized that implementing technology requires actively engaging stakeholders and fostering buy-in by providing avenues for input on design and functionality. P4 stressed the importance of early-stage scoping and cross-functional collaboration prior to technology implementation.

Successful adoption starts with scope. And so, scoping the project and getting it into a document that really fulfills the needs of all the stakeholders is an art, and it is also a lot of work. But if you do it right, there's a lot of benefits to having everybody on the same page and everybody agrees to a document.

Phadnis (2024) suggested that successful technology implementation involves a strategy of planning, organizational alignment, and active buy-in from both employees

and stakeholders. Stakeholder collaboration was instrumental in building a shared understanding to foster acceptance. P2 brought in experts from cybersecurity, the financial department, and other departments to hasten a discovery phase that enabled the team and leadership to have a clear picture of how the new technology will be designed and implemented. P2 noted that the most successful aspect was “making sure everyone kind of felt like they had a voice and that voice was heard.”

This perspective was supported by the work of Brennan et al. (2021), whose study on shared governance in nursing demonstrated that stakeholder involvement enhances engagement. Ashari et al. (2022) found that when employees perceive that important peers and leaders endorse a technology, their willingness to adopt it increases significantly. P3 further supported stakeholder engagement by reiterating the importance of leadership alignment and the practice of proactive communication. P3 reported that:

So, getting buy-in is really important and buy-in at all different levels. Right.

Buy-in at the bottom. Buy in at the top. So, you make sure that like your bps' and directors are on board with what you're going to implement.

P3's perspective is validated by Mulani et al.'s (2024) view that the blockchain consensus functionality ensures that all nodes in the supply chain network are approved to the terms of the contracts in the blockchain agreement. Social influence plays a primary role in shaping technology adoption decisions. The importance of leadership support and peer encouragement during and prior to implementation became a recurring theme throughout the interviews.

Important practices reported by the participants include scoping, inclusive design and testing, transparent communication, and multi-level buy-in. The concept of participatory and inclusive design in innovative technology is supported in literature. Brennan et al. (2021) iterated that when technology initiatives are supported by dependable data and communicated effectively, stakeholder support begins to enable the transition process to be more efficient and well-organized. Tremoulet et al. (2024) also discusses the participatory design approach in the development and pilot-testing of a digital assistant tool (DAT), which involves collaboration and iterative feedback from users and stakeholders. The insights gained from the responses of the participants and the literature identify some of the common issues pertaining to the difficulties and challenges encountered in technology transformation.

The inclusivity of stakeholders is supported by William's (2024) claim that collaborative risk-sharing, transparency and inclusive communication help to build trust and encourage stakeholder alignment. P3 utilized early training and testing of technology initiatives to engage stakeholders in R&D and manufacturing. The goal was to allow them to experience functionality prior to implementation. This process helped clarify workflows and secure buy-in for employees that would be performing the work and the stakeholders involved in the day-to-day operations. P3 emphasized that:

Stakeholders buy-in is really important, I think just, and some of the softer aspects of it, you know, not, not even like, the hardcore technical innovations, stakeholder

buy-in is always super important and making sure to include people, cause that's one of the, ways that software fails, right?

The importance of multi-level buy-in was reiterated by all participants to some degree or capacity. P6 reported that initially there was resistance to the new technology stemming from unfamiliarity to the technology and comfort level with current policies and procedures. Once users and leadership were able to see the benefits of real-time data tracking, support for the new technology grew. Dadsena et al. (2024) emphasize that standardizing processes through stakeholder consensus reduces variability in adoption and mitigates resistance. Participants reported that demonstrations of the efficacy of the technology helped to establish buy-in and foster usability.

The study by Brennan et al. (2021) supports these findings that visibility plays a role in developing a greater sense of empowerment and commitment to the process and final product. P4 stated that successful adoption required a high level of executive commitment, support, and active involvement in the process prior to, during and after the implementation process. Collectively, these studies confirm that structured, multi-level stakeholder engagement fosters perceived usefulness and cultivates the organizational alignment required for successful technology adoption.

### ***Correlation to the Conceptual Framework Related to Stakeholder Buy-in***

Stakeholders buy-in and the technology acceptance model (TAM) are closely connected constructs that incorporate human behavior as mediating factors in technology acceptance. The TAM identifies two primary factors of perceived usefulness and

perceived ease of use as determinants of whether individuals will accept and utilize a new technology. These same factors are believed to influence stakeholder engagement when stakeholders believe technology will add value to their work. Stakeholders are more likely to support the use of new technology as it is pertinent to their work.

When stakeholders buy into a new technology, TAM's principles are reinforced in the form of positive feedback loops. Engaged users share their experiences and encourage wider acceptance across the organization. TAM provides the theoretical foundation for understanding technology acceptance, while stakeholder buy-in is more likely if the technology is perceived to be useful and easy to use. Stakeholders must first view the technology as useful or easy to use before buying into the technology.

The interview data showed that when stakeholders are involved early in the process via planning meetings, training sessions, and system testing, they are more likely to perceive the technology as valuable. P3 described how stakeholder involvement helped validate the value of the initiative by stating "Hey, I did this initiative, and it paid off with X, those things are always helpful and help to increase your credibility". Similarly, Schmidt et al. (2022) found that new technologies facilitate information flow, enhance stakeholder communication, support informed decision-making, and enhance profitability. Enhancing buy-in and stakeholder engagement leads to perceived usefulness.

Perceived Ease of Use (PEOU) is also strengthened when stakeholders are given opportunities to learn and interact with the system before full implementation. P3 reiterated the need for involvement by stating:

It goes through a bunch of test cycles up to what's called the UTA user acceptance testing it's still in a sandbox environment it's not in production you basically like test everything as though it will be in production but you're still in a like a test environment and then once you've gone through a bunch of test scenarios you make sure that like the system is functioning as it should be and then you push it over to production then you actually implement the process both systematically and functionally in the workplace.

Sandboxing practices were used by P3 to reduce the perception of complexity and build user confidence. Perceptions of complexity and confidence levels are components of perceived ease of use. Behavioral Intention (BI) to use is most directly influenced by stakeholder buy-in. When stakeholders feel heard, informed, and involved, their willingness to adopt and support the technology increases.

P3's early involvement of end users and iterative testing sessions strengthened the perceived ease of use. By creating a co-designing process and offering "sandbox" environments, managers reduced technology anxiety. P3 explained "Having a sandbox is super helpful if people don't buy into the tool inside of the system" A hands-on approach helped stakeholders to clarify interaction steps and builds user confidence to increase perceived ease of use and made the system feel more intuitive (Hong et al., 2024). The

insights discussed helped to confirm that deliberate stakeholder engagement initiates TAM's social influence and cognitive instrumental processes. Effecting behavioral intentions is a necessary component for successful technology adoption.

P2, P3 and P4 engaged cross-functional experts and stakeholder involvement to allow input and expertise to incorporate a variety of ideas and perspectives. P2 stated "I would say that was the most successful part, making sure everyone was on page, making sure everyone kind of felt like they had a voice and that voice was heard." Oraman et al. (2024) similarly argued that stakeholder engagement before implementation enhances perceived ease of use by aligning new tools with existing workflows. Perceived usefulness was exemplified by participants' effort to improve ease of use in a sandbox environment and training to reduce complexity in the hopes of strengthening behavioral intention.

### **Theme 3: Challenges in Technology Adoption Across the Supply Chain**

The interviewees reported a diverse array of technological challenges related to the implementation of new technology into current supply chain structures. Data integrity emerged as a pain point described by P3. The difficulty reported by P3 was establishing accurate master data across hundreds of items, especially when sourcing information from various departments and buyers. P2 stated "Trying to get master data accurate was very challenging because you're going from a system in which you have individual parties buying all different types of supplies". This point of pain made it difficult to resolve lead time issues, associated costs, and identify patterns related to demand

forecasting. This insight reported by P2 supports the need for more robust data governance and higher levels of cross-functional collaboration. Some participants communicated a more global perspective to challenges encountered.

Coordinating efforts across multiple departments in different locations often presents significant challenges. P4 discussed the limitations of traditional planning systems such as MRP (Material Requirements Planning) in effectively meeting demand across multiple locations and departments.

We need DRP because we're trying to serve the world. So, distribution requirements planning then that's not enough. We need an MES system. Because we want to be able to track, communicate and track process performance by operator, by time, by quality result through a process. And we also want to capture the components that go into that product.

Tools such as DRP (distribution requirements planning) and MES (manufacturing execution systems) were used in conjunction with MRP to more accurately meet demand. MES was reported as a real-time system that allows for monitoring and control of production. The system tracks materials, labor, and quality during the manufacturing process (Reus, 2023). The MES system was used to bridge the gap between the DRP and MRP tools to help improve efficiency and quality.

P4 reported this was especially important during the Brexit and COVID-19 epidemics, as meeting demand became more difficult for global distribution due to changing regulations and the shutdown of traditional supply lines. The impact of these

external disruptions revealed vulnerabilities in the product delivery system, prompting leadership to adopt counterstrategies to address these types of challenges.

We had one distribution center for all of Europe. And with Brexit, there were great delays. And delays are our enemy. So, we ended up having to bite the bullet and set up a secondary distribution center in the UK which is expensive. There's a lot of technological applications, software, and hardware automation that we apply, but it's always to solve a problem.

Automation technology was implemented to resolve issues and problems in the supply chain. The technology was primarily used to address disruptions and delays caused by Brexit and COVID. Leaders had to react to the disruption and make difficult decisions in terms of balancing the cost of new technology and the need to keep the supply chain functional. P4 described the difficult trade-offs that were identified and presented to leadership. The use of the three tools MPR, MES and DRP suggested to leadership that, to sustain demand, the business would need to reallocate resources to counter external disruptions in distribution efforts. More distribution facilities had to be built, and new technology had to be implemented, increasing overall costs for the business. Identify and discuss tradeoffs with leadership was reported by P4 as he stated:

So, for me as a supply chain guy and maybe the manufacturing guy, my strategy needs to be aligned to the business strategy. How are we going to be distinctive in the business? That means I'm not going to be great if I'm going to be great at some things. I'm probably going to have to make some tradeoffs.

Fluctuating demand and disruptions in the supply chain create complications that require technological agility. Participants articulated that a well-defined strategy, and strong executive alignment help to counter external disruptions and fluctuating demand.

Participants identified the challenge of aligning new technologies with existing structures and functionalities. The responses to questions pertaining to challenges were rooted in the idea that successful integration is a combination of technical solutions, a clear strategy, continuous engagement with stakeholders, and adaptability that is built into the supply chain.

### *Correlation to Literature*

Participants across all interviews pointed out the challenges, including resistance to technology and compatibility issues. The challenges reported by participants identified the importance of mapping out the current infrastructure to identify any compatibility issues prior to implementation. This challenge is supported by Steward's (2024) emphasis on anticipating technical incompatible issues prior to implementation. P5 noted that many users were reluctant to adopt new systems, preferring familiar procedures and systems. P5 reported that "you pick a technology and then there is nobody really managing actively anymore, so stuff starts breaking".

Resistance to change was frequently cited by participants as a significant barrier to technology acceptance. P4, reported that "employees often resist learning new systems, and without active oversight, technology can quickly become obsolete". Dadsena et al. (2024) identified employee resistance and lack of standardization as major inhibitors of

blockchain adoption, reinforcing the need for structured change management. Ashari et al. (2022) found that perceived ease of use and social influence significantly shape adoption intentions, suggesting that clearly demonstrating benefits and providing robust training are essential for technological acceptance.

P4 reported that complexity and overambitious scoping further reduce perceived ease of use and “overwhelm users”. Zhang et al. (2024) cautioned that the sheer volume of data gathered by IoT efforts can overwhelm analytical capabilities. P4 discussed the danger of over scoping on large-scale projects that fall short after lengthy implementations stating that:

You can over scope, people can dream up these perfect tools, those take a long time to implement, and then oftentimes they still fall short or something changes.

Over scoping can increase system complexity and delays result in leaving users frustrated and less inclined to adopt the new technology (Fateme et al., 2024; Davis, 1986). Participants reported that governance, scoping, and strategic alignment issues further complicated implementation efforts. The need for clear ownership and structured documentation to maintain continuity throughout adoption efforts is supported in literature as a means for resolving challenges (Manzoor et al., 2024).

External disruptions and internal challenges played a significant role in shaping technology deployment. Participants described how supply shortages, Brexit-related delays, and the COVID-19 pandemic necessitated rapid strategy development to react to future shortages and transportation challenges. Some businesses adopted a rigid stance,

choosing to wait out the disruptions rather than taking proactive measures to mitigate their impact. Phadnis (2024) advocated flexible procurement and pricing strategies to mitigate market volatility. Flexible strategies enable supply managers to respond more effectively to sudden disruptions, maintain supply chain continuity, and reduce financial risks. Manzoor et al. (2024) noted that blockchain's transparency and real-time data sharing can bolster resilience during crises. Real-time data sharing helps to maintain operational continuity and enhance trust among stakeholders. Schilling and Seuring (2022) added that robust communication and partner certification practices strengthen trust and accountability. Collaboration and stakeholder input across supply chain nodes help to maintain transparency and operational continuity during periods of disruption.

#### ***Correlation to the Conceptual Framework- Challenges in Technology Adoption***

The technical constraints reported by participants illustrate how infrastructure compatibility plays a role in technology acceptance or resistance. P2 indicated that the existing tools were incompatible with the new technology. By involving stakeholders and leaders during the development phase, input from various departments and coworkers was gathered to ensure the new technology would be seen as both user-friendly and valuable. Compatibility issues exacerbate the perception that innovative technology is too complex to work and therefore not easy to use and not useful. If stakeholders and leaders believe the new technology cannot be integrated into the current supply chain, it will be difficult to show that it will enhance job performance and add value.

P2 identified technical limitations as significant barriers to the implementation of the new technology. The current tools in use were incompatible with the existing network infrastructure, prompting systems overhaul. The outdated current infrastructure posed challenges due to high conversion costs and constrained timelines imposed by leadership.

P2 reported:

So, we were looking at, time saved, you know, ease of use. You know, how much easier is this to use than the last system you were using? And then we were consistently also sending, we also hosted classes. Hey, here's how to use the new system. You know, we know it's a big change. But constantly reaching out to the customer and trying to get that feedback was what was most important to us for evaluating that.

P2's response aligns closely with the technology acceptance model (TAM), which posits that perceived usefulness and perceived ease of use are key determinants of user acceptance of new technology. By emphasizing time saved and ease of use, P2 directly addresses these two primary principles of the TAM framework for ease of use and usefulness. P2's approach reflects a strategic alignment with TAM principles. P2 engaged users to determine receptiveness and provided training to exhibit the benefits of the technology. Questioning users about their perceptions of efficacy and their level of engagement helped determine the factors that influence acceptance. The importance of supporting users during the transition was further exemplified by P2 offering

instructional classes and consistent outreach. The effort to gather customer feedback reflects a commitment to iterative improvement and responsiveness. P5 stated:

Follow-up meetings, Q&A meetings, or what do you call it? No, not like idea meetings. Think that was especially useful in the tone of ‘hey, let’s use this you’re going to do this, but it was more like how we can do better or more fully utilize this tool.

Instead of treating the rollout phase as a one-time event, the management team prioritized continuous engagement and accountability as an iterative process to refine the design and implementation strategy. The importance of accountability and oversight was stressed by P5 noting that “You pick a technology and then there’s nobody really managing it actively anymore, so stuff starts breaking, and...you know, it becomes sort of obsolete”. A lack of accountability and oversight creates the perception that management does not fully support the new technology initiative. The TAM framework predicts that a lack of accountability will eventually extinguish behavior intention. When employees feel disfranchised by the lack of leadership, stakeholders and employees tend to revert to the old way of performing their work (Ashari et al., 2022; Davis & Venkatesh, 2000). Participants understood that input from multiple stakeholders and leaders promotes a higher level of buy-in to generate acceptance. P1’s response suggested that any proposed changes must be accompanied by strategies to ensure continuity.

So, you must be able to adapt what you’re offering to their current operational scheme. Um, massive changes to business operations kind of upset routines,

which tend to be critical to the functioning of a business. We found it best to target one aspect of the business. And then, that's needing improvement and then kind of take a step-by-step approach.

New technology must be perceived to be adaptable to existing workflows and infrastructure to influence perceived usefulness. P1's insights on maintaining routines while systematically introducing new technology in one department at a time supports incremental deployment. Ensuring that new technology aligns closely with users' workflow is essential to maintaining behavioral intention and fostering positive attitudes toward the new technology (Venkatesh & Davis, 2000). Challenges reported by the participants such as technical incompatibility, resistance, data integrity issues, and complexity relate directly to the determinants of TAM, TAM2, and TAM3. The responses from the participants demonstrate how barriers to compatibility, social influence, cognitive instrumental processes, and computer self-efficacy impede technology acceptance.

#### **Theme 4: Resistance to Technology**

The interviews reveal that resistance to technology and change is multifaceted. P5 stated "There's an ethos I've seen a lot where a developer person is like, 'I'm a programmer god and I'm so smart and I don't have to talk to anybody about it'". Resistance of this nature aligns with the social identity theory, which suggests that challenging one's professional self-concept invokes defensive reactions rather than collaboration. Self-concept resistance requires a strategy that acknowledges individuals'

identity-related concerns. The goal of this type of strategy is to reinforce their sense of competence to align technological change with their personal and professional values. P2 noted that:

There were some people that were definitely hindering the process. Not everyone likes change, or sometimes people don't like we were actually brought in. So, we were brought in as consultants over another cyber team. So, they weren't exactly too fond of being told that you're gonna follow this other team. So, it was more; most of the issues were technical, but the people involved didn't necessarily help either.

The response from P2 demonstrates how active pushbacks can inhibit technology initiatives. P1 stated that "half of the dairy farmers out there cannot, will not, or will not use new technologies". Technological resistance on this level often stems from fear of change, lack of understanding, or perceived threats to their position. Many participants attempted to counteract these types of resistance by incorporating targeted communication and inclusive engagement strategies before and during the implementation process. Resistance at this level highlights the difficulty of breaking business cultural norms to effect real changes. Participants across interviews identified cultural and behavioral resistance as barriers that must be addressed to strengthen technology acceptance.

Leadership attitudes and behaviors were discussed by participants exposing how change efforts can be inhibited when top level stakeholders do not buy in to the

technological changes. When early buy-in was lacking or ineffectual, participants discussed how to influence leadership to accept the new technology. P3 identified technology resistance by stating:

Even if you have a fancy piece of software, people have a tendency if they've been doing something another way to just keep doing it offline, outside of the system"

There is sometimes a tendency for leadership to remain lackadaisical in technology acceptance, and they may prefer not to challenge employees and stakeholders just to keep the peace. There is a strong propensity for maintaining the status quo for some employees and leaders. When leaders prioritize short-term harmony over strategic direction, they tend to unknowingly reinforce resistance. P6 identified this stating:

Some are still averse to technology, and I think if they can help their subordinates, not be happy with the software, that there's gonna be a way that they can discard this change or that they'll get rid of it.

Participant insights regarding resistance to technological changes indicate that effective strategies should incorporate a three-pronged approach. Successful change management must integrate psychological, cultural, and structural strategies to counter resistance. Resistance to change was addressed by Kurt Lewin in his model through the concept of "unfreezing- change- and refreezing," which involves preparing individuals and organizations to let go of existing behaviors. The old behaviors are released to allow new

mindsets to be introduced and eventually “refrozen” into a new long-lasting policy or procedure (Cummings et al., 2016).

Another influential framework developed to address organizational change is Kotter’s 8-Step Change Model, which outlines a process for initiating, managing, and sustaining change. The 8 steps include establishing a sense of urgency, forming a powerful guiding coalition, creating a vision for change, communicating the vision, empowering others to act on the vision, generate short-term wins, consolidating gains and producing more change, and sustaining new approaches in the organizational culture (Mayo, 2021).

The emphasis in Kotter’s model is to develop a leading coalition to appoint and empower change agents at multiple levels who hold teams accountable. The process helps to prevent employees from reverting back to old behaviors and norms prior to implementation. Building a culture of continuous learning via communities of practice, technology champions, and recognition systems helps to address pushbacks that can stifle progress. P2’s responses alluded to a similar order of operations. P2 stated:

We took a week at every location. We sat down with them, and we said, ‘walk us through your process So we tracked; we had experts, and we had cyber experts. We had the actual. supply experts, all of them the people who manage the system, financial experts. We had everyone there. Explain the process, what you’re doing. After we got that, we went back to the main headquarters and we said, hey, here’s how each of your three locations is doing business

The participants in this study employed a variety of interventions, such as hands-on workshops for farmers, sandbox demonstrations, and development teams, to foster a sense of ownership to counter resistance.

### ***Correlation to Literature: Resistance to Technology***

Many participants discussed the necessity of stakeholders and leadership support. Without support for new technology from leadership stakeholders will not see it as important and will be resistant to the change P3 stated,

I did this initiative, and it paid off with X... those things are always helpful and help to increase your credibility so that you actually have data to support what you were doing and hopefully what you're gonna do in the future.

This supports Cortellazzo et al. (2019), who found that when leaders create an environment that supports collaboration, the business is better able to leverage digital tools to facilitate communication and coordination among team members. Santo et al. (2014) also highlights the importance of team strengths in technology adoption, noting that the strength stage is utilized to use the strengths of the team and usefulness of the technology. These factors contribute to behavioral intention by fostering a culture of acceptance and strategic alignment.

Participants across interviews described cultural and behavioral resistance as a barrier to technology adoption. P2 stated "Of course, there was the infighting of, well, I want that, well, I don't want that" when new tools were introduced. Competing priorities and opinions among team members can surface during periods of technological

implementation. P4 observed that “There was a really interesting aspect because there’s a large tendency for development-type people to sort of hide. P6 recounted a similar experience stating:

And then the other challenges that we’ve kind of faced is just a difference of opinion with leadership, leadership and these individuals.

Participants emphasized structured training and leadership support as essential to overcoming resistance. P5’s development team created detailed playbooks outlining common errors and fixes for each new hire. The playbook served as a resource guide for troubleshooting issues and streamlined the implementation process. Szukalowski (2022) argued that investing in employee input, comprehensive training, and analytics enhances organizational culture and supports successful technology integration. These targeted change management strategies align with Steward’s (2024) warning that failing to address human factors can prevent realization of technology’s benefits and lead to unacceptable costs and disruptions.

### ***Correlation to the Conceptual Framework***

The interview data validates key themes from the literature and demonstrates how perceived usefulness, perceived ease of use, and behavioral intention to use are reflected in real-world supply chain practices. The integration of pilot testing, scenario planning, cybersecurity protocols, and leadership support provides a comprehensive framework for mitigating risk and successfully implementing new technologies.

The TAM is based on perceived ease of use and social influences as key determinants of technology adoption. Dadsena et al. (2024) identified employee resistance and lack of standardization as primary inhibitors of blockchain and other technology adoption in supply chains. P4's comment that "people just don't want to learn something new" and P6's report of staff clinging to old processes support the research by Ashari et al. (2022) finding that lower perceived ease of use reduces behavioral intention to adopt technology. Oraman et al. (2024) similarly demonstrated that compatibility between new technology and existing procedures and processes significantly affects perceived usefulness and adoption intentions.

Several participants described how new tools were incompatible with existing workflows, leading to apprehension and preference for the old familiar methodologies. These responses align with TAM3's emphasis on "computer self-efficacy" and "perceptions of external control." The lack of structure left users with a degree of uncertainty. The uncertainty created a lack of confidence in computer self-efficacy, and the perception of no external controls helped to reinforce resistance. The combination of uncertainty, low confidence, and perceived lack of support contributed to a higher degree of resistance

Several interviewees stressed the necessity of formal governance to counteract resistance to technology adoption. P5 noted that "If they care, they need to have somebody to report back to that has the authority or role to make sure others are following the yeah, the change strategy." These observations relate to the observation by

Benton's (2019) recommendation for strong collaborative relationships and information-sharing policies to mitigate disruptions and ensure accountability. These observations reinforce the TAM2 framework by highlighting the importance of social influence such as leadership endorsement to drive technology acceptance (Tirpan & Bakirtas, 2024).

Overall, the interviews reveal that resistance to technology adoption is influenced by a combination of low perceived ease of use, weak social reinforcement, and insufficient structural support. TAM is reflected in participants' belief that new systems were too complex and not beneficial enough to justify the effort. TAM2 is predicated on the idea that social influence and cognitive processes play a critical role in determining a user's intention to adopt new technology. This concept was exemplified in the interviewees' focus on creating buy-in and inclusivity at all levels prior to and during implementation. The TAM frameworks help explain why technical solutions fail to gain users acceptance when users lack confidence and the cultural support needed to embrace technological change.

### ***Subtheme 1.1: Pilot Testing to Assess Performance in Real-World Conditions***

Pilot testing appeared to be a key strategy for mitigating risk and validating system performance. P3's use of parallel systems running Excel-based planning tools alongside the ERP system demonstrated a real-world application of pilot testing to ensure accuracy and system reliability. P3 explained:

We almost ran it like in parallel. I would have my same kind of planning tool set up in an Excel document that we had in the system, and I would run them in

parallel for the first few weeks so that we could make sure that the output in the planning system was matching my Excel document. (P3)

Interviewees highlighted the importance of contingency planning and system maintenance prior to technology implementation. Proactive preparation helps mitigate risks and reduces the likelihood of costly disruptions during deployment. P2 discussing the need for backup plans in case of system failure reporting “That helps, at least in my mind, for when we’re developing these systems, because then we know if we maintain the system, they’ll be like their backup plan.”

These practices support TAM’s perceived ease of use by reducing complexity and increasing confidence in the reliability of innovative technology. The interviewees discussed the significance of pilot testing in ensuring the new technology meets user needs. P2 explained “We went through beta testing with a couple facilities as well to make sure that it was fulfilling their needs”. Real-world validation before full deployment was an important strategy prior to full implementation. P3 elaborated on his team’s sandbox approach:

There’s what’s called like, different stages within software implementations that are, CRP, which is a conference room pilot, and so you kind of go through the demo of what the tool should look like. And so, we had internal specialists that kind of had a theory of what this would look like. They mocked it up in the system in a sandbox environment. And so you run through what the demo would look like and then you start iterating on that kind of early iteration of what the

design will be, and then it goes through a bunch of test cycles up to what's called UAT, user Acceptance testing.

P3's use of a conference room pilot (CRP) served as a preliminary test of the software's intended functionality prior to implementation. A mockup of the system in a sandbox environment allowed stakeholders to interact with the prototype. By introducing the system in a controlled environment for interaction, the team was able to improve the new technology through successive test cycles. Next, the team utilized User Acceptance Testing (UAT) to determine if employees accepted the new technology. UAT simulates real-world conditions to ensure the system performs as expected before it is deployed into production (Venkatesh et al., 2003).

Once acceptance is validated and the technology has passed the tests, the new technology is implemented into the supply chain. P1 observed, "We found it best to target one aspect of the business and then this needing improvement and then kind of take a step-by-step approach to offering our full solution". Interviewees emphasized the value of an incremental approach to implementation. Participants found it more effective to focus on one aspect of the business that requires improvement. A step-by-step strategy was deployed to allow for stress testing and reduced risk during implementation. Incremental deployment allowed problems or compatibility issues to be addressed at one a time instead of all at once.

P4 noted, "You do a contract, you do a certain deliverables statement of work, and you move into acceptance criteria". The importance of contractual clarity was

highlighted, particularly using Statements of Work (SOW) and defined deliverables. These agreements establish clear expectations and acceptance criteria, ensuring that all parties are aligned on the scope, timeline, and performance standards of the implementation. The responses from participants suggest that effective pilot training procedures must include user-centered testing environments done incrementally. Embedding conference room pilots and user acceptance testing within project plans allows teams to validate processes.

### **Theme 5: Managing Operational and Compatibility Risk**

Risk management procedures helped guide participants to anticipate and manage risk from the beginning to the end of the implementation process. P2 utilized a more standardized approach to risk management by mapping out and discussing acceptable risks versus unacceptable risk prior to implementation with stakeholders and leadership. P6 reduced risk by consulting with other businesses stating:

I guess, to help us understand risk management, was talk to other organizations that had used the software prior to us and how it had benefited them. And so, we talked to about three other hospitals prior and just kind of got their feedback and some of the pitfalls and some of the issues that they've faced and tried to avoid those and have continued to use those same ideas to avoid issues when we implement in the new areas.

P6 evaluated whether the new technology was suitable for the business by consulting with 3 other companies about its effectiveness and the issues that were prevalent during

the implementation and deployment process. The other businesses offered recommendations based on common issues they encountered during their own implementation processes. This approach not only allowed managers to assess the effectiveness of the technology in advance but also helped them identify the necessary changes and training needed before implementation.

P2 reported risk was associated with the downtime that is experienced when new technology is being incorporated into the system. By allowing for limited planned downtime, the risks associated with costs can be minimized, and disruptions can be controlled.

There are certain things that they do allow for risk. So, things like that could be like downtime or when you're doing updates, things like that: how much time you can be down. Those are risks they're willing to take, but things that are not willing to risk are like SQL injection, a lot of like your DDoS attacks; you're not protecting against that.

P2 understood that there are acceptable risk levels that must be taken into consideration prior to implementation. Assessing risks and determining acceptable levels is an important step to develop strategies to minimize risks and take steps to eliminate unacceptable risks. P4 responded to the pandemic by instituting a procurement tactic of increasing necessary supplies to anticipate future shortages of raw materials. It is important to react quickly to the changing of the external business environment when the forecast shows extreme demand fluctuations or external disruptions. The use of formal

tools such as Failure Mode and Effects Analysis (FMEA) by P4 indicated a rapid response helps to ensure that resources were allocated to the area of the most significant risks.

I'm a big fan of failure mode and effects analysis, using that tool to make sure that you understand the aggregate risk, everything that could go wrong, probability, impact, detectability, and ranking those things and then knocking off the top of that list. You can't de-risk every possible scenario. But what you can do is de-risk the important ones. And so that is key in a supply chain to focus on what's important and get those very important ones de-risked.

Failure Mode and Effects Analysis (FMEA) is a powerful analytical tool that not only assesses risk but also supports scenario planning by helping teams anticipate potential issues before they occur. The risk ranking process provides a structured way to prioritize failure modes based on their severity, likelihood, and detectability, enabling organizations to focus resources on the most critical areas. Risk management emerged as an imperative for ensuring operational continuity and minimizing disruptions during technology implementation. As organizations navigated complex transitions, mitigation of potential risks became central to maintaining project timelines, safeguarding data integrity, and securing stakeholder confidence.

### ***Correlation to Literature***

The interview findings strongly correlate with the literature on risk mitigation and technology adoption in supply chains. Participants emphasized the importance of

proactive risk assessment. P2 described their approach by stating “We kind of just laid out, ‘Hey, here’s all our risks.’ We evaluated them, what risks we were willing to accept, what we were not willing to accept. This comment aligns with Smith’s (2024) assertion that understanding the organization’s risk tolerance is essential to help managers determine which technologies provide the greatest benefit with acceptable risk tolerance levels. Similarly, Stewart (2024) emphasizes that proactive risk assessment and resilience planning are fundamental for mitigating disruptions in the supply chains. Proactive risk assessment practices enhance Perceived Usefulness (IPU) by demonstrating how technology can improve operational resilience and decision-making.

The use of pilot testing and parallel systems was another process for addressing risk. P3 explained, “I would run them in parallel for the first few weeks so that we could make sure that the output in the planning system was matching my Excel document” This response is supported by the work of Chatha et al. (2024), who suggested that Pilot testing is used to identify potential incompatibility issues, evaluate performance and enables managers to address any issues prior to full-scale implementation. Tremoulet et al. (2024) further supports this by reporting that valuable insights are extrapolated from examining the unforeseen challenges of technology integration with the use of pilot testing prior to full-scale implementation. These strategies helped to reduce complexity and uncertainty. Reducing complexity influences perceived ease of use and behavioral intention to use the new technology.

Cybersecurity and data governance risks were a major concern for P2, who stated, “We look at things like cybersecurity on how long it is going to take to transfer the data, who has control over said data, where is it hosted?” This concern is supported by Chatha et al. (2024), who argued that the integration of communication technologies helps to reduce errors, ensure accurate information exchange, and facilitate product customization and quality. Zhang et al. (2024) reported that supply chain managers can remain ahead of market demands and meet consumer expectations by continuously evaluating and upgrading technology and monitoring devices via feedback loops. These insights reinforce perceived usefulness by highlighting the importance of secure and reliable systems in maintaining business continuity.

Participants also discussed scenario planning and structured risk tools. Scenario planning in supply chain management is a strategic process used to prepare for potential future disruptions, risks, and uncertainties. Instead of relying only on implementation instructions, scenario planning involves researching multiple “what-if” scenarios to evaluate how different events such as supplier failures, demand surges, regulatory changes, or natural disasters could impact the supply chain (Salokivi, 2024). P4 emphasized the use of Failure Mode and Effects Analysis (FMEA) as a scenario planning strategy, stating, “You can’t de-risk every possible scenario. But what you can do is de-risk the important ones. And so that is key in a supply chain-to focus on what’s important and get those very important ones de-risked.”

This aligns with Ryu et al. (2023), who stated that scenario analysis enables managers to evaluate worst-case scenarios and potential outcomes resulting from fluctuations in demand and supply chain disruption. Bralsford (2023) reported that by utilizing scenario planning managers can better anticipate potential issues and evaluate the overall impact of adopting innovative technologies into their supply chain. These tools enhance perceived usefulness by enabling informed decision-making. P2 explained the risks associated with technology implementation:

There are certain things that they do allow for risk. So things like that could be like downtime or when you're doing updates, things like that: how much time you can be down. Those are risks they're willing to take, but things that are not willing to risk are like SQL injections, a lot of like your DDoS attacks; you're not protecting against that.

P2 iterated that downtime posed a significant risk of a cyberattack. Longer downtimes created vulnerabilities for the system to be attacked. Short downtimes were considered an allowable risk. The unacceptable risks were allowing enough time for a cyberattack such as SQL (insertion of malicious code) injections or DDoS (Distributed Denial of Service) vulnerabilities. DDoS is a process of flooding a server with massive traffic from multiple sources to make the system unstable or crash. P2 initiated a type of cost-benefit analysis and risk threshold approaches to risk management. The strategy deployed by P2 supports the research by Hong et al. (2024), who recommends explicit risk classification when

deploying new technologies. Manzoor et al. (2024) underlined the importance of transparency in identifying enablers and barriers to technology integration.

To verify system compatibility and minimize operational disruptions, P3 ran the legacy spreadsheet in parallel with the new planning tool for several weeks to confirm output alignment before full roll out. This research supports Wu et al.'s (2023) recommendation to gradually implement blockchain and related technologies to minimize unexpected failures. P4's use of subcontracting and agile procurement during supply shortages illustrates risk mitigation was addressed by rapidly securing raw materials and applying Failure Mode and Effects Analysis (FMEA). This practice aligns with Phadnis's (2024) recommendation to adopt flexible procurement strategies for managing market volatility.

Dinh et al.'s (2024) recommends adaptive technology roadmaps that respond to shifting external conditions. By focusing on de-risking, the most important functions in the supply chain can enhance sustainability. P3 stated "this initiative paid off with X" bolstered credibility for future projects. This approach reflects Zhu et al.'s (2024) finding that pilot successes, when documented and communicated, help secure stakeholder buy-in by demonstrating tangible benefits. Schilling and Seuring (2022) further recommend data-driven feedback loops and partner certification to reinforce resilience, ensuring that risk management remains an ongoing, transparent process throughout the technology implementation process.

### ***Correlation to the Conceptual Framework***

The findings from this interview study reveal a strong alignment between participants' experiences and the literature on risk mitigation strategies in supply chain technology adoption. Participants consistently emphasized the importance of proactive risk assessment prior to implementation. The results of this study support Smith (2024), who advocated for evaluating organizational risk tolerance and developing contingency plans. P2 described their approach to risk evaluation: "We kind of just laid out, 'Hey, here's all our risks.' We evaluated them, what risks were we willing to accept, what we were not willing to accept."

These practices support the technology acceptance model by enhancing perceived usefulness and increasing behavioral intention through reduced uncertainty and increased confidence in the new technology. The alignment between risk mitigation strategies and TAM constructs suggests that when organizations actively address potential disruptions through pilot testing, scenario planning, and cybersecurity protocols, they improve operational outcomes.

Organizational support and credibility also played a significant role in facilitating technology adoption. These insights align with Cortellazzo et al. (2019) and Santo et al. (2014), who highlighted the importance of leadership and collaboration in successful digital transformation. The aesthetics and strengths stages of the IDEAS methodology, as described by Tremoulet et al. (2024), further reinforce the need for visually appealing and functionally useful tools that capitalize on team capabilities.

Risk mitigation strategies such as pilot testing, scenario planning, and cybersecurity protocols enhance perceived usefulness and ease of use, while leadership support and credibility increase behavioral intention to adopt new technologies. The findings of this study suggest that interview data, literature, and the theoretical framework together provides a foundation for understanding how supply chain managers can effectively implement innovative technologies while managing risk.

### ***Subtheme 2.1: Structured Training***

All interviewees emphasized that training was essential throughout every stage of the implementation process. Participants noted that the goal of early training was to help build a coalition, influence buy in and show job relevance by allowing participation to be involved in the development of the new technology.

P1 stated, “We have farm specialists on staff and so as we put a new technology or solution onto the farm, our farm specialists will go out there on board and train the dairymen how to use those products”. A hands-on approach ensures that users receive personalized guidance to help build confidence and reduce resistance. P3 instituted a training process that included input from R&D, manufacturing, and warehouse personnel to prepare workflow requirements and training needs. P6 noted that “we have the modules that we train with. It’s kind of like a homework assignment that gets assigned to all the employees and their leadership can see whether or not their employees have completed that assignment”. Self-paced modular training allowed learners to absorb information in manageable segments rather than being overwhelmed with everything at

once. P4 highlighted the role of leadership presence during training and implementation stating:

And all the experts have signed off. Then you go into training and implementation. And so it's very important for managers to be right there as training occurs and as implementation occurs, listening to what the people who have to use the system might be struggling with, or they might think there's a better way.

Consistency and accessibility were also highlighted in responses as essential components to effective training. Comprehensive training is required to ensure the implementation process, and the workflows are consistent to ensure the technology is effective in meeting expectations. P2 noted that having the same training for all departments was important in making sure all departments received the same training to reduce conflicting information.

We were consistently also sending information; we also hosted classes. Hey, here's how to use the new system. You know, we know it's a big change, Training was delivered via Zoom with standardized materials: We had the same person give the training, like I said, to build that consistency. User guides were made.”

P3 described a segmented training strategy based on functional roles “I sat with each of them separately ‘cause they're completely different functions, completely different needs... the way that the flow works is different.” This customization processed by P4 is an acknowledgement of the diversity of supply chain roles and the need for targeted and

consistent instruction. P4 also described structured programs like Lean Six Sigma training, which aligned skill development with strategic goals.

P6 noted the importance of advance notice and open communication: “We give them a month in advance to review... and we opened up for questions and emails.” This flexible, self-paced model empowered employees to engage in training on their own terms while maintaining accountability.

The interviewee responses revealed that successful technology adoption in supply chain contexts depends on thoughtful, well-structured training. Each participant had a different method for training employees including live instruction, visual aids, personalized support, and modular e-learning. Training served as the bridge between technical preparedness and user engagement. Each approach to training is dependent on the type of technology required, the purpose of the training, and the level of support needed for successful implementation.

### **Business Contributions and Recommendations for Professional Practice**

This study contributes to professional practice by providing an in-depth understanding of how technology adoption strategies can be improved and optimized to enhance success. The findings of this study suggest that the implementation process is highly dependent on the technical capabilities of the supply chain and on the strategic alignment of the strategy with organizational goals and stakeholder expectations as guiding principles. By aligning technological implementation with organizational goals and stakeholder expectations, businesses can improve operational outcomes and

contribute to social change by empowering individuals via skill development and promoting ethical practices.

The principles of the (TAM) were evident in the motivations of supply chain managers as they guided the adoption of new technologies to enhance operational efficiency, reduce costs, and improve decision-making processes. Although not always explicitly stated, the strategies and goals employed by participants were rooted in the core TAM constructs of perceived ease of use and perceived usefulness which served as drivers of behavior and intention. The TAM effectively predicted the actions of supply chain managers, as reflected in the strategies they used to promote technology adoption. Successful adoption was heavily influenced by the approach taken to foster stakeholder engagement and acceptance, address resistance to change, manage risk, and apply return-on-investment (ROI) considerations. By applying the technology acceptance model (TAM), the importance of perceived usefulness and ease of use as determinants of behavioral intention became apparent.

One of the most impactful contributions in the study is the emphasis on structured training as a business imperative to successful technology implementation. Training programs that incorporate comprehensive job aids, role-specific instruction, and leadership visibility foster greater user engagement and help to reduce stakeholder resistance. Business leaders should prioritize technology training as a continuous capability-building process, prior to, during and following implementation. The findings of this study exemplified the value of modular implementation strategies, such as

sandbox testing and phased rollouts, which allow organizations to enhance supply chain performance, manage risk, and adapt in real time.

The participant responses and existing literature identifies risk management methodologies as critical to successful technology implementation in the supply chain. A variety of tools were reported as useful in the endeavor to implement technology. Participants described the use of tools such as Failure Mode and Effects Analysis parallel modeling, and downtime planning to anticipate and mitigate disruptions. This research provides actionable steps for improving business outcomes, including the development of cross-functional implementation teams, the use of pilot testing to validate system fit, and the integration of continuous improvement frameworks such as Lean Six Sigma.

### **Implications for Social Change**

Successful innovative technology integration in supply chains enhances efficiency, assists in reducing the effect of internal and external disruptions, and lowers costs. Enhanced efficiency and reduced costs enable companies to lower prices, making products and services more accessible to low-income communities. Lower costs for low-income communities provide additional disposable income for living essentials such as housing, nutrition, and education. An increase in disposable income can lead to improved quality of life, greater economic participation within underserved populations.

Some innovative technologies increase transparency through data sharing. When businesses provide collaborative platforms or blockchain ledgers across a network of computers systems, all participants can view many of the business transactions in real

time. Greater transparency fosters trust and accountability throughout the supply chain, making labor abuse and environmental destruction more difficult to accomplish. In effect, higher levels of transparency create better working conditions for stakeholders at all levels of the organization. Better working conditions help pave the way for social change. Innovative technologies that enhance transparency set the stage for investments in advanced training.

As businesses increasingly embrace innovative technologies like analytics, automation, and IoT devices, they must prioritize comprehensive training for both employees and stakeholders to ensure successful implementation. Businesses are continually choosing digital technologies to enhance performance. When employees and stakeholders acquire contemporary skills sets, they become more marketable. An increasingly skilled workforce drives economic growth and resilience. This shift enhances individual career opportunities and empowers businesses to stay competitive in a rapidly advancing digital landscape.

Contribution to social change was evident by the well-developed strategies used to create acceptance. Supply managers employed a variety of strategies to promote inclusiveness such as stakeholder engagement and transparent communication. The participants were explicit in their goal to support the development of more equitable and participatory business cultures to create buy-in. When employees are asked to help design new technologies, contribute feedback, and receive targeted training, they develop a greater sense of ownership, engagement, and confidence in technology. The implication

of this research supports the development of inclusive digital transformation strategies that address diverse learning needs of employees. The development of individuals, communities, and businesses promotes the principles of positive social change by improving the human condition via ethical leadership and inclusive strategies. By nurturing equitable access to technological tools and training, the workforce is empowered to participate in economic and social systems.

### **Recommendations for Further Research**

The qualitative insights presented in this study opened new avenues for deeper exploration into the efficacy of innovative technology. Quantitative research investigating post technology implementation would reveal long-term results. Post-implementation metrics to strengthen the causal relationship between innovative technologies and profitability outcomes could include specific performance benchmarks, ROI analyses, and long-term financial tracking data to determine effectiveness and value. Determining the effectiveness of specific tools including AI forecasting, digital twins, IoT, or blockchain technology would provide supply chain managers with data to better understand how and where these technologies could be used to enhance productivity and profitability. Research of this nature would assist supply chain managers in examining how businesses adapt to new technologies. A technology roadmap can be developed to provide a strategic pathway for supply chain professionals to respond to changing market conditions, disruptions, and emerging opportunities. Future studies could also examine

how technologies including AI, blockchain, IoT, and cloud computing interplay drive digital transformation and enhance operational efficiency.

The importance of training became apparent as all participants reported specific types of training that they found to be effective for their technological endeavor.

Longitudinal studies could be conducted to examine the long-term impact of structure training programs on effectiveness, employee performance, and sustainability. Deeper insight into how training evolves over time and the effectiveness of certain types of training. The insights gained would provide a roadmap for supply chain managers to design and implement training programs to align their employee capabilities with technological advancements. Studies could be conducted to identify which types of training are most effective for specific technologies. The participants in this study used interactive workshops, visual job aids, modular training, and self-paced learning.

Comparative studies could be conducted to understand how training can be enhanced for optimal gains. Training programs can be developed to identify which instructional designs are best suited to functional roles and specific learning styles, enabling supply chain managers to tailor development strategies that maximize employee engagement and performance.

The limitation identified in Section 1 relates to sample size. Future research should expand the sample size to include a broader range of industries to enhance generalizability. Expanding the sample would allow for more robust statistical analysis and increase the reliability of the findings. Incorporating a variety of industry

perspectives could reveal specific trends and training that could enhance the overall performance of the organization.

### **Conclusion**

Five themes were identified in this study as key determinants influencing strategic direction and the perception of technology adoption success. The five themes included ROI focus, stakeholder engagement, adoption challenges, technology resistance, and risk mitigation. A variety of methodologies were discussed by participants used to facilitate and direct technology implementation. According to the interviewees, the successful adoption of the new technology was shaped by several critical influencing factors including leadership support, training, user engagement, integration procedures, and measurable outcomes. The themes identified in this research provide a detailed framework for understanding the important practices and leadership methodologies that influence successful implementation.

The technology acceptance model was used to ground this study to demonstrate that perceive usefulness and ease of use must be reinforced via strategic alignment, cultural acceptance and continuous support through training, feedback loops, and iterative system improvements. The technology implementation strategy should align implementation goals, enhance operational efficiency methods, and support workforce development through targeted training. The findings of this study provide supply chain managers with a roadmap for planning, execution, and monitoring technology integration initiatives. In this study, the technology acceptance model (TAM) reinforced the

importance of identifying social and psychological determinants to help managers develop effective strategies for generating buy-in and influencing behavioral intentions.

The themes identified in this study closely align with the existing literature pertaining to innovative technology and supply chains. The results of this study reinforce the findings related to technology adoption and resistance to technology. The goal of this study was not to reinforce common themes, but to explore how the themes manifest within current business structures to provide a deeper understanding of the complex interplay between business structures, individual behavior and technical capabilities. The findings of this study identified some of the specific challenges encountered, the adaptive strategies they employed, and the factors that shaped the responses from the participants. To explore these dimensions, the study's questions were designed to elicit detailed accounts of the challenges faced, the strategies employed, and the solutions developed to support effective technology implementation and profitability. The questions in this study focused on identifying key issues, examining reported strategies and methodologies, and exploring solutions for technological implementation.

The findings are clear that successful technology integration in supply chain management requires a detailed strategic vision of success, extensive collaboration among stakeholders and leadership and strong commitment to training, iterative design, feedback loops, and RIO focus. More specifically, adoption challenges were mitigated by providing comprehensive training programs that addressed skills gaps, established iterative feedback loops for continuous improvements and pilot testing for refining the

technology prior to full deployment. To counter technology resistance, participants focused on aligning the initiatives with the current culture, enlisted change champions and encouraged stakeholder and leadership involvement from beginning to end of implementation process. To mitigate risk participants used scenario planning, parallel testing, sandbox environments and the Failure Modes and Effects Analysis (FMEA). Some participants brought in technology vendors to manage risks and provide technical support for employees during the process.

The participants' insights provide a roadmap for supply chain leaders looking to leverage technology to enhance profitability. Participants used ROI as the primary performance metric to enable managers to quantify financial impact and to guide leadership in selecting technologies most likely to improve ROI. Ultimately, participants emphasized combining ROI analysis with early stakeholder engagement, pilot testing, and sustained change-management practices to realize returns on investments and enhance performance. Supply chain teams enhanced stakeholder and leadership engagement through structured training workshops, inclusive implementation planning with suppliers and customers, and formalized communication protocols such as monthly alignment meetings and shared digital portals.

To improve stakeholder and leadership engagement, supply chain management teams should consider conducting training workshops and inclusive planning involving stakeholders along with suppliers and customers to design a roadmap for implementation. Communication protocols should be formalized to include monthly alignment meetings,

shared data, and digital portals to build trust and create structured collective problem-solving sessions.

Supply chain leaders should incorporate scenario planning exercises and resilience metrics into their strategic plans. By simulating disruptive events and stress-testing digital systems before full-scale roll-out, organizations can identify vulnerabilities and implement mitigations that protect profitability during periods of volatility. Risk mitigation includes visible leadership involvement and the establishment of aligned technology strategies, continuous oversight, and contingency plans to promote accountability and facilitate continuous improvement.

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## Appendix: Interview Protocol

### Interview Questions

1. What specific technology innovations have you integrated into your supply chain, and what strategies did you use to implement them effectively?
2. What key factors influenced your decision to integrate innovative technology into your supply chain?
3. What strategic steps did you take to ensure smooth adoption and integration of the technology into your supply chain operations?
4. What challenges did you face during the integration process, and what strategies helped overcome these challenges?
5. How do you assess the effectiveness of your technology integration strategy in terms of profitability and operational efficiency?
6. What risk management strategies did you employ when integrating new technology into your supply chain?
7. How did you align your technology integration strategy with supplier and customer relationship management?
8. Did you develop a formal technology implementation strategy before integration? If so, what key components did it include?
9. What training and change management strategies did you use to ensure your team adapted successfully to the new technology?
10. Based on your experience, what best practices would you recommend to other supply

chain managers seeking to integrate innovative technology successfully?