

**Enhancing supply chain collaboration: Investigating the benefits and challenges
across manufacturing supplier and distributor networks.**

Dissertation Manuscript

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MFON GEORGE BASSEY

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Abstract

This qualitative embedded single case study investigated the benefits and challenges of supply chain collaboration across manufacturing supplier and distributor networks, with a focus on the North American sheet metal manufacturing industry. The problem addressed was the ineffective supply chain collaboration within these networks, which limits operational efficiency, resilience, and long-term competitiveness. The purpose of this study was to explore the factors influencing collaboration effectiveness and to develop strategies for improving supply chain collaboration between manufacturing suppliers and distributors. The conceptual framework guiding the study integrated Social Network Theory, Resource Dependence Theory perspectives. A qualitative methodology was employed using semi-structured interviews with executives, middle managers, and production floor staff. A purposive sampling approach ensured that perspectives were captured across organizational levels and functional roles. Data analysis followed Braun and Clarke's six-step thematic method, supported by NVivo software, to identify patterns and themes. Findings revealed seven themes under three research questions: communication barriers, technological constraints, process misalignment, cultural differences, leadership gaps, collaborative strategies, and future-oriented practices. Results indicated that ineffective collaboration stemmed from siloed communication, reliance on outdated systems, and cultural resistance, while successful collaboration was facilitated by trust-building, aligned leadership practices, and shared integration mechanisms. Recommendations for practice included investing in digital tools for integration, establishing structured cross-tier communication, and cultivating leadership competencies in collaborative governance. Recommendations for future research included expanding comparative studies across industries and exploring the role of digital transformation in mitigating collaboration challenges.

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Finally, to everyone pursuing knowledge and growth, may you find strength in perseverance and purpose in your journey.

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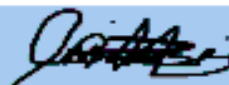
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Candidate's University ID Number: **5905219510**

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Chapter 1: Introduction

Supply chain management has evolved into a critical arena for competitive advantage, emphasizing the necessity for firms to coordinate and integrate their operations amid globally dispersed activities (V. Osei and Asante-Darko, 2023). As supply chains grow to embrace more complexities, collaboration emerges as a vital navigating strategy, enabling independent firms to foster long-term relationships aimed at integrating processes and achieving mutual success (V. Osei and Asante-Darko, 2023). In modern times, competition transcends individual companies, with the focal point shifting to the competitiveness of entire supply chains (Hove-Sibanda and Pooe, 2018). However, this evolution is challenging in today's rapidly evolving sphere of supply chains, and there is a need to stress the significance of preparing for unforeseen disruptions. According to Hans (2023), disruptions in the supply chain pose significant challenges for businesses, ranging from shipping delays to complete production halts. These disruptions, whether caused by minor delays or major crises like pandemics or cyberattacks, can profoundly affect supply chains (Katsaliaki et al., 2021) and heightened awareness of the disruptive potential, which has led to an increased emphasis on supply chain collaboration, as businesses seek to mitigate the adverse effects of such events (Hans, 2023).

As Zhong (2021) described, supply chain collaboration involves working seamlessly with internal departments and external partners to improve the flow of goods, information, and services. This collaborative approach aims to sustain an optimized flow through the supply chain, efficiently meeting demand and ensuring on-time, in-full delivery Osei and Asante-Darko (2022) also emphasized that supply chain collaboration is often deemed critical for ensuring that all independent firms work cooperatively to create a cohesive, singularly competitive supply

network capable of improving overall performance, stressing the importance of real-time shared visibility and efficient processes across the supply chain, including functions like purchase orders, forecasting, capacity planning, and quality management (Osei and Asante-Darko, 2022; Zhong, 2021). Supply chains often operate in fragments, with different departments using different systems, highlighting the inefficiencies that come with it and emphasizing the potential for improvement through collaboration (Gardner et al., 2019).

Innovative concepts like collaborative manufacturing revolutionize traditional supply chain models. CM initiatives have resulted in a reduction in production costs and an increase in production speed for participating companies (RVJ, 2023). Effective demand and capacity management, facilitated by collaboration in production planning, optimizes resource utilization, minimizes inventory costs, and enhances customer satisfaction. Through enhanced communication and coordinated decision-making, manufacturers streamline workflows, mitigate risks, and adapt to changing market conditions, ultimately leading to improved productivity and reduced costs (RVJ, 2023). F. Topan (2023) highlighted that CM helps cut costs and energy use and boosts efficiency and customer responsiveness. The CM approach allows the industry to work with imports to make global supply chains more responsive and agile by enhancing visibility and flexibility (F. Topan, 2023). This collaboration goes beyond traditional manufacturing, involving innovative initiatives like cloud computing, blockchain, and collaborative robots (Oliveira-Dias et al., 2022). In supply chain integration, collaborative efforts contribute to diversification, offering alternatives, and increasing competitiveness in global supply chains (F. Topan, 2023).

In the vast and ever-changing global market, supply chain collaboration is crucial for individual and organizational efficiency and broader global competitive dynamics (S. Li et al., 2016). For example, they use the automotive industry, where CM efforts involving multinational corporations, suppliers, and distributors extend beyond geographical boundaries. In this tangled network, synchronized collaboration is crucial, ensuring timely production, optimal resource use, and efficient distribution. These collaborative initiatives boost the industry's ability to meet global market demands. According to a report by McKinsey (2024), the potential effect of the supply chain is significant. Collaborative efforts within the automotive supply chain have resulted in promising outcomes, including a reduction of 75% in lost sales, up to 30% in transport and warehousing costs, and a decrease of up to 80% in administration costs (McKinsey, 2024).

Similarly, in the technology sector, cooperative efforts among manufacturers, component suppliers, and distributors play a vital role in speeding up the development and delivery of innovative products to a diverse and geographically dispersed consumer base. Wiengarten et al. (2018) showed that companies embracing collaborative supply chain practices experience more revenue growth than their competitors, buttressing the significant role of supply chain collaboration not only as a strategic advantage but as a critical factor for success in the interconnected and boundary-blurring landscape of the modern global market. This interconnectedness spans manufacturing, supplier, and distributor networks, collectively shaping the efficiency and effectiveness of supply chains on a global scale (Durugbo and Al-Balushi, 2022; Sytch et al., 2022). Collaboration in the supply chain significantly affects organizations' costs, competitiveness, and overall performance in the constantly evolving global market.

Supply chain collaboration has been the subject of extensive research, examining various facets and implications. Hudnurkar et al.'s (2014) literature review identified 28 factors influencing collaboration, spotlighting the crucial role of information sharing in effective supply chain collaboration. Hudnurkar et al.'s findings align with R. Y. Zhong's (2021) emphasis on real-time shared visibility and streamlined processes. In the context of international economic integration, Dung (2015) explored factors affecting collaboration in Vietnam's mechanical sector, highlighting nine direct factors, such as trust and commitment. The approach aligns with CM initiatives, emphasizing cultural, strategic, and policy considerations (E. Topan, 2023).

Fayezi et al. (2022) proposed a framework addressing collaboration and risk mitigation, highlighting the strategic importance of risk management in supply chains. This framework aligns with J. Chen et al. (2013) examination of collaboration as a risk mitigation strategy in supplier, customer, and internal contexts. Christopher and Lee (2004) highlighted escalating marketplace turbulence. Their study advocated for improved end-to-end visibility, aligning with the theme of collaboration as a mechanism for enhanced efficiency and risk mitigation. Abbasi and Varga's (2022) complex systems perspective highlights the need for a collaborative approach to manage modern supply chain complexities. Cao and Zhang's (2010) studies on collaborative advantage and firm performance revealed a positive correlation, echoing the broader context of exploring how collaboration influences organizational competitiveness. McLaren et al. (2002) investigated the costs and benefits of collaboration alternatives in uncertain business environments, aligning with the theme of risk mitigation and performance enhancement through collaboration. Doganay and Ergun (2017) analyzed the relationship between collaboration and supply chain performance by emphasizing a significant and positive

connection, reinforcing the pivotal role of collaboration in enhancing organizational performance.

Statement of the Problem

The problem to be addressed in this study is the ineffective supply chain collaboration within manufacturing supplier and distributor networks. Disruptions, ranging from minor setbacks to major emergencies like pandemics or cyberattacks, have been identified as significant threats to supply chains (Katsaliaki et al., 2021), making collaboration crucial in managing such challenges. However, there needs to be more comprehension of the specific factors that impede effective collaboration and the strategies that can be employed to mitigate them (Morrison-Smith and Ruiz, 2020). The problem is discernible in the fragmented nature of supply chains, where different departments often operate with different systems, resulting in inefficiencies (R. Y. Zhong, 2021). This lack of collaboration is exacerbated by the complexity of modern global supply chains, which involve various stakeholders such as manufacturers, suppliers, and distributors (Durugbo and Al-Balushi, 2022; Sytch et al., 2022).

The effect of this problem extends beyond individual organizations to the broader competitive dynamics globally (Omar et al., 2022). Lack of collaboration in the supply chain is also evident as industries such as automotive and technology, where CM is crucial, face challenges in achieving synchronized collaboration for timely production, optimal resource utilization, and efficient distribution, as E. Topan (2023) noted. Failure to address these collaboration challenges can result in increased costs, delayed production, and decreased competitiveness, highlighting the urgent need to explore the issues resulting from ineffective supply chain collaboration.

Purpose of the Study

The qualitative embedded single case study sought to investigate the ineffective supply chain collaboration within manufacturing supplier and distributor networks, enhancing the factors influencing supply chain collaboration within the North American-based sheet metal manufacturing industry and developing strategies for improving collaboration effectiveness. This research sought to address the identified problem of ineffective collaboration by exploring the underlying challenges and opportunities within the industry. An embedded single case study design involved focusing on individual components, as described by Creswell and Poth (2018), was a systematic approach that allowed researchers to contrast between different groups of people with differing expertise of qualities and extremes to create depth and understood a broad phenomenon without losing the individuality of the single case study (Baxter and Jack, 2008; Thomas, 2011).

This embedded single case study drew inspiration from existing research in supply chain collaboration, particularly from studies that have adopted case study designs. Pereira and da Silva (2015) conducted a case study to enhance supply chain resilience, focusing on buyers and suppliers. Nakano and Matsuyama (2021) explored the design of internal supply chain structures through a case study of Japanese manufacturers. Yang et al. (2022) investigated ways to improve vegetable supply chain collaboration in Vietnam using a case study approach. Similarly, Manville et al. (2021) conducted a case study analysis within the UK aerospace industry to understand supply chain management practices. These studies exemplified the effectiveness of case study designs in gaining insights into supply chain collaboration dynamics, aligning with the objectives of this research endeavor.

The embedded single case study focused on North America's sheet metal manufacturing industry employees. These employees will comprised production floor staff, machine operators, middle managers, and executives. The sample population for this study consisted of employees from North America's sheet metal manufacturing industry, from which purposive sampling was employed to select an optimal sample size of 8 participants. Each type of participant represented a different sample: employees (8), such as production floor staff and machine operators directly involved in the day-to-day operations and middle managers (8), such as production supervisors and department managers, and executives (8), including CEOs and directors of supply chain management. The selection of a small sample size of 24 participants was suitable for conducting a qualitative embedded single case study, which enabled in-depth exploration based on previous studies from Saunders et al. (2018) and Mason (2010). The data collection method involved personal interviews with participants utilizing an online open-ended interview. These interviews were conducted remotely via video conferencing to accommodate participants' geographical dispersion.

The collected data were analyzed using the qualitative content analysis method described by Miles et al. (2020), which was well-suited for extracting insights and practical implications (Miles et al., 2020; Pereira and da Silva, 2015). The method allowed for collecting relevant textual data, such as interview transcripts, written documents, and recordings, that the researcher used in the analysis to align with research goals (Miles et al., 2020). As the study participants were interviewed, data collection will conclude following the saturation of emerging responses from the participants. Bracketing and bias identification acknowledged researchers' potential biases and set aside preconceptions and assumptions so that the researcher could approach data

with an open mind (Miles et al., 2020). A coding scheme was established that outlines how to categorize and label different aspects of the data. The researcher used the scheme to code the data by assigning relevant codes to segments of the text based on themes, patterns, and meanings. Once the researcher coded the data, the content analysis research method will identify the recurring themes and patterns. The data analysis ensured the emergent concepts, connections, and contradictions that were interpreted within the research context (Miles et al., 2020; Pereira and da Silva, 2015). The data collection and content analysis method provided the essential resources for triangulation by interviewing and observing all the various samples. The triangulation process involved detailed descriptions to corroborate the results and probe the accuracies of the data collected (Flick, 2009; Howe, 2012; Salkind, 2010). The data were analyzed using the content analysis method (Coghlan and Filo, 2013; Flick, 2009) to investigate the benefits and challenges across manufacturing supplier and distributor networks with available literature. The researcher used member checking to ensure the data's credibility by allowing participants to correct inaccuracies and ensure that the researcher interpreted participant responses accurately from their perspectives (Reilly, 2013). Member checking was a process that increased accuracy by verifying research data and preliminary results (Reilly, 2013).

Introduction to Conceptual Framework

This study's conceptual framework is deeply rooted in social network theory (SNT) and resource dependence theory (RDT). Initially articulated by Bourdieu (1985), SNT views social relationships as valuable resources that contribute to human capital accumulation (Turner and Machalek, 2018). Social networks, depicted as interconnected nodes and edges, represent manufacturers, suppliers, and distributors within the sheet metal manufacturing industry's supply

chain (Sherchan et al., 2013). Within this context, social capital emerges through trust, cooperation, and competition among entities, shaping network structures and influencing information, resource flow, and collaboration opportunities (McMillan and Schumacher, 2014; Sherchan et al., 2013). SNT application in the sheet metal industry offers insights into optimizing collaborative dynamics and enhancing overall supply chain performance via knowledge transfer, resource access, and collective problem-solving (Sherchan et al., 2013; Turner and Machalek, 2018).

Complementing SNT, RDT explores resource acquisition, interdependencies, and collaborative strategies within the sheet metal manufacturing industry's supply chain (de Camargo Fiorini et al., 2018; Klein and Pereira, 2016). Organizations within this sector heavily rely on external resources, motivating collaborative efforts to bolster resource access and mitigate risks (de Camargo Fiorini et al., 2018; Klein and Pereira, 2016). RDT asserts that organizations are interdependent within the supply chain, unable to be entirely self-sufficient in strategically vital resources for survival (de Camargo Fiorini et al., 2018). Interorganizational relationships, including alliances and joint ventures, are crucial for accessing resources and achieving mutual goals (Klein and Pereira, 2016). Moreover, RDT emphasizes restructuring dependencies through collaborations to reduce resource flow uncertainty and enhance operational resilience (Klein and Pereira, 2016). The concept of dependence, central to RDT, highlights organizations' reliance on each other for critical resources, shaping collaborative strategies and resource allocation within the sheet metal manufacturing industry's supply chain (de Camargo Fiorini et al., 2018; Klein and Pereira, 2016). This integrated framework informs the study's problem statement, purpose statement, and research questions, facilitating the

comprehensive exploration of supply chain collaboration dynamics in the sheet metal manufacturing industry.

Introduction to Research Methodology and Design (Nature of the Study)

This study adopted a qualitative embedded single case design to investigate the factors influencing supply chain collaboration within the North American-based sheet metal manufacturing industry. This embedded approach sought to understand the trends rather than focusing on individual components (Creswell and Poth, 2018). In qualitative embedded single-case study research, several seminal works have significantly shaped the methodology and guided researchers in conducting rigorous studies (Creswell and Poth, 2018; Morse, 2015; Priya, 2020; Stake, 1995; Yin, 2014). The study involved selecting and collecting rich qualitative data through interviews and observations of the sample population, analyzing data thematically, and reporting findings to provide insights into the researched phenomenon. It sought to understand complex phenomena within its real-life context (Ding, 2021; Priya, 2020). This design allowed the researcher to collect rich data through various methods, such as interviews, observations, and documents, and analyzed the patterns, themes, and unique aspects of the case (Ding, 2021; Priya, 2020).

As Priya (2020) articulated, case study research strategies encompass various dimensions, including epistemological considerations and factors enhancing case study effectiveness. Case study research also provides information with deep meaning, focusing on individual perceptions, thinking processes, and contextual behaviors about a phenomenon within a real-life situation. The phenomenon under study was the dynamics of supply chain collaboration within the sheet metal manufacturing industry, including the practices that bound the sample population and the

decision-making processes within sheet metal manufacturing executives (Baxter and Jack, 2008; Ogren, 2016; Thomas, 2011).

The data collection procedure involved semi-structured interviews and observations with key stakeholders, including production managers, operation managers, warehouse managers, quality control managers, corporate transportation managers, and purchasing managers. To facilitate participation from different locations, interviews were conducted remotely via video conferencing (Miles et al., 2020). The collected data were analyzed using qualitative content analysis methods, which were particularly effective in extracting insights and practical implications. Examining the interview transcripts enabled the identification of underlying themes, patterns, and relationships within the data (Miles et al., 2020). This process led to a comprehensive understanding of the dynamics of supply chain collaboration within the sheet metal manufacturing industry, with direct implications for industry practices and decision-making.

The chosen qualitative methodology and embedded single case study design perfectly aligned with this study's problem statements and research questions. The problem statement directly addressed the issue of ineffective collaboration within the North American-based sheet metal manufacturing industry. Qualitative research methodologies, particularly case studies, are well-suited for exploring complex social phenomena such as collaboration dynamics and offering depth and context (Merriam, 2009). By adopting a case study approach, this study was able to thoroughly investigate the factors influencing collaboration effectiveness, providing a comprehensive understanding of the issue. The research questions also aimed to uncover the main challenges to creating supply chain resilience and explored how buyers and suppliers could

enhance resilience. An embedded case study design enabled the examination of these questions from various perspectives within the sheet metal manufacturing industry. The use of similar methodologies by Pereira et al. (2015), Nakano and Matsuyama (2021), Yang et al. (2022), and Manville et al. (2021) further validated the suitability of the chosen methodology and design for addressing the research questions.

Research Questions

In addressing the effective supply chain collaboration within the context of the manufacturing supplier and distributor networks, identifying, and understanding these dynamics, the study sought to provide actionable insight that could guide organizations in enhancing their collaborative practices, leading to improved supply chain performance, resilience, and overall competitiveness in the global marketplace. Understanding the ineffectiveness of supply chain collaboration was improved in the context of supply chain (F. Topan, 2023); the research questions will provided a clear focus for the study and served as a basis for the data collection. From the basis of systematic examination, the study aimed to uncover critical insights into supply chain collaboration among manufacturers, suppliers, and distributors (Benzidia et al., 2021). The importance of collaboration and identifying specific factors hindering effective collaboration and mitigating strategies for disruption were tackled with research participants, production managers, operation managers, warehouse managers, quality control managers, cooperate transportation managers, and purchasing managers, using the following research questions:

RQ1

What underlying factors contribute to the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?

RQ2

What challenges hinder effective interpersonal relationships between manufacturers and their supply chain partners in the North American-based sheet metal manufacturing industry?

RQ3

What strategies can help overcome the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?

Significance of the Study

Supply chain collaboration is crucial for organizational success, particularly in complex and globally dispersed industries (S. Li et al., 2016). This study addressed the significant challenge of ineffective supply chain collaboration within the North American-based sheet metal manufacturing industry. This research contributed to the academic literature and practical applications in the field by investigating the factors influencing collaboration effectiveness and developing strategies for improvement.

From an academic perspective, this study advanced the understanding of supply chain collaboration dynamics within a specific industry context. By integrating SNT and RDT as guiding frameworks, the research provided insights into the underlying factors shaping collaboration patterns and resource dependencies among manufacturers, suppliers, and distributors. These insights contributed to the conceptual foundations of supply chain

management and organizational theory, enhancing scholarly discourse on collaboration within complex supply chain networks.

The findings of this study offered practitioners and industry leaders actionable, practical strategies for enhancing supply chain collaboration effectiveness. By identifying specific challenges and proposing targeted solutions, organizations in the sheet metal manufacturing industry can improve their collaborative practices, enhance operational efficiency, reduce costs, and increase competitiveness. The study's recommendations can inform decision-making processes related to supply chain management, resource allocation, and strategic partnerships, ultimately driving performance improvements across the industry.

The benefits of addressing the study problem, achieving the study purpose, and answering the research questions are multifaceted. First and foremost, effective supply chain collaboration is essential for mitigating disruptions, reducing production delays, and enhancing overall resilience in the face of unforeseen challenges such as pandemics or cyberattacks (Katsaliaki et al., 2021). Organizations can better navigate complex supply chain environments by improving collaboration practices, ensuring on-time delivery, and maintaining customer satisfaction.

Addressing the study problem and achieving the study purpose can also lead to tangible business outcomes, including cost savings, productivity gains, and revenue growth. By optimizing collaboration processes and fostering stronger relationships with supply chain partners, companies can unlock new opportunities for innovation, expand market reach, and drive sustainable growth.

Definitions of Key Terms

Business Landscape

Business landscape is the overall environment in which businesses operate (Hunt, 2019). It encompasses various factors and elements affecting businesses' operations, strategies, and success. It is dynamic and constantly evolving, influenced by economic, technological, social, legal, and environmental factors (Dwivedi et al., 2020).

Collaborative Manufacturing

Collaborative manufacturing is a strategic approach in which manufacturers actively engage with stakeholders to collectively design and create products and business processes, enhancing efficiency and competitiveness within the global supply chain (Osei and Asante-Darko, 2022).

Distributor Networks

Distributor networks are typically involved in the organizations and entities responsible for the distribution of products from manufacturers to end-users or retailers. Distributor networks are integral to supply chain collaboration, offering opportunities for market reach, efficiency, and improved customer satisfaction (Wiltshire and Ronkainen, 2021).

Economic Implications

Economic implications are the consequences or effects of economic events, policies, or changes on various aspects of an economy (McConnell, 1984). These implications can result from macroeconomic factors, such as government policies and global economic conditions, and microeconomic factors, including individual business decisions and market dynamics (Hofmann et al., 2019).

Global Supply Chain

Global supply chain cross-border organizations in sports must provide items and offerings and produce them for buyers through input and various development, manufacturing, and delivery levels (Larrañeta et al., 2020).

Supplier

Suppliers are entities or individuals that provide goods or services to another entity, often as part of a business-to-business relationship. They play a crucial role in the supply chain by providing the inputs necessary for producing goods or delivering services (McMaster et al., 2020).

Supply Chain Analysis

Supply chain analysis involves the comprehensive assessment and examination of data sets originating from various facets of supply chain operations. These encompass a spectrum of programs integral to supply chain management, such as procurement and inventory management, order processing, warehouse operations, fulfillment processes, and transportation logistics (Fonseca and Azevedo, 2020).

Supply Chain Resilience

Supply chain resilience is the ability of the supply chain to adapt, be ready for sudden events, respond to disruptions, maintain operational continuity with appropriate levels of connectivity, and manage disruptions in form and function (Xiao and Khan, 2021).

Supply Chain Strategy

Supply chain strategy is the roadmap that allows companies to get their goods to their customers with as little friction as possible (Ivanov, 2020). The plan optimizes all its supply chain segments, including material procurement, manufacturing, delivery, and coordination.

Vendor Managed Inventory

Vendor-managed inventory is a supply chain management practice in which the vendor (supplier or manufacturer) actively manages a customer's or retailer's inventory (Dolgui and Ivanov, 2022). The customer orders and manages their inventory in a traditional supply chain model. However, in a vendor-managed inventory system, the vendor assumes more control and responsibility for certain aspects of inventory management (Dolgui and Ivanov, 2022).

Summary

Chapter 1 introduced the critical theme of supply chain collaboration in response to the evolving challenges and disruptions within global supply chains (Debnath et al., 2023). It emphasized the interconnectedness of industries like automotive and technology, and the chapter highlighted collaboration's pivotal role in enhancing efficiency, responsiveness, and competitiveness (Bhatti et al., 2023; Garcia-Buendia et al., 2023). Literature reviews on collaboration factors, international integration, and risk mitigation revealed valuable insights but identified gaps, leading to the study's focus on ineffective collaboration within manufacturing supplier and distributor networks. The study adopted qualitative case research to answer the research questions. The significance lies in its potential to offer insight for professionals, policymakers, and academic contributions. The chapter concluded with definitions of key terms such as CM and supply chain collaboration, laying the groundwork for a comprehensive

understanding in subsequent chapters. In the next chapter, the literature review discusses supply chain collaboration, manufacturing suppliers, and distributor networks in detail.

Chapter 2: Literature Review

The problem of ineffective supply chain collaboration within manufacturing supplier and distributor networks is a significant challenge highlighted in this study. Disruptions, ranging from minor setbacks to major emergencies like pandemics or cyberattacks, have emerged as threats to supply chains (Katsaliaki et al., 2021), highlighting the critical role of collaboration in managing such challenges. However, a need remains to comprehend the specific factors impeding effective collaboration and the strategies to mitigate them (Morrison-Smith and Ruiz, 2020). The fragmented nature of supply chains, where departments often operate with different systems, further exacerbates this problem, resulting in inefficiencies (Zhong, 2021). Moreover, the complexity of modern global supply chains involving various stakeholders, such as manufacturers, suppliers, and distributors, compounds the issue (Durugbo and Al-Balushi, 2022; Sytch et al., 2022). The consequences of ineffective collaboration extend beyond individual organizations to broader global competitive dynamics (Omar et al., 2022), leading to increased costs, delayed production, and decreased competitiveness if not addressed promptly. In light of these challenges, the purpose of this qualitative embedded single case study was to investigate ineffective supply chain collaboration within manufacturing supplier and distributor networks. The study sought to enhance understanding of the factors influencing supply chain collaboration within the North American-based sheet metal manufacturing industry and developed strategies for improving collaboration effectiveness. This study endeavored to address the identified problem of ineffective collaboration by exploring the underlying challenges and opportunities within the industry.

The literature review will be structured comprehensively to explore key themes relevant to the study's focus on ineffective supply chain collaboration within manufacturing supplier and distributor networks. The review will start with the framework of Supply Chain Collaboration, where conceptual perspectives and models related to supply chain collaboration are explored, drawing from seminal works such as Katsaliaki et al. (2021) and Morrison-Smith and Ruiz (2020) to establish a foundational understanding. Challenges in Supply Chain Collaboration will follow, examining specific challenges hindering effective collaboration, informed by insights from A. Zhong (2021) and Durugbo and Al-Balushi (2022) on the complexities and inefficiencies within modern global supply chains. This is followed by Strategies for Mitigating Collaboration Challenges and exploring innovative approaches to enhancing collaboration effectiveness through works such as Sytch et al. (2022) and Topan (2023). The Economic Implications and Competitive Dynamics section analyzes the broader effect of ineffective supply chain collaboration, drawing from scholars like Omar et al. (2022) and Mahmud et al. (2021) to highlight its implications on competitiveness and operational efficiency in industries such as automotive and technology.

Literature Search Strategies

This study's literature search strategies involved a systematic query of various online databases, primarily focusing on resources available through the university library portal. The primary databases accessed included Google Scholar, ProQuest, EBSCOhost, JSTOR, Scopus, Web of Science, IEEE Xplore, ScienceDirect, and Statista. Searches were conducted using specific terms relevant to the study's focus on ineffective supply chain collaboration within manufacturing supplier and distributor networks. Key search terms included "supply chain

collaboration," "challenges in supply chain collaboration," "strategies for mitigating collaboration challenges," "economic implications of supply chain collaboration," and "case studies of collaborative manufacturing."

The search parameters included publications from the past five years (2019-2024) to ensure the inclusion of recent and relevant studies. The types of literature targeted were peer-reviewed journal articles, conference papers, industry reports, dissertations, and case studies. The search terms were combined using Boolean operators (AND, OR) to refine the results and ensure comprehensive coverage of the relevant literature. For example, combinations such as "supply chain collaboration AND challenges," "strategies for mitigating collaboration challenges OR economic implications," and "case studies AND collaborative manufacturing" were used to broaden the scope of the search.

Variations of these terms were employed to ensure comprehensive coverage of relevant literature. The selection criteria for identified works included (a) clear relevance to the research topic of supply chain collaboration, (b) primary focus on one or more of the specified search terms, and (c) demonstrable validity of the research conducted. Priority was given to peer-reviewed articles published within the last five years, except for seminal works essential to understanding the research topics under evaluation. Each article considered for inclusion underwent individual assessment to ensure alignment with the study's objectives and methodological rigor.

Conceptual Framework

This study's conceptual framework is rooted in Social Network Theory (SNT) (Bourdieu, 1986) and Resource Dependence Theory (RDT) (Pfeffer and Salancik, 1978). Social Network

Theory, originally developed by sociologist Pierre Bourdieu in 1985, explores how social structures influence network relationships and behaviors (Bottero and Crossley, 2011). SNT emphasizes the importance of social ties and interactions in shaping organizational outcomes and provides a lens through which to examine the interconnectedness of supply chain partners. Resource Dependence Theory, on the other hand, focuses on how organizations manage dependencies on external resources to achieve strategic goals (Jiang et al., 2023). By integrating these theories, this study aims to understand the dynamics of supply chain collaboration within the North American sheet metal manufacturing industry, highlighting the significance of social relationships and resource management in fostering effective collaboration.

Social Network Theory

Bourdieu introduced the concept of social capital, defined as the sum of the actual and potential resources available through a network of institutionalized relationships (Bourdieu, 1986). These relationships, embedded within social structures, enable individuals to access resources that might otherwise be unavailable (Sánchez-Famoso et al., 2013). Bourdieu's framework highlights how social networks can enhance individuals' social and economic positions by facilitating access to critical information, support, and opportunities (Claridge, 2018). Understanding these dynamics is essential for examining the collaboration practices within supply chains, as relationships among stakeholders significantly impact the efficiency and success of collaborative efforts (Baah et al., 2022)

SNT conceptualizes social networks as aggregations of interconnected individuals who communicate with varying frequency and intimacy (Çetin, 2022). These networks are critical for facilitating the flow of information and resources and enhancing personal and professional

outcomes (Khalili et al., 2024). Modern applications of SNT extend beyond its initial scope, encompassing organizational behavior, sociology, and information technology. For instance, Turner and Machalek (2018) explore how social networks function within organizations, examining how network structures influence innovation, knowledge sharing, and overall organizational performance. Their research demonstrates that robust social networks can significantly enhance collaborative efforts and organizational efficiency (Turner and Machalek, 2018).

Within supply chain collaboration, SNT provides a framework for optimizing relationships between manufacturers, suppliers, and distributors. The theory suggests that effective collaboration hinges on the quality of interpersonal relationships and the network's ability to facilitate seamless communication and resource exchange (Mitchell et al., 2012). This perspective is particularly relevant for addressing research questions about the sheet metal manufacturing industry in North America, where identifying and overcoming collaboration barriers can lead to improved performance and resilience.

The seminal work by Rajkumar et al. (2022) and his team on the "strength of weak ties" emphasizes that weak relations, characterized by infrequent interactions and low emotional intimacy, are crucial for connecting disparate social groups and facilitating the flow of new information across a network. This concept of multiplexity highlights the varied layers of connections individuals can maintain, ranging from strong, intimate ties to weak, bridging ones, each serving different functional roles within the network (Redhead and Power, 2022).

Homophily, the tendency for individuals to associate with others similar to themselves, is a fundamental principle in SNT (Talaga and Nowak, 2019). It suggests that people are more

likely to form strong ties with others with similar socio-demographic characteristics, such as age, gender, education, and socioeconomic status (Ertug et al., 2022). Proximity, or physical closeness, further influences the formation and strength of ties, as individuals who live or work near each other have more opportunities for interaction, thereby strengthening their social bonds (Fasbender and Drury, 2022). Moreover, behavioral homophily on social media significantly affects the perception of tie-strengthening within personal networks, particularly among young adults (Figeac and Favre, 2023). The principle of homophily also extends to health decision-making, where individuals are influenced by those who share similar characteristics (Berry et al., 2018). These recent studies highlight the persistent relevance and multifaceted impact of homophily in understanding social network structures and dynamics.

The structure of a social network, comprising elements such as nodes (individuals or entities) and ties (relationships), provides insights into its overall connectivity and functionality (Gupta et al., 2024). Key structural features in SNT include cliques (subgroups of densely connected nodes), bridges (nodes that connect otherwise separate subgroups), and centrality (the degree to which a node is central within the network (Freeman, 1978). Scholars like Lin et al., 2021 and his team emphasize the importance of these features. For instance, metrics such as density, which measures the proportion of potential ties, and betweenness centrality, which assesses the extent to which a node acts as a bridge within the network, are critical for analyzing network cohesion and information flow (Lin et al., 2021).

Social networks are dynamic (Karadoğan and Karcı, 2022), evolving structures influenced by the creation and dissolution of ties over time. Factors such as social influence, wherein individuals' behaviors and attitudes are shaped by their network peers, and social

selection, where individuals choose ties based on perceived similarities and benefits, drive these changes (Kwon et al., 2021). Understanding these dynamics is crucial for comprehending how networks adapt to internal and external pressures, such as changes in social norms, technological advancements, or organizational restructuring (Dubey et al., 2023).

Rodriguez-Rodriguez and Leon (2022) emphasize the importance of frameworks that link social analysis outcomes with the supply chain objectives, highlighting how integrating social network perspectives can enhance supply chain performance in the digital age. By analyzing relationships within the supply chain, organizations can better understand and leverage the social capital embedded in their networks to improve collaboration, innovation, and efficiency (Leon et al., 2022). J. Han et al. (2020) illustrated the growing relevance of social network approaches in addressing contemporary operations and supply chain challenges. They argue that by mapping and analyzing the interactions between different entities in the supply chain, companies can identify critical nodes and relationships that influence overall supply chain performance. This understanding can help mitigate risks, optimize resource allocation, and foster a more resilient supply chain network (J. Han, Zhong, and Akbari., 2020).

Pedroza-Gutiérrez and Hernández (2020c) combine resource- and knowledge-based views with social network analysis to delve into supply chain dynamics and competitive advantage. They highlight that understanding a network's knowledge flows and resource exchanges can provide strategic insights into enhancing collaboration and achieving a competitive edge. This integrated approach helps identify critical players and foster innovation through better connectivity and knowledge sharing (Pedroza-Gutiérrez and Hernández, 2020c).

Applying SNT in supply chain management involves mapping the relationships among suppliers, manufacturers, and distributors (Fang et al., 2022). By identifying and analyzing the ties and interactions within this network, companies can uncover valuable insights into how information and resources flow, which is crucial for optimizing supply chain operations. For instance, weak ties, as described by Ali et al. (2019), can serve as essential bridges for introducing new information and innovations into the supply chain, thereby enhancing adaptability and responsiveness (Y. Han and Xie, 2023b).

Utilizing social network analysis can significantly enhance collaboration and performance in supply chains (Bento et al., 2024; Fouad and Rego, 2024; Meisel et al., 2023). By focusing on the network structure, companies can identify central actors who play pivotal roles in communication and coordination. These central actors can be leveraged to facilitate more efficient and effective information dissemination and resource allocation (Bento et al., 2024). Additionally, understanding the dynamics of social influence and selection within the network can help design strategies that foster more robust, more cooperative relationships among supply chain partners (Bruin et al., 2019; Borgatti et al., 2018; Castañer and Oliveira, 2020; V. Osei and Asante-Darko, 2023). By applying the principles of SNT, organizations can achieve a more nuanced understanding of their supply chain networks, leading to improved collaboration, efficiency, and competitive advantage (Osei et al., 2023).

Resource Dependence Theory

Pfeffer and Salancik (1978) formulated Resource Dependence Theory (RDT) in their seminal work, *The External Control of Organizations: A Resource Dependence Perspective*, published in 1978. The theory posits that organizations fundamentally depend on external

resources critical for their survival and success. This dependence shapes organizational behavior and strategies, as firms must navigate their external environment to secure necessary inputs (Pfeffer and Salancik, 1978).

The concept of power is central to RDT (Stevens et al., 2015). According to the theory, power within organizational relationships is determined by controlling essential resources, and organizations that control scarce and critical resources can exert considerable influence over those that depend on these resources (Delke, 2015). Consequently, organizations strive to manage their dependencies by adopting various strategies to reduce their reliance on external entities while increasing their control over critical resources (Celtekligil, 2020). This relational and situational nature of power is vital to understanding how organizations navigate their external environments.

The application of RDT extends to various aspects of organizational strategy, including forming alliances, mergers, and acquisitions. Organizations use these strategies to mitigate the risks associated with resource dependence and enhance their stability in a dynamic environment (Coşkun and Öztürk, 2023). By engaging in strategic alliances and joint ventures, firms can secure essential resources and reduce their vulnerability to environmental uncertainties (Emami et al., 2022).

RDT provides a valuable framework for understanding how organizations interact with suppliers and distributors in supply chain management (Matopoulos et al., 2015). The theory emphasizes the importance of securing critical resources and managing dependencies to maintain operational stability and competitiveness (Rožman et al., 2023). Organizations in supply chains often engage in strategic alliances and partnerships to ensure a steady supply of essential inputs

and mitigate the risks associated with resource dependence (Emrouznejad et al., 2023). To manage dependencies and reduce risk, they adopt various strategies such as vertical integration, diversifying their resource base, and influencing their environment through lobbying and other means, helping them mitigate the uncertainties and constraints posed by their dependence on external resources (Luz, 2024).

RDT emphasizes the importance of environmental uncertainty in shaping organizational behavior and decision-making processes (Adhikara et al., 2022). Firms must remain flexible and adaptable to respond effectively to changes in the external environment, such as shifts in market demand, regulatory changes, and technological advancements (Çakmak, 2023). This flexibility allows organizations to dynamically adjust their resource management strategies, ensuring they can secure the necessary resources and maintain competitive advantages (Y. Wang et al., 2021). By fostering a culture of adaptability and continuous improvement, firms can navigate the complexities of their external environment and achieve sustained success (Kamaldeen, 2024; Radu, 2023).

In supply chain management, RDT suggests that firms within a supply chain should prioritize collaboration over competition to achieve long-term performance gains (Sánchez-Flores et al., 2020). This approach emphasizes the importance of interdependency, where firms work together to optimize the flow of resources, information, and goods throughout the supply chain (Lisak et al., 2022). By fostering collaborative relationships, member firms can enhance overall efficiency and resilience, mitigating the risks associated with resource scarcity and environmental uncertainties (Radu, 2023).

According to RDT, firms lacking essential resources are inclined to establish relationships with other organizations to acquire these resources (Thomran et al., 2022). This strategic behavior is critical for enhancing environmental and productivity outcomes. Sohrabi and Mohammad Rahmani (2021) discuss how firms engage in partnerships, alliances, and joint ventures to access necessary resources such as raw materials, technology, and expertise. These inter-organizational relationships are pivotal for improving resource efficiency and achieving competitive advantages. By leveraging external resources, firms can enhance their operational capabilities and drive innovation, leading to improved performance and sustainability (Dubey et al., 2024; Oh et al., 2024).

While RDT has been widely influential, it is not without criticism. One criticism is that the theory often overemphasizes external constraints at the expense of internal organizational dynamics (Oksamytna and Wilén, 2022). Critics (Craighead et al., 2020; Oketcho, 2023; Yli-Renko et al., 2023) argue that RDT may not fully capture the complexity of organizational behavior, particularly in highly dynamic or digital markets where resource flows are more complex and less predictable. Some scholars (Cheah et al., 2019; Mansi, 2021) suggest that RDT's focus on external dependencies may lead to underestimating the role of internal resources and capabilities in shaping organizational strategies and outcomes. Despite these limitations, RDT remains a cornerstone of organizational theory, providing valuable insights into how organizations navigate their external environments and manage resource dependencies (Bor and Cropper, 2023; Sharif and Yeoh, 2014; van Mossel et al., 2018; Y. Wang, 2018).

Scholars (Hove-Sibanda, 2018; N. Shin et al., 2019a; Uddin, 2022) have emphasized the significant role of strategic commitment and collaboration in enhancing supply chain

performance, aligning well with the principles of RDT. Uddin (2022) investigates the effects of strategic commitment and supply chain collaboration on operational and innovation performance, finding that strong strategic commitments and collaborative efforts substantially improve operational efficiency and innovation. This finding highlights the importance of fostering committed and collaborative relationships within supply chains to drive performance improvements. Supporting this, N. Shin et al. (2019) explore the positive relationships between partnership orientation, commitment, and performance measures. Their research demonstrates that investment and contractual-based partnership orientations positively impact partnership commitment, enhancing performance metrics such as innovation and operational efficiency. This study highlights the necessity of developing a strategic partnership orientation and maintaining high commitment levels to achieve better supply chain outcomes. Li et al. (2023) examined the roles of collaboration and formal contracts in the digitalization of supply chains to enhance resilience. Their findings indicate that collaborative relationships and well-defined contracts are crucial for implementing digital technologies and improving supply chain resilience. The study emphasizes that digitalization, supported by strong collaborative practices and formal agreements, can significantly bolster a supply chain's ability to withstand and adapt to disruptions.

Integrating SNT and RDT

Integrating SNT and RDT provides a comprehensive framework for understanding the complex dynamics within supply chain networks (Ahmad, 2019). This combined perspective elucidates the interplay between social relationships and resource dependencies that influence supply chain performance. SNT focuses on the formation and dynamics of collaborative ties,

highlighting how trust, cooperation, and knowledge exchange can enhance relationships among manufacturers, suppliers, and distributors (J. Han, Lee, and Kim, 2020). Meanwhile, RDT emphasizes the strategic importance of managing dependencies on critical external resources to mitigate risks and improve performance (Lai et al., 2020; Pfeffer and Salancik, 1978).

SNT helps analyze how relationships among supply chain partners are formed and maintained, emphasizing the role of social capital in fostering cooperation and information sharing (Y. Han, Caldwell, and Ghadge, 2020). Networks characterized by strong ties and high levels of trust are more likely to exhibit effective collaboration, leading to improved supply chain resilience and performance. For instance, the role of trust and commitment in logistics integration has been shown to enhance supply chain performance (Lai et al., 2020).

RDT, on the other hand, offers insights into how organizations manage their dependencies on external resources. It underscores the importance of strategic collaborations to secure critical resources and reduce environmental uncertainties (Pfeffer and Salancik, 1978). Firms that manage their resource dependencies effectively are better positioned to achieve competitive advantages through enhanced operational efficiency and innovation. For example, electric vehicle supply chain firms strategically manage their dependencies by forming alliances with key suppliers, helping to navigate resource constraints and achieve development goals (Lai et al., 2020).

The integration of SNT and RDT can be particularly beneficial in addressing supply chain disruptions. While SNT provides a framework for understanding how strong social ties and networks can facilitate rapid information flow and coordinated responses during disruptions (Arji, 2023). RDT highlights the importance of resource access and dependency management in

maintaining supply chain continuity (Shymko, 2020). This combined approach can help organizations develop more robust strategies for enhancing supply chain resilience and mitigating risks associated with resource dependencies.

Exploring social interactions and resource dependencies within the North American-based sheet metal manufacturing industry using SNT and RDT offers valuable insights into supply chain dynamics (Singh, 2024). The interplay between these theories allows for a nuanced understanding of how social ties and resource dependencies impact supply chain efficiency and effectiveness (Chowdhury et al., 2022).

The combined SNT and RDT framework provides actionable insights into enhancing supply chain collaboration by addressing both social and resource-based challenges. Understanding how trust, cooperation, and knowledge exchange (critical aspects of SNT) interact with strategic resource management (a focus of RDT) can help organizations develop robust collaborative strategies. Integrating these theories can help identify and address power imbalances and dependencies that often hinder effective collaboration (Drees and Heugens, 2013; Pfeffer and Salancik, 1978). This integrated approach is particularly relevant for industries like sheet metal manufacturing, where close coordination and resource sharing are crucial for operational success.

The North American sheet metal manufacturing industry often faces challenges related to interpersonal relationships among supply chain partners (Dametew, 2020). Utilizing SNT, the dynamics of these relationships can be better understood, highlighting the importance of trust and cooperation. RDT underscores the necessity of managing resource dependencies effectively. Studies have shown that when organizations foster strong social ties and simultaneously manage

resource dependencies, they can significantly improve interpersonal relationships and overall supply chain performance (Lai et al., 2020).

Combining SNT and RDT can also enhance the supply chain's resilience in the sheet metal manufacturing industry. SNT provides insights into the network's structure and the strength of ties, which can be leveraged to maintain supply chain stability during disruptions. Concurrently, RDT highlights the importance of strategic resource management in buffering uncertainties (Kalaitzi, 2016). Organizations strategically managing their resource dependencies while fostering strong social networks are better equipped to handle disruptions and maintain continuity (Mena et al., 2013; Schrepel, 2019).

Combining SNT and RDT provides a robust framework for understanding supply chain dynamics. Pedroza-Gutiérrez and Hernández (2020) emphasized the value of integrating resource-based views with social network analysis to examine supply chain networks. Their study demonstrated that leveraging both perspectives can elucidate the intricate interplay of resource dependencies and social interactions, enabling organizations to achieve competitive advantages through enhanced collaboration and knowledge sharing (Pedroza-Gutiérrez and Hernández, 2020).

Recent studies highlight the significance of combining these theories to address contemporary supply chain challenges. Cruz et al. (2024) underscored that SNT helps visualize and analyze the interconnections between supply chain actors, while RDT emphasizes the importance of managing critical resource dependencies to mitigate risks. This dual approach can be particularly beneficial in complex and dynamic supply chains, such as those in the

manufacturing sector, where the need for strategic alliances and robust networks is paramount (Bento et al., 2024; Y. Li et al., 2023).

Further supporting this integrated approach, research by Y. Li et al. (2023) illustrated how digitalization in supply chain management can enhance resilience. By applying SNT, organizations can map out and strengthen their network ties, facilitating better information flow and trust among partners. Simultaneously, RDT provides insights into how these digital networks can help manage dependencies on critical resources, ensuring continuity and performance even during disruptions (Y. Li et al., 2023). Studies by N. Shin et al. (2019) and Uddin (2022) reinforce the utility of combining SNT and RDT. N. Shin et al. demonstrated that partnership orientation and commitment, central tenets of SNT, significantly improve performance measures when aligned with strategic resource management advocated by RDT. Uddin's work further indicated that strategic commitment to supply chain collaboration enhances operational and innovation performance, highlighting the synergistic effects of robust social networks and strategic resource dependencies (N. Shin et al., 2019; Uddin, 2022).

Supply Chain Collaboration

In recent years, the concept of supply chain collaboration has gained significant traction as businesses increasingly recognize its potential to add value to their operations and activities (L. Chen et al., 2017; Fawcett et al., 2015; S.-H. Liao et al., 2017; Ramanathan and Gunasekaran, 2014; Soosay and Hyland, 2015; Um and Kim, 2019). While collaboration within supply chains has long been established, its renewed emphasis reflects a shift toward fostering strategic partnerships among logistics companies worldwide. This holistic concept encompasses various

supply chain activities, including procurement, manufacturing, strategic sourcing, financing, and logistics (Fornasiero et al., 2021; Zhao et al., 2023).

Defined as a long-term relationship wherein participants work jointly to share information, plan processes, and execute supply chain activities, supply chain collaboration embodies the essence of cooperative endeavor (Al Ajmi, 2023). It emphasizes transparency and cooperation among multiple stakeholders, highlighting the importance of aligning goals and sharing resources to achieve mutual objectives (Imam, 2024). However, despite its widespread adoption and recognition, the conceptualization of supply chain collaboration remains a subject of debate and scrutiny (Panahifar et al., 2018). Critics argue that the term often lacks clarity, leading to misconceptions and challenges in implementation (Mahmud et al., 2021). The complexity of supply chain dynamics further complicates matters, necessitating a better understanding of collaborative relationships and processes (Mahmud et al., 2021; Panahifar et al., 2018).

According to scholars, two primary conceptualizations of collaboration have emerged (Abubakar et al., 2019; Min et al., 2005; Mofokeng, 2019). Firstly, collaboration is viewed as a business process wherein partners work together toward common goals, involving joint decision-making and problem-solving (Abubakar et al., 2019). This collaborative approach seeks to enhance supply chain operations and achieve greater success than individual efforts. Secondly, collaboration is perceived as forming interfirm partnerships that share information, resources, and risks to accomplish mutual objectives (Min et al., 2005; Mofokeng, 2019).

Effective collaboration necessitates a departure from traditional business practices, particularly concerning information exchange (Barker Scott and Manning, 2024). Realistic,

informed, and detailed information sharing improves decision-making and supply chain efficiency (Ahmed, 2022). Collaboration fosters the creation of new knowledge, which is one of the primary objectives of collaborative efforts (Al-Omoush et al., 2020). Expected outcomes of supply chain collaboration include the development of capabilities such as better demand planning, inventory visibility, and acquiring new knowledge and skills (Baah et al., 2021; Zhao et al., 2023). Also, collaboration leads to improved supply chain efficiency, effectiveness, and responsiveness to customer needs (LastMile, 2024; Webster, 2023).

The key role of collaboration within effective supply chain management is elaborated in recent studies emphasizing its potential as a core capability (Ho et al., 2020; V. Osei and Asante-Darko, 2024; H. Wang et al., 2023). Osei and Asante-Darko (2024) highlight the importance of collaboration in coordinating and integrating business activities across globally dispersed operations. They argue that supply chain collaboration is crucial for creating a cohesive, competitive network that enhances overall performance. This perspective is particularly relevant in complex, multi-stage supply chains that require coordinated efforts among numerous firms and functions. Wang et al. (2023) support this view by reviewing the mechanisms, methods, and performance assessments of collaborative decision-making in supply chains. Their study points out that while collaboration directly improves performance, the specific processes and mechanisms through which this occurs are often underexplored. They emphasize the need for dynamic horizontal and vertical collaboration within the supply chain, suggesting that future research should focus on these aspects to understand better and enhance collaborative efforts. Ho et al. (2020) further provided empirical evidence on the relationship between supply chain collaboration and performance using a maturity model. Their research shows that higher levels of

collaboration maturity correlate with better performance outcomes. They identify internal collaboration, including information integration and operations management, as critical mediators that enhance the effectiveness of external collaborations.

Attention has also been focused on supply chain collaboration, particularly in light of disruptions challenging traditional operational paradigms. Duong and Chong (2020) conducted a systematic literature review to explore how collaborations aid supply chains in responding to and recovering from disruptions. Their analysis of 157 papers identified various collaboration mechanisms, research methodologies, and influential factors, shedding light on the dynamics of collaborative endeavors within supply chains. This study highlights the importance of collaboration in bolstering supply chain resilience. It highlights the need for further research to deepen our understanding of its mechanisms and impacts, especially in the face of evolving disruptions. Herczeg et al. (2018) examined supply chain collaboration within the context of industrial symbiosis networks, emphasizing its role in fostering sustainability and resource efficiency. Analyzing existing industrial symbiosis collaborations and stakeholder interviews, they developed a conceptual framework to elucidate the organizational and operational requirements for effective collaboration in industrial symbiosis networks. These studies underline the multifaceted nature of supply chain collaboration and its potential to drive sustainable, resilient, and efficient supply chain practices in an increasingly interconnected world.

Similarly, Alsaad et al. (2018) and Panahifar et al. (2018) emphasized the critical role of collaboration in supply chain management within different contexts. Alsaad et al. (2018) focused on electronic collaboration within the pharmaceutical supply chain in Jordan, highlighting the

positive effect of information and resource sharing on competitive priorities. They emphasize the importance of mutual resource synergy and collaboration among trading partners for value creation within supply chain electronic systems.

Similarly, Panahifar et al. (2018) explored the interrelationships between information sharing and trust in supply chain collaboration initiatives, finding that trust and secure sharing of information significantly improve collaboration effectiveness and, consequently, firm performance. These studies (Baba et al., 2021; Hoang et al., 2023) collectively underline the centrality of electronic or information-sharing-centric collaboration in enhancing supply chain performance and fostering value creation within supply chain networks. Nimmy et al. (2019) conducted a meta-analysis to review various collaborative techniques within supply chains, emphasizing the importance of SC relationships, trust, quality of information sharing, and technological involvement for successful collaboration implementation. On the other hand, Huang et al. (2020) looked into the complexity of collaborations within supply chain networks, highlighting the intricate dynamics of collaboration and the evolving nature as supply chain structures change.

Collaborative Manufacturing

According to Topan (2023), collaborative manufacturing is an approach where manufacturers work with their business partners to create value for their business. This concept involves manufacturers collaborating not only with customers and suppliers but also with machine builders, product designers, software developers, and integrators. Together, they co-design and co-create their products as well as the andir business and manufacturing processes (Ming, et al., 2018).

In modern manufacturing, collaborative manufacturing has emerged as a strategic approach for enhancing competitiveness, particularly for Small and Medium Enterprises (Gherghina et al., 2020). Collaborative manufacturing is where manufacturers work with their business partners to create value for their business (Karkkulainen, 2021). The idea is that manufacturers, collaborating with customers and suppliers, machine builders, product designers, software developers, and integrators, all co-design and co-create their products and business and manufacturing processes (E. Topan, 2023). Companies increasingly recognize the necessity of partnering with external entities to enhance their core competencies and meet evolving market demands (N. Shin et al., 2019). Collaborative manufacturing (CM) provides several advantages, including cost reduction, increased efficiency, and enhanced customer responsiveness (Katsikeas et al., 2020). By collaborating with new partners, particularly within industry clusters, manufacturers can access new markets and improve competitiveness through enhanced communication, collaborative efforts, and knowledge exchange (N. Shin et al., 2019).

Strategic partnerships enable companies to leverage complementary capabilities and resources, thus enhancing value creation (Ribeiro and Barbosa-Povoa, 2018). This necessity for collaboration is driven by the increasing demands for agility, flexibility, and innovation in a competitive market environment (Wang et al., 2023). As businesses strive to differentiate themselves, collaboration becomes crucial for addressing diverse customer needs and delivering superior value (Katsikeas et al., 2020). Effective collaboration relies heavily on trust, which forms the foundation of sustainable partnerships (Ho et al., 2020). Addressing capability gaps and improving communication skills are vital for building mutual trust among collaborating entities (Katsikeas et al., 2020).

Quality management systems, such as ISO 9000, play a significant role in promoting internal standardization and problem-solving, thus facilitating organizational transparency and trust (N. Shin et al., 2019; Sztompka, 1999). These systems are designed to ensure that organizations consistently meet customer and regulatory requirements, fostering a culture of quality and continuous improvement. By establishing clear processes and standards, quality management systems help organizations identify and address issues systematically, leading to more reliable and efficient operations. Internally, these systems cultivate a culture of continuous improvement that extends into external collaborations, thereby enhancing inter-organizational trust (Katsikeas et al., 2020). This trust is crucial for effective collaboration, as it encourages open communication, reduces uncertainty, and builds confidence among partners.

Challenges in Supply Chain Collaboration

Supply chain collaboration, while promising significant benefits, is fraught with challenges that can impede its effectiveness. This section explores several critical challenges identified in scholarly literature. These include the impact of corruption on trust among supply chain partners (Monteiro et al., 2018), inefficiencies and increased costs associated with corrupt practices (Rashed et al., 2021), as well as issues specific to emerging economies, the complexities of implementing circular economy principles, operational perspectives, and interpersonal dynamics between manufacturers and supply chain partners.

Corruption

The intersection of sustainable supply chain management (SSCM) and corruption presents a significant challenge to effective collaboration (Monteiro et al., 2018). Corruption undermines trust among supply chain partners, which is essential for achieving sustainability

goals. Research indicates that corruption leads to inefficiencies and increased costs, disrupting the seamless integration necessary for sustainable practices (Kshetri, 2020). In regions or organizations with high corruption levels, adopting sustainable supply chain practices is often impeded by bribery and favoritism (Rashed et al., 2021). These dynamics hamper transparency and create an uneven playing field where some companies gain unfair advantages, discouraging ethical behavior and collaboration (Rodríguez et al., 2019).

Corruption also affects the monitoring and enforcement of sustainable practices. Companies operating in corrupt environments may find it challenging to ensure compliance with sustainability standards due to unreliable regulatory bodies (Silvestre et al., 2018). This lack of accountability can lead to adopting superficial sustainability measures rather than genuine, impactful actions (Li et al., 2020). Consequently, the potential for SSCM to drive long-term value is diminished as corrupt practices stymied collaborative efforts (Jain and Jain, 2022). Silvestre et al. (2018) further argued that corruption embedded in supply chain relationships can form a "corruption triangle," complicating effective efforts to implement sustainable practices.

Scholarly findings highlight the complex nature of corruption in supply chains and its detrimental effects on sustainability efforts. For instance, Silvestre et al. (2018) emphasized that while stakeholder collaboration is generally seen as positive, it can sometimes exacerbate corruption risks, particularly in environments where both "petty" and "grand" corruption are prevalent. This complexity requires a multifaceted approach to governance and the adoption of interdisciplinary research agendas to understand and mitigate the effects of corruption on SSCM (Monteiro et al., 2018).

However, mitigating corruption requires robust governance frameworks and international cooperation. Establishing clear, enforceable anti-corruption policies and promoting transparency through technology, such as blockchain, can enhance accountability (Goel and Grimpe, 2022). Encouraging a culture of integrity within organizations and across supply chains can also help foster trust and collaboration (Zhu et al., 2021). As companies strive to balance sustainability with economic objectives, addressing corruption dynamics is crucial for effective collaboration to achieve SSCM (Teah et al., 2020). Moreover, Monteiro et al. (2018) suggest that linking corruption research to sustainable development goals (SDGs) can provide a comprehensive framework for holistically addressing these issues.

Emerging Economies

Emerging economies face unique challenges in implementing sustainable supply chain collaboration. Limited infrastructure and financial resources often hinder the adoption of sustainable practices (Huq et al., 2020). The regulatory environment in many emerging economies may not be as stringent, allowing companies to overlook sustainability in favor of cost-saving measures (Mani et al., 2022). This laxness creates a significant barrier to effective collaboration, as supply chain partners may have differing priorities and capabilities regarding sustainability (Gopal and Thakkar, 2021). The lack of robust environmental and social governance frameworks in these regions often results in companies prioritizing short-term financial gains over long-term sustainability goals, further complicating collaborative efforts (Meena et al., 2023).

Cultural differences and varying levels of technological advancement also play a role in these challenges. In emerging economies, supply chain partners might have differing perceptions

of sustainability, influenced by local cultural and economic contexts (Pakdeechoho and Sukhotu, 2018). These differences can lead to misalignment in sustainability goals and practices, further complicating collaboration efforts (Dubey et al., 2021). The disparity in technological capabilities can result in inefficiencies and communication barriers, making it difficult to implement integrated, sustainable supply chain solutions (Bag et al., 2021). The diverse cultural attitudes towards environmental and social responsibilities can also impede the standardization of sustainability practices across the supply chain (Shekarian, 2022).

Targeted strategies are necessary to attempt to overcome these challenges. Capacity-building initiatives that focus on enhancing supply chain partners' sustainability knowledge and skills can be beneficial (Kusi-Sarpong et al., 2019). Governments and international organizations can also play a crucial role by providing financial and technical assistance to support sustainable supply chain initiatives in emerging economies (Subramanian et al., 2022). Collaborative platforms that facilitate knowledge sharing and best practices can help align the sustainability efforts of diverse supply chain partners, fostering more effective collaboration (Agyabeng-Mensah et al., 2020). Fostering a culture of sustainability through education and policy reforms can significantly enhance the alignment of sustainability goals among supply chain partners (Pereira et al., 2023).

Implementing these strategies requires a holistic approach that includes stakeholder engagement at multiple levels. Engaging local communities and suppliers in sustainability initiatives can create a sense of ownership and accountability, which is critical for the success of collaborative efforts (Huq et al., 2020). Additionally, leveraging technological advancements such as blockchain for transparent and efficient supply chain management can bridge the gap

between technological capabilities (Kshetri, 2020). Integrating digital tools can enhance real-time communication and data sharing, improving coordination and reducing inefficiencies (Bag et al., 2021).

Economic incentives and regulatory frameworks are also pivotal in promoting sustainable supply chain collaboration. Tax benefits, subsidies, and other financial incentives to companies that adopt sustainable practices can encourage more businesses to participate in collaborative sustainability efforts (Pakdeechoho and Sukhotu, 2018). Additionally, enforcing stricter environmental and social regulations can compel companies to adhere to sustainable practices, leveling the playing field and ensuring that all supply chain partners are committed to the same standards (Esfahbodi et al., 2016).

The role of multinational corporations (MNCs) in fostering sustainable supply chain collaboration cannot also be overstated (Ghauri, 2022). MNCs can leverage their resources and influence to implement sustainability standards across their supply chains in emerging economies (Pereira et al., 2023). By providing local suppliers technical support, training, and resources, MNCs can help bridge the gap between developed and emerging economies regarding sustainability practices (Subramanian et al., 2022). This collaborative approach not only enhances the overall sustainability of the supply chain but also contributes to the economic and social development of emerging economies (Gopal and Thakkar, 2021).

Circular Economy

Implementing circular economy principles within supply chains poses significant collaboration challenges. The circular economy emphasizes the continuous use of resources, requiring a fundamental shift in how supply chains operate (Bressanelli et al., 2018). This shift

demands close collaboration among all supply chain partners to redesign products and processes for resource efficiency and waste reduction (Gupta et al., 2021). However, achieving such deep collaboration can be difficult due to partners' varying levels of commitment and capability (Stahel, 2020). Collaborative efforts must address diverse operational, cultural, and technological disparities to foster an environment conducive to circular economy practices (Danvers et al., 2023).

One major challenge is the need for shared information and transparency. For a circular economy to function effectively, supply chain partners must share data on product life cycles, material flows, and recycling processes (Govindan and Hasanagic, 2018). This level of transparency is often hard to achieve due to competitive concerns and differing data management systems (Jaeger and Upadhyay, 2020). Establishing standardized metrics and practices across the supply chain can be complex, given the diverse nature of products and industries involved in circular economy initiatives (Sudusinghe and Seuring, 2022). Furthermore, competitive pressures can inhibit the willingness of partners to share critical information, thereby impeding collaborative efforts and integrated sustainability initiatives (Mishra et al., 2021).

However, advancing circular economy practices within supply chains requires overcoming these challenges, which require a concerted effort to build trust and align incentives among supply chain partners. Developing joint ventures and collaborative frameworks can help facilitate the necessary coordination and information sharing (Borrello et al., 2020). Policies incentivizing circular economy practices, such as extended producer responsibility and subsidies for recycling initiatives, can also promote greater collaboration (Ranta et al., 2018). Leveraging technological advancements, such as blockchain, for transparent materials tracking can enhance

trust and streamline collaboration in circular supply chains (Esmaeilian et al., 2016).

Implementing these technologies can reduce the friction associated with data sharing and establish a more robust foundation for circular supply chain practices (Ritter et al., 2024).

Multi-stakeholder collaboration is particularly crucial in developing countries, where resources and capabilities may be limited. Research indicates that collaboration between multinational and local businesses can foster technology transfer and organizational learning, which is essential for resource efficiency and clean technology adoption (Mishra et al., 2021). By engaging in collaborative initiatives, multinational companies can help local firms overcome resource constraints and enhance their ability to participate in circular economy practices. This symbiotic relationship supports local economic development and strengthens the global supply chain's sustainability (Bloise, 2020).

Supply chain partners must also focus on creating a supportive institutional and regulatory environment to facilitate effective collaboration. Governments and international organizations can play a critical role by setting clear regulations, providing financial incentives, and fostering a culture of sustainability (Ritter et al., 2024). In addition, collaborative networks and platforms can enable the sharing of best practices, innovations, and lessons learned across different sectors and regions (Danvers et al., 2023). These collaborative efforts can drive systemic changes and promote a more integrated approach to circular economy implementation (Bloise, 2020).

Practical examples highlight how collaboration can reduce waste and enhance sustainability in specific sectors. For instance, farmers managing stakeholder relationships within the supply chain to reduce food waste demonstrate the potential of collaborative practices in a

circular economy framework (Bloise, 2020). By adopting collaborative relationships, these farmers can manage exchanges of food waste and share knowledge of waste management practices. Such collaborative efforts echo the importance of geographic proximity and the type of exchange—physical or non-physical—in optimizing resource utilization and reducing waste (Bloise, 2020).

Operational Perspective

Optimizing sustainable supply chains involves addressing several collaborative challenges. One key issue is the integration of sustainability metrics into traditional supply chain optimization models (Barbosa-Póvoa et al., 2018). This integration requires developing new methodologies that can balance economic, environmental, and social objectives, which can be complex due to the multidimensional nature of sustainability (Chardine-Baumann and Botta-Genoulaz, 2020). Traditional models often focus solely on economic efficiency, but sustainable supply chain models must also incorporate environmental impact assessments and social responsibility metrics. This incorporation broadens the scope of optimization problems, necessitating more sophisticated algorithms and comprehensive data sets.

Another significant challenge is the dynamic and uncertain nature of global supply chains. Factors such as fluctuating demand, variable supply conditions, and geopolitical risks complicate the optimization process (Govindan et al., 2020). Sustainable supply chains must be resilient and adaptable to such changes, requiring OR methods to handle stochastic variables and multiple scenarios. This adaptability involves robust optimization techniques, real-time data analytics, and predictive modeling to anticipate and mitigate potential disruptions (Jafari-Nodoushan, 2024).

Collaborative decision-making is critical for effective SSCM. Aligning the objectives and actions of various supply chain partners can be challenging due to differing priorities and risk tolerances (Blome et al., 2019). Effective communication and trust-building mechanisms are essential to facilitate collaborative decision-making processes (Moktadir et al., 2020). This facilitation includes developing shared sustainability goals, transparent data-sharing platforms, and joint risk management strategies.

Integrating advanced technologies, such as big data analytics and artificial intelligence (AI), can enhance monitoring and optimize sustainable supply chain operations (Kamble et al., 2020). However, implementing these technologies requires significant investment and collaboration across the supply chain. Big data analytics can provide insights into consumption patterns, waste generation, and resource utilization, while AI can optimize logistics and production schedules for minimal environmental impact (Allahham et al., 2023). The challenge lies in the interoperability of different technological systems and the willingness of supply chain partners to invest in and adopt these innovations.

Fostering a continuous improvement and innovation culture within supply chains is also crucial. Encouraging collaborative research and development initiatives can lead to the creation of new solutions that enhance sustainability (Bai and Sarkis, 2020). For instance, collaborative platforms for open innovation can bring together various stakeholders to co-create sustainable technologies and processes. Additionally, implementing robust training programs that enhance the sustainability competencies of supply chain professionals can help align operational practices with sustainability goals (Azevedo et al., 2019).

Policymakers are crucial in creating regulatory frameworks that support sustainable supply chain practices and encourage collaboration among supply chain partners (Dubey et al., 2020). Regulations that mandate environmental reporting, set emission reduction targets, and incentivize sustainable practices can drive supply chain partners to align their operations with sustainability principles. Public-private partnerships can facilitate the sharing of resources and knowledge necessary for sustainable supply chain innovation. Governments can catalyze the transition towards more sustainable and collaborative supply chain networks by providing financial incentives and regulatory support.

Interpersonal Dynamics Between Manufacturers and Supply Chain Partners

Interpersonal dynamics between manufacturers and supply chain partners are critical determinants of the success of collaborative efforts within the supply chain as such effective collaboration depends heavily on the quality of these relationships, which are influenced by various factors such as communication practices, cultural alignment, and shared goals (Durugbo and Al-Balushi, 2022). Inadequate interpersonal dynamics can lead to significant issues, including misunderstandings and reduced trust, ultimately jeopardizing collaborative initiatives (Rawlinson et al., 2021). For example, when manufacturers and suppliers fail to align their expectations and communication styles, it can result in conflicts and operational inefficiencies, thereby disrupting the supply chain (Omar et al., 2022). Empirical studies emphasize the necessity of regular, transparent communication and the establishment of shared objectives to maintain healthy relationships within the supply chain (Durach and Machuca, 2018; Wang et al., 2018). Aligning corporate cultures and values soothes interpersonal dynamics significantly, fostering a collaborative spirit and enhancing overall performance (Radu, 2023). Understanding

and proactively addressing these interpersonal dynamics are vital for improving supply chain resilience and performance, particularly in managing supply chain disruptions and fostering sustainable partnerships (Omar et al., 2022). Interpersonal relationships, acting as "social lubricants," can advance conventional inter-organizational antecedents of firm resilience, further supporting the strategic importance of interpersonal dynamics (Durach and Machuca, 2018). Therefore, organizations must invest in developing robust interpersonal skills and practices that enhance communication and cultural alignment to ensure successful collaboration and long-term supply chain resilience (Durugbo and Al-Balushi, 2022; Wang et al., 2018).

Effective Relationship Management in Supply Chains

Effective relationship management in supply chains is pivotal for fostering collaboration and achieving operational excellence. It involves building trust, ensuring clear and open communication, and aligning the objectives of all stakeholders (Kayode, 2024). By nurturing strong relationships with suppliers, customers, and partners, organizations can enhance coordination, reduce conflicts, and improve overall supply chain performance.

Trust in Supply Chain Relationships

High levels of trust between partners can reduce transaction costs, enhance information sharing, and increase the willingness to engage in joint problem-solving (Durugbo and Al-Balushi, 2022). Effective trust-building strategies, such as consistent and transparent communication, are essential for maintaining robust supply chain relationships (Yang et al., 2022). A lack of trust can lead to significant challenges, including increased monitoring costs and reduced cooperative behavior, which ultimately hampers supply chain efficiency (Ghondagsaz and Engesser, 2022). Lee and Ha (2024) found that trust significantly enhances

satisfaction and reduces transaction uncertainty, highlighting its critical role in logistics performance. Scholars have highlighted that trust is not only about reliability but also about the humanity and empathy shown by leaders, which significantly motivates employees and enhances overall performance (Deloitte, 2023; Islam et al., 2020; Kleynhans, 2022).

Conflict Resolution Mechanisms

Conflict resolution mechanisms are equally important, as unresolved conflicts can escalate and disrupt the supply chain (Omar et al., 2022). Effective conflict resolution involves clear communication, empathy, and a commitment to finding mutually beneficial solutions (Bouazzaoui et al., 2024). Proactive conflict management practices like regular meetings and performance reviews can help prevent potential disputes and maintain a collaborative atmosphere (Durach and Machuca, 2018). Addressing conflicts promptly and effectively ensures that minor disagreements do not escalate into significant disruptions (Wang et al., 2018). Huo et al. (2023) identified that adopting a cooperative or competitive approach to conflict management, based on the interfirm interdependence structure, can enhance relationship satisfaction and reduce supplier opportunism. Recent research (Abdul Rahman and Ishak, 2022; Risely, 2024; Szymczak and Cyplik, 2023) emphasizes that conflict resolution strategies must be dynamic and tailored to the specific context of supply chain relationships to be effective. (Omar et al., 2023).

Relationship Management Practices

Relationship management practices, such as joint planning sessions and collaborative decision-making processes, are essential for sustaining trust and cooperation within the supply chain (Durugbo and Al-Balushi, 2022). These practices foster a collaborative spirit and contribute to continuous improvement by encouraging open dialogue and feedback (Omar et al.,

2022). Moreover, relationship management can help identify and address emerging issues before they become critical problems, enhancing overall supply chain resilience (Yang et al., 2022). Squire et al. (2024) emphasized the importance of regular interaction and shared goals in maintaining strong supply chain relationships and preventing conflicts. Recent studies highlight that collaborative practices are critical in managing the complexities of modern supply chains, especially in times of global disruptions (Abdul Rahman et al., 2022; Moradi, 2021; Zare and Majava, 2022). Scholars like Khatun (2024) emphasize the importance of SSCM strategies that integrate economic, environmental, and social aspects to enhance business performance and resilience. Collaborative models, such as integrated and lean project delivery, promote early involvement of key participants, joint planning, and trust-based relationships, which are essential for adapting to disruptions and maintaining supply chain continuity (Moradi, 2021).

Cultural Alignment and its Role

Proactive relationship management can also facilitate the alignment of corporate cultures and values, which is crucial for smooth interpersonal dynamics (Einhorn et al., 2021). When supply chain partners share similar values and business philosophies, it becomes easier to establish a common ground for collaboration (Osei, and Asante-Darko, 2023). This cultural alignment supports more effective communication and joint problem-solving, reducing potential conflicts and misunderstandings (Ghondagsaz and Engesser, 2022). Insights from (Reynolds, 2024) suggest that understanding the cultural contexts of partners can enhance conflict resolution strategies, leading to more effective supply chain management. Scholars (Handfield et al., 2022; Lee et al., 2023; SandP Global, 2024; World Economic Forum, 2024; Pederson, 2021) point out that cultural alignment is increasingly crucial in a globalized supply chain environment where

diverse cultural perspectives can both challenge and enrich collaboration highlighting how cultural differences can impact communication, negotiation, and trust between international partners, thereby affecting the overall efficiency and effectiveness of supply chain operations.

Impacts of Leadership on Trust and Collaboration

Leaders demonstrating integrity, fairness, and a commitment to mutual benefits foster high trust among supply chain partners (Durugbo and Al-Balushi, 2022). Trust, in turn, facilitates open communication and reduces the likelihood of conflicts, thereby enhancing collaborative efforts (Omar et al., 2022). Several studies indicate that leaders who actively engage in trust-building activities, such as transparency in decision-making and accountability for actions, can significantly improve the quality of supply chain relationships (Shin and Park, 2021; Sahay, 2023; Sridharan and Simatupang, 2023). Leadership prioritizing collaboration and teamwork can create an environment where supply chain partners feel valued and motivated to contribute to joint goals (Durugbo and Al-Balushi, 2022). Recent studies emphasize the critical role of empathy and human-centric leadership in building trust and enhancing collaboration (Deloitte Insights, 2024; Lee and Kim, 2023; Moradi, 2021). These studies highlight how empathetic leadership can foster a positive organizational culture, improve employee morale, and facilitate better communication, all essential for effective teamwork and collaboration. In supply chain management, these leadership qualities help navigate complex and dynamic environments by ensuring that all stakeholders feel valued and understood, thus enhancing overall operational efficiency and resilience.

The Role of Transformational and Distributed Leadership

Transformational leadership, which focuses on inspiring and motivating employees, is particularly effective in promoting innovative behaviors and enhancing organizational change capabilities (Costa et al., 2023; Genovaitė and Liobikienė, 2023). Trust in leadership facilitated by transformational leaders reduces vulnerability and fosters a supportive environment, which is critical for successful collaboration (Bayraktar and Jiménez, 2020; Le and Lei, 2018).

Transformational leaders are known to build and maintain trust through fairness, integrity, and support, leading to enhanced collaboration and organizational change capabilities (Busari et al., 2019; Lei et al., 2019).

Distributed leadership, involving shared decision-making and collective responsibility, significantly impacts innovative teaching practices and organizational innovation (de Jong et al., 2022; O'Shea, 2021). Both transformational and distributed leadership are essential for navigating the complexities of modern supply chains and fostering a culture of continuous improvement and innovation. Transformational leadership, characterized by its focus on inspiring and motivating employees, is crucial in building trust and driving continuous improvement efforts within organizations (Khattak et al., 2020). Distributed leadership, which emphasizes shared responsibility and collaborative decision-making, is also critical for addressing the dynamic challenges of supply chains and promoting innovative practices (Mohamad et al., 2019).

Factors Contributing to Ineffective Supply Chain Collaboration

Supply chain collaboration often falls short due to a variety of factors. Key issues include misaligned goals among partners, poor communication and information sharing, and differences

in organizational cultures and processes (Sharma et al., 2022). Understanding these factors is essential for identifying areas of improvement and developing strategies to enhance collaborative efficiency.

Misalignment of Goals

When manufacturers, suppliers, and distributors have differing priorities and objectives, it can result in conflicting actions that undermine the overall performance of the supply chain. For example, a supplier might focus on cost reduction while the manufacturer prioritizes quality improvement, leading to inefficiencies as efforts to optimize one aspect might negatively impact another (Kim and Cavusgil, 2020). Clear communication and mutual understanding of goals are essential to fostering a collaborative environment (Xu et al., 2020). Misalignment hampers collaboration and increases the likelihood of conflicts and disruptions (H. Chen et al., 2021).

Albishri (2018) emphasized that goal alignment, commitment to networking, and effective decision-making are critical for supply chain effectiveness. Misalignment creates inefficiencies and increases the potential for conflicts and disruptions (H. Chen et al., 2021). Traditional supply chain performance measures often focus solely on cost minimization and efficiency and must incorporate effectiveness-based measures to address goal alignment issues better (Albishri, 2018).

Gligor et al. (2020) highlighted the importance of alignment within the broader context of the triple-A supply chain framework, including agility, adaptability, and alignment. They argue that alignment is crucial for developing a sustainable competitive advantage and enhancing firm performance. Their research highlights that various combinations of agility, adaptability, and

alignment can lead to high performance, suggesting that firms do not necessarily need to develop all capabilities simultaneously (Gligor et al., 2020).

Communication Barriers

Effective collaboration necessitates goal alignment to ensure all parties work towards a common objective (Flynn et al., 2019). Communication barriers can exacerbate misalignment, as misunderstandings regarding priorities and objectives often arise from poor communication (Xu et al., 2020). Therefore, clear communication and mutual understanding of goals are essential to fostering a collaborative environment and ensuring the effective functioning of the supply chain.

Effective communication is essential for the smooth operation of supply chains, yet communication barriers remain a significant challenge. These barriers can arise from various sources, including language differences, lack of standardized communication protocols, and technological gaps (K. Liao et al., 2021). Poor communication can lead to misunderstandings, delays, and errors in the supply chain processes, ultimately affecting operations' overall efficiency and effectiveness (Huo et al., 2020). For instance, language differences can cause significant misunderstandings between international supply chain partners, leading to misinterpretations of critical information and instructions (V. Osei and Asante-Darko, 2023). The absence of standardized communication protocols often results in inconsistent information sharing, which can cause confusion and inefficiencies in the supply chain (Golini et al., 2019).

The lack of technological integration further exacerbates communication barriers. Technological gaps can prevent seamless information flow between supply chain partners, hindering real-time data sharing and collaborative decision-making (Mahmud et al., 2021). For example, when different entities within the supply chain use incompatible systems, it becomes

challenging to maintain a cohesive flow of information, leading to delays and errors in order processing and inventory management (Rajagopal and Venkatesan, 2021). Implementing advanced communication technologies, such as integrated information systems and collaborative platforms, can help bridge these technological gaps and facilitate better coordination among supply chain partners (Rajagopal and Venkatesan, 2021).

Despite the availability of technological solutions, the human element of communication remains crucial. Training programs aimed at improving communication skills and fostering a culture of open dialogue can significantly enhance the effectiveness of supply chain collaboration (Wang et al., 2022). Moreover, regular meetings and continuous interaction among supply chain members can help build trust and ensure all parties are aligned with the shared goals and objectives (Xu et al., 2020). However, it is essential to note that merely adopting technological tools without addressing the underlying human factors may not be sufficient to overcome communication barriers (Mahmud et al., 2021).

Organizational Culture and Behavior

A collaborative culture, characterized by openness and shared values, is essential for effective collaboration (F. Topan, 2023). Organizations cultivating such a culture are more likely to engage in successful partnerships, enhancing supply chain performance (Morrison-Smith and Ruiz, 2020). In contrast, a culture dominated by siloed thinking and internal competition can significantly hinder collaboration efforts. Aligning organizational culture with collaborative values facilitates better teamwork and strengthens supply chain resilience (Chowdhury et al., 2021).

Commitment from top management to fostering a collaborative culture is crucial as it cascades through all levels of the organization, ensuring that every employee aligns with the common goals of the supply chain (Garcia et al., 2022). Cross-functional teams and joint problem-solving sessions can enhance cultural integration, leading to more effective collaboration (Li et al., 2023). For instance, studies have shown that cross-functional teams are better equipped to address complex supply chain challenges due to their diverse expertise and collaborative mindset (Morales-Huamán et al., 2023).

The influence of organizational culture on team dynamics cannot be overstated (Dettling 2023). Elements of culture such as openness, inclusivity, and trust significantly impact team performance. Dettling (2023) found that these cultural factors enhance trust, improve conflict resolution strategies, and increase team performance. In project-based industries like construction, forming and maintaining a collaborative organizational culture are challenging yet essential. Tulokas et al. (2024) highlighted the importance of managing organizational culture in collaborative construction projects. They suggest that psychological safety, trust, and a mindset focused on collaboration are critical preconditions for effective cultural integration. These factors help overcome traditional barriers and foster a culture supporting project success. Adham and Sukkar (2024) further emphasize the intersection of organizational culture with team management in construction projects. Their research identifies critical strategies such as effective communication, employee development, and cultivating a collaborative culture of trust and respect as fundamental to managing construction teams efficiently. These strategies enhance productivity and improve cohesion and efficiency within teams, demonstrating the significant impact of organizational culture on team dynamics and performance.

The relationship between organizational culture and innovation performance provides additional insights into the importance of cultural alignment. Zhang et al. (2023) explored how cultural factors like psychological safety and collectivism contribute to innovation performance. Their findings indicate that a supportive social and performance management context, fostered by these cultural attributes, can significantly enhance innovation outcomes. These findings highlight the broader implications of organizational culture on various aspects of organizational performance, including innovation and collaboration.

Technological Disparities and System Integration Issues

When partners utilize incompatible systems or technologies, misalignments can lead to delays, errors, and increased costs (Zhong, 2021). For example, one organization might leverage advanced data analytics tools, while another relies on outdated manual processes, causing discrepancies in data exchange and hindering real-time decision-making (Schoenherr and Speier-Pero, 2020). This technological misalignment disrupts the flow of information and hampers the coordination required for synchronized operations within the supply chain. As R. Y. Zhong (2021) highlighted, aligning technological infrastructures across different organizations facilitates smoother collaboration and enhances overall supply chain performance. Moreover, Wamba et al. (2022) emphasized that adopting standardized technologies and platforms can mitigate the risks associated with technological disparities, thereby promoting more seamless integration and efficient data flow.

System integration is critical for effective supply chain collaboration but remains fraught with challenges. Integrating disparate systems across different organizations demands significant time, resources, and coordination. The lack of interoperability between systems often leads to

data silos, which restrict visibility and hinder comprehensive decision-making processes (Choi et al., 2019). These silos create barriers to the holistic view of the supply chain, making it challenging to respond swiftly to market changes or disruptions.

Integration efforts frequently encounter resistance from employees accustomed to existing systems and workflows. This resistance can stem from a lack of understanding of the new systems or fear of the unknown, which underscores the need for strategic change management (Rogers et al., 2020). By addressing these human factors, organizations can facilitate smoother transitions and foster a culture of adaptability and continuous improvement.

Zhong (2021) comprehensively analyzed the effect of technological disparities and system integration challenges on supply chain collaboration. The study explains the necessity of technological alignment and seamless integration for effective collaboration. It recommends practical strategies such as adopting standardized technologies, investing in employee training, and fostering a collaborative culture that supports technological innovation.

In the context of the automotive component manufacturing industry in Indonesia, for example, Gumilang (2021) identifies vital IT factors that influence successful supply chain management. The study highlights the critical role of information technology in enhancing supply chain collaboration and suggests that a deeper understanding of these factors can significantly improve business value. Specifically, Gu et al. (2021) examine the dual role of IT in enhancing supply chain resilience and performance. They argue that exploitative and explorative IT uses are crucial for building supplier and customer resilience. Their findings suggest that an ambidextrous approach to IT—balancing exploitation and exploration—can reconcile the paradox between these two dimensions, leading to improved supply chain performance. This

perspective is particularly relevant in today's volatile business environment, where resilience is a key determinant of supply chain success.

Similarly, Cui et al. (2023) investigated the relationship between digital technologies, supply chain integration, and firm resilience in COVID-19. Their study reveals that digital technologies significantly enhance firm resilience by improving supply chain integration. Specifically, internal, customer, and supplier integration mediate the relationship between digital technologies and firm resilience, highlighting the critical role of integrated digital systems in navigating supply chain disruptions. The findings justify the importance of investing in digital technologies to enhance supply chain resilience, particularly in times of crisis.

Ning and Yao (2023) explore the impact of digital transformation on supply chain capabilities and competitive performance. Their research demonstrates that digital transformation significantly enhances supply chain capabilities, positively influencing sustainable competitive performance. The study's structural equation model shows that environmental uncertainty drives digital transformation, prompting supply chains to explore digitalization more intensively. This finding suggests that digital transformation responds to external pressures and is a proactive strategy for achieving long-term competitive advantages.

Effective Strategies and Best Practices in Supply Chain Collaboration.

In today's interconnected and competitive market, companies must foster solid partnerships and leverage advanced technologies to ensure a seamless flow of goods and information. Key strategies include enhancing communication through integrated software platforms, promoting a collaborative culture based on trust and mutual respect, leveraging emerging technologies like Artificial intelligence and the Internet of Things (IoT) for real-time

insights and automation, and establishing clear metrics and Key Performance Index to monitor and improve performance.

Enhance Communication

Enhancing communication within the supply chain is crucial for improving collaboration and efficiency, and implementing advanced communication tools such as integrated software platforms is a fundamental strategy (Osei, 2023). These platforms, including ERP systems, cloud-based platforms, and IoT devices, facilitate real-time data sharing and enhance transparency among stakeholders, thereby improving decision-making processes and reducing delays (Li, 2021; Kumar and Nath, 2020; Zamiri and Esmaeili, 2024). For instance, cloud-based platforms allow for seamless information exchange, ensuring all parties have access to the most current data, which helps maintain consistency and reduce errors (Martínez-Peláez et al., 2023). Standardizing processes and protocols across the supply chain further enhances consistency and operational efficiency by minimizing variations and discrepancies in task performance (Smith et al., 2022).

IoT devices can automate data collection and monitoring, providing real-time insights into various supply chain activities, which aids in proactive decision-making and quicker response times to any issues that arise (Brown, 2020). Leveraging team communication platforms (TCPs) such as Slack can support situated knowledge sharing and collaborative workflows through their media capabilities, enabling flexible and scalable communication practices (Anders, 2016). These technological advancements collectively contribute to a more integrated, transparent, and efficient supply chain, where enhanced communication fosters better collaboration and overall performance (Johnson et al., 2023; Lee, 2019).

Collaborative Culture

Promoting trust and mutual respect among partners lays the foundation for successful collaboration. Trust, built on mutual respect and integrity, is crucial for developing long-lasting relationships and ensuring effective cooperation (Kayode, 2024; Kucharska, 2017). Investing in joint training programs and workshops further solidifies these relationships by aligning partners' skills and knowledge bases, which is critical for synchronized efforts toward common objectives (Chauhan et al., 2022). Creating a shared vision through goal alignment ensures all parties work cohesively towards the same targets, enhancing overall efficiency and reducing conflicts (N. Shin et al., 2020). Open forums for discussion and transparent reporting encourage honest communication, allowing stakeholders to share insights and address issues collaboratively (Johnson, 2021; Lee and Wang, 2023).

Dedicated investments in partnership management, including strategies like continuous information sharing, significantly boost trust and commitment, leading to more resilient and agile supply chains (Shin et al., 2020). Kayode (2024) noted that enhancing transparency and collaboration through Supplier Relationship Management (SRM) can help identify and mitigate risks, thereby improving supply chain resilience. A collaborative culture, supported by trust and transparent communication, drives performance and enables supply chains to respond more effectively to disruptions and challenges (Chauhan et al., 2022).

Leverage Technology

Leveraging evolving advanced technologies like the current wave of artificial intelligence (AI) and machine learning (ML) is a key strategy for optimizing supply chain operations. AI and ML can predict demand with high accuracy, optimize inventory levels, and enhance decision-

making processes by analyzing vast datasets to identify patterns and trends (Joel et al., 2024; Mwangi, 2024). AI-driven analytics provide insights into market trends and customer preferences, allowing companies to adapt quickly to changing conditions and consumer behaviors (Haleem et al., 2022). These technologies also play a crucial role in mitigating risks and improving supply chain agility by offering real-time visibility and predictive analytics that can forecast disruptions and suggest optimal responses (Nguyen et al., 2023; Patel, 2022). For instance, AI-powered tools can automate routine tasks such as inventory replenishment and logistics management, reducing human error and enhancing operational efficiency (Joel et al., 2024).

AI applications in supply chain management can also enhance resilience by enabling dynamic resource allocation and improving supplier relationship management through better data integration and transparency (Perifanis and Kitsios, 2023). As AI and ML evolve, they offer the potential to create self-learning supply chains that autonomously optimize operations and adapt to new challenges, driving continuous innovation and competitive advantage (Mwangi, 2024; Haleem et al., 2022).

Establish Clear Metrics and Key Performance Indicators (KPIs)

Developing robust Key Performance Indicators (KPI) allows organizations to monitor performance accurately and ensure that all partners are meeting their responsibilities. Regular performance reviews and feedback loops are crucial for identifying areas for improvement and ensuring continuous enhancement of collaborative efforts (Garcia et al., 2021; Martinez, 2023). Implementing a comprehensive KPI framework helps organizations track critical metrics related to efficiency, productivity, and partner performance, facilitating data-driven decision-making and

strategic adjustments (Graça and Camarinha-Matos, 2020). For example, KPIs can be used to assess the timeliness of deliveries, the accuracy of demand forecasting, and the reliability of suppliers, providing a clear picture of operational performance and collaboration efficacy (Sreedharan et al., 2024). Organizations can visualize and benchmark their performance against industry standards by utilizing a KPI dashboard, ensuring they remain competitive and responsive to market demands (Sreedharan et al., 2024). The continuous monitoring and evaluation facilitated by KPIs enhances transparency and accountability among partners and drives innovation and operational excellence across the supply chain (Graça and Camarinha-Matos, 2020).

Other Best Practices in Supply Chain Collaboration

One practical practice is integrating Supply Chain Management (SCM) software solutions that provide end-to-end visibility. These solutions enhance coordination and resource allocation, significantly improving efficiency and customer satisfaction (H. Chen et al., 2021; Thompson and Lee, 2023). Companies utilizing these technologies have reported notable advancements in their supply chain operations (Davies and Young, 2019; Hernandez, 2021).

Another critical best practice is the development of strategic partnerships with suppliers and logistics providers. These collaborative partnerships foster more flexible and responsive supply chains (Roberts et al., 2022; Zhang and Wang, 2021). For instance, engaging in co-innovation projects with suppliers can lead to the development of new products and processes, driving competitive advantage (Liu and Hu, 2022; Miller, 2023).

Adopting agile methodologies also plays a pivotal role in improving supply chain responsiveness and adaptability. Practices such as regular stand-up meetings and iterative

planning enable organizations to swiftly adjust to changing market conditions (Clark and Lee, 2021; Evans, 2020). Companies that have implemented agile practices report faster response times and better alignment with customer needs (Gomez et al., 2023; Peterson, 2022).

Investing in talent development and cross-functional training is another best practice. By equipping employees with diverse skills and knowledge, organizations can enhance problem-solving capabilities and foster a collaborative work environment (Nguyen et al., 2022; Smith and Brown, 2021). Cross-functional teams with a comprehensive understanding of the supply chain are better positioned to address challenges and drive innovation (Martinez and Garcia, 2023; Taylor, 2020).

Maintaining an open and transparent communication policy is essential for effective collaboration. Regular updates, open forums for discussion, and transparent reporting build trust and ensure that all stakeholders are informed and engaged (Johnson et al., 2023; Lee, 2019). Transparency not only enhances collaboration but also improves accountability and performance across the supply chain (Hernandez, 2020; Wang and Zhao, 2022).

Scholars like Ho et al. (2020) emphasize the importance of supply chain collaboration (SCC) for improving business performance. Their research highlights the role of internal collaboration, including information integration and operations management, in mediating the relationship between external integration and performance, reinforcing the significance of robust collaborative practices within supply chains. Nitsche et al. (2023) provided a comprehensive literature review using machine learning-based text mining, offering insights into evolving research themes and future directions in supply chain collaboration. This study underpins the

importance of systematically analyzing research to derive actionable insights and improve collaboration practices.

Summary

This chapter has explored the multifaceted problem of ineffective supply chain collaboration, particularly within the North American-based sheet metal manufacturing industry. It discussed the importance of effective collaboration, emphasizing its role in enhancing efficiency, fostering innovation, and improving overall supply chain performance. Through a comprehensive literature search using databases including Google Scholar and university portals, the researcher identified fundamental studies and conceptual frameworks such as SNT and RDT, which provide a robust foundation for understanding supply chain dynamics. The review highlighted best practices, including the integration of advanced SCM software, strategic partnerships, agile methodologies, talent development, and transparent communication. Despite these insights, significant challenges persist, such as technological disparities, misalignment of goals, and interpersonal relationship issues. The literature also revealed a need for more empirical research on effective strategies and best practices tailored to this industry. These gaps echo the necessity for our study, which aims to fill these voids and contribute to the body of knowledge. The next chapter will unveil the research methodology and design, outlining how to address these gaps and advance the understanding of supply chain collaboration in this context.

Chapter 3: Research Method

In this chapter, the research method employed in the study was discussed. The problem to be addressed in this study is ineffective supply chain collaboration within manufacturing supplier and distributor networks. Disruptions, ranging from minor setbacks to major emergencies like pandemics or cyberattacks, have been identified as significant threats to supply chains, making collaboration crucial in managing such challenges (Katsaliaki et al., 2021). However, there is a lack of comprehension regarding the specific factors that impede effective collaboration and the strategies that can be employed to mitigate them (Morrison-Smith and Ruiz, 2020). This problem is discernible in the fragmented nature of supply chains, where different departments often operate with different systems, resulting in inefficiencies (Zhong, 2021). This lack of collaboration is exacerbated by the complexity of modern global supply chains, which involve various stakeholders such as manufacturers, suppliers, and distributors (Durugbo and Al-Balushi, 2022; Sytch et al., 2022). The purpose of this qualitative embedded single case study is to investigate the ineffective supply chain collaboration within manufacturing supplier and distributor networks, enhancing the factors influencing supply chain collaboration within the North American-based sheet metal manufacturing industry, and developing strategies for improving collaboration effectiveness.

This qualitative embedded single case study was a beacon of hope in the face of ineffective supply chain collaboration within manufacturing supplier and distributor networks. It aimed to enhance the factors influencing supply chain collaboration within the North American-based sheet metal manufacturing industry and develop strategies for improving collaboration effectiveness. This research promised significant improvements by addressing the identified

problem of ineffective collaboration and exploring the underlying challenges and opportunities within the industry. The embedded single case study design, as described by Creswell and Poth (2018), is a systematic approach that allows researchers to contrast between different groups of people with differing expertise qualities and extremes to create depth and understand a broad phenomenon without losing the individuality of the single case study (Baxter and Jack, 2008; Thomas, 2011).

This chapter outlined the research methodology and design employed in this study. It began with a comprehensive discussion of the qualitative research approach and a detailed explanation of the embedded single case study design. The chapter then meticulously details the data collection methods, including the selection of participants, data collection procedures, and the instruments used for data gathering. The chapters also covered the thorough data analysis process, ethical considerations, and measures to ensure the credibility and reliability of the study. This chapter's final part summarized the key points, reinforcing the confidence in the study's findings.

Research Methodology and Design (Nature of the Study)

The research methodology and design selected for this study are rooted in their appropriateness to address the problem of ineffective supply chain collaboration within manufacturing supplier and distributor networks. Specifically, this study employed a qualitative embedded single case study approach, a methodology particularly suited for exploring complex social phenomena, such as the intricate dynamics of supply chain collaboration (Yin, 2018). According to Denzin and Lincoln (2011), qualitative research is well-suited for investigating contexts where the goal is to understand processes, meanings, and experiences from the

participant's perspective. Given the multifaceted nature of supply chain relationships, qualitative methods enable a rich, in-depth exploration of the perspectives and strategies that shape collaboration between manufacturers, suppliers, and distributors.

The embedded single case study design was chosen because it allows for a thorough examination of a phenomenon within a specific industry context, in this case, the North American sheet metal manufacturing industry. This design is handy when the phenomenon under investigation is unique or complex and requires a detailed understanding of its real-world context (Yin, 2018). The embedded case study approach also allows for multiple units of analysis within the same case, facilitating a solid understanding of the factors influencing supply chain collaboration.

Regarding research questions, the methodology and design aligned well with the study's objectives, which aim to explore the underlying factors that influence collaboration and identify potential strategies for improvement. The open-ended nature of qualitative inquiry supports the discovery of insights that may not be apparent in quantitative approaches, as it captures the complexities and subtleties that define supply chain relationships (Creswell and Poth, 2018).

Several alternative methodologies and designs were considered less appropriate for this study's objectives. A quantitative approach could involve surveys or experiments to gather numerical data on supply chain collaboration factors (Baycik, 2024;). While this method could provide broad generalizations and statistical significance, the researcher considered it to lack the depth and contextual richness necessary to understand the intricate dynamics of supply chain relationships. Quantitative methods often fail to capture participants' interactions and detailed perspectives, which is crucial for exploring supply chain collaboration's complex and

multifaceted nature (MacCarthy, 2022; Priya, 2021). The study's focus on exploring detailed, contextual insights makes the qualitative approach more suitable.

Combining qualitative and quantitative methods through a mixed-methods design could offer a comprehensive perspective by leveraging the strengths of both approaches (Wasti, 2022; Poth, 2022). However, the primary aim of this study was to gain an in-depth understanding of the qualitative aspects of supply chain collaboration, which requires a focused and intensive examination of individual experiences and perceptions. Introducing quantitative elements could dilute the depth of qualitative insights and potentially complicate the research process without adding significant value to understanding the core phenomena (Susitha, 2024).

A multiple-case study design could involve studying multiple cases within the sheet metal manufacturing industry or across different industries to compare and contrast findings (Bass, 2018). While this approach could provide broader generalizability and potentially identify common patterns and divergences across different contexts, it would require extensive resources and time, potentially limiting the depth of analysis for each case. In contrast, the embedded single case study design allows for a concentrated examination of a single industry, providing more detailed insights into the dynamics and challenges of supply chain collaboration within the North American sheet metal manufacturing sector (Farquhar, 2020; Safari, 2023).

An ethnographic approach could involve extended immersion in the manufacturing environment to observe and understand the cultural and social dynamics influencing supply chain collaboration (Hammersley and Atkinson, 2019). While this method could offer rich, detailed observations, it would require significant time and resources and might not provide the focused insights needed to address specific collaboration challenges in the sheet metal

manufacturing industry. However, while ethnography offers depth of insight, it presents challenges regarding time and resource investment.

Grounded theory, initially developed by Glaser and Strauss (1967), is a widely recognized qualitative research method designed to generate conceptual frameworks directly from data collected in the field. This approach is beneficial in situations where little is known about a phenomenon, as it allows for the emergence of new theories grounded in empirical evidence. The primary objective of grounded theory is to develop a robust, explanatory model that accounts for the patterns and relationships observed within the data (Charmaz, 2014). While grounded theory is well-suited for exploratory studies aiming to generate new conceptual frameworks, it is not the most appropriate approach for this study. This research aimed not to develop new theories regarding supply chain collaboration but to understand and improve existing collaboration practices within the North American-based sheet metal manufacturing industry.

The phenomenological approach is another qualitative method that explores individuals' lived experiences and perceptions of a phenomenon (Moustakas, 1994). While this approach could provide valuable insights into personal experiences of supply chain collaboration, it needs more structural and contextual focus to address organizational and systemic factors influencing cooperation within the industry. The phenomenological approach is more suitable for studies that aim to understand the essence of a shared experience rather than the interplay of multiple organizational and environmental factors (Neubauer, 2019).

Population and Sample

The population for this study comprised employees from the North American-based sheet metal manufacturing industry, spanning various roles within the manufacturing firm. Specific relevant characteristics of this population included their involvement in different stages of the supply chain, such as production, quality control, logistics, and supply chain management. The population included production floor staff, machine operators, middle managers, and executives, each playing a critical role in the supply chain collaboration process.

The chosen population is appropriate for this study because the identified problem, purpose, and research questions focus on the dynamics of supply chain collaboration within the sheet metal manufacturing industry. By targeting individuals directly involved in these processes, the study aimed to gather detailed insights into the factors influencing collaboration effectiveness and develop strategies for improvement. The diversity within the population, including various job roles and levels of responsibility, ensures a comprehensive understanding of the supply chain dynamics from multiple perspectives (Caylan, 2024; Govindan, 2020).

The study consisted of three distinct samples, each contributing unique insights to the investigation of supply chain collaboration. These samples consisted of three distinct groups: (1) production floor staff and machine operators; (2) middle managers, including production supervisors and department managers; and (3) executives, such as CEOs and directors of supply chain management. Each group comprised eight participants, totaling 24 participants. Beyond their job titles, the selection criteria included a minimum of five years of experience to ensure that participants have a deep understanding of supply chain collaboration dynamics. Grouping participants by these hierarchical levels allows for a comprehensive analysis of collaboration

from operational, managerial, and executive viewpoints, offering diverse insights across the supply chain (Miller, 2022).

This sample size and composition are appropriate for the study's objectives, as they provide a balanced representation of the different roles within the supply chain, facilitating an in-depth exploration of collaboration issues and opportunities. Purposive sampling was used because it allows for the deliberate selection of participants who have direct experience and expertise in supply chain processes within the sheet metal manufacturing industry. This approach ensures that the data collected is rich and relevant to the research questions (Campbell et al., 2020; Palinkas et al., 2020).

In qualitative research, reaching data saturation is crucial, meaning additional interviews are unlikely to yield new information (Saunders et al., 2018). Given the three distinct samples, saturation must be achieved separately within each group before triangulating the data to develop comprehensive findings. With eight participants per group, it was expected to achieve saturation within each sample, supported by previous studies indicating that smaller samples can still reach saturation, especially when participants have specific expertise (Mason, 2010). Data triangulation across these samples further ensured the robustness and credibility of the study's findings.

Participants were recruited through various methods. Potential participants were identified by reviewing staff information provided on industry websites and LinkedIn profiles. Formal electronic communications, such as emails, were used to contact companies directly or through industry associations. These emails explained the study's purpose, request permission to

invite their staff to participate, and outline the expectations for participation. Copies of these communications will be included in the Appendix for reference.

Once potential participants respond to the invitations, follow-up communications, including emails and phone calls, were conducted to confirm participation, address any questions, and finalize the selection of participants. In addition to their specific roles—production floor staff and machine operators, middle managers, and executives—eligibility were based on a minimum of five years of experience in their respective positions. This experience requirement ensures that participants possess sufficient industry knowledge and expertise relevant to the study. The selection process were carried out separately for each of the three groups to maintain the integrity and focus of the research.. This recruitment and screening process aligned with the study's aim to comprehensively understand supply chain collaboration by incorporating insights from various levels within the industry. The targeted approach ensures that the participants selected are best positioned to provide valuable insights into the study's research questions (Mason, 2010).

Instrumentation

The instrumentation for this study was meticulously developed through a comprehensive review of the literature on supply chain collaboration, focusing on factors influencing collaboration effectiveness within the manufacturing industry. The primary data collection method involved semi-structured interviews to delve deeply into participants' experiences and perspectives.

The interviews will last between 60 and 90 minutes to enhance participant engagement and align with academic recommendations (Jamshed, 2014). This duration ensures that the

sessions remain manageable for participants and facilitates a thorough exploration of the research topics. Follow-up sessions may be arranged to gather additional insights or clarify previous responses, though no single session will exceed 90 minutes. This approach adheres to best practices in qualitative research, ensuring data collection is comprehensive and respectful of participants' time (Islam, 2022).

Prior to the commencement of primary data collection, a pilot test was conducted with five participants from the larger sample groups. These individuals were interviewed using a preliminary version of the interview protocol. This pilot testing sought to assess the interview questions' clarity, relevance, and comprehensiveness (Creswell and Poth, 2018). Feedback gathered from these pilot interviews guided the refinement of the interview protocol, enhancing its validity and reliability.

The Appendix comprehensively documented adjustments based on pilot testing to ensure transparency and facilitate replication in future studies (Tate et al., 2023). This iterative process will involve analyzing feedback through follow-up communications, such as brief interviews or questionnaires, to confirm that the revised protocol effectively captures the nuances of supply chain collaboration and addresses the research questions comprehensively.

The finalized interview protocol, along with supplementary materials such as observation protocols and consent forms, was included in the Appendix of this dissertation. This section will also include detailed records of the pilot testing process, including participant feedback and any subsequent modifications to the protocol. This comprehensive documentation ensures transparency, allows for study replication in future research, and aids in reproducibility.

Study Procedures

The study followed a structured and systematic approach to collecting data from the selected North American sheet metal manufacturing industry sample. This process ensures that the data gathered is relevant, thorough, and reliable, allowing for a comprehensive analysis of supply chain collaboration dynamics. The study adhered to strict ethical guidelines, ensuring that all data is collected with participants' informed consent and that confidentiality is maintained throughout the research process.

Recruitment of Participants

Potential participants were identified through various channels, including industry websites and LinkedIn profiles (Campbell et al., 2020). Formal electronic invitations were emailed detailing the study's purpose and expectations for participation and requesting permission where necessary. A rigorous screening process will ensure that participants meet the eligibility criteria relevant to their respective sample group—production floor staff, middle managers, or executives. Follow-up communications, including emails and phone calls, were used to confirm participation and finalize the selection of participants (Palinkas et al., 2020).

Interview Process

The study employed semi-structured interviews to gain insight into and understand supply chain collaboration practices. These interviews were conducted virtually using Google Meet, chosen for accessibility and convenience for participants in various geographic regions. Each interview was scheduled for 60 to 90 minutes to provide ample time for detailed responses while preventing participant fatigue (Jamshed, 2014). Follow-up sessions may be arranged if necessary, but no individual session exceeded 90 minutes to maintain engagement and focus.

Participants were informed about recording interviews for transcription purposes, and their consent will be obtained prior to the commencement of each session. All interviews were recorded with the participants' informed consent and transcribed verbatim using Nvivo software. This software assisted in systematically coding and analyzing qualitative data, ensuring that all relevant themes and insights are captured accurately.

The interview protocol was applied consistently to ensure uniformity and reliability in the data collection (Islam, 2022). The semi-structured format allows for flexibility in exploring emergent themes and probing deeper into specific areas of interest as they arise during the interviews. This approach helped uncover a comprehensive understanding of the factors influencing supply chain collaboration.

To ensure the security and confidentiality of the data, all recordings, transcriptions, and observation notes were stored on encrypted drives and backed up on cloud storage using Google Drive. Access to these data was restricted to the researcher to maintain privacy and confidentiality. Participants' identities were anonymized in all reports and publications to protect their privacy further. Personal identifiers will be removed, and ethical guidelines handled the data to safeguard participants' confidentiality and protect their contributions (Fouad and Rego, 2024).

Following each interview, a debriefing session was conducted to address any immediate questions or concerns from participants and ensure their responses are accurately interpreted. Detailed records of any modifications to the interview protocol, based on pilot testing feedback, were included in the dissertation's Appendix. This documentation provided transparency and facilitate replication of the study in future research (Creswell and Poth, 2018; Tate et al., 2023).

Observation Protocols

In addition to the interviews, observational data were collected to capture non-verbal cues and other contextual information that may influence participant responses. These observations were meticulously recorded during the virtual interviews and later analyzed alongside the transcriptions to enrich the understanding of the data (Anderson et al., 2023). The observation protocols were adapted from established qualitative research guidelines and tailored to the remote interview setting.

Data Analysis

The data analysis process began with thematic analysis, a rigorous method involving multiple steps to ensure a thorough and accurate interpretation of the data. The interview recordings were transcribed verbatim with NVivo, a qualitative data analysis software that facilitates the organization and management of large volumes of qualitative data. In addition to the transcriptions, observation notes, and any additional relevant documents were compiled for analysis (Anderson et al., 2023). The researcher familiarized themselves with the content by reading the transcriptions and notes multiple times to identify significant statements, phrases, and patterns (Kritika, 2024; Nowell et al., 2017).

Given the study's design, the data will be collected from three samples: production floor staff, middle managers, and executives. Each data set will be analyzed separately to capture these groups' unique perspectives and experiences. Thematic analysis will be conducted individually for each sample, following the steps outlined below, ensuring that the nuances specific to each group are identified and thoroughly examined.

Initial coding involved applying descriptive labels to text segments from each group's transcripts using NVivo. This open-ended process will allow the researcher to capture as many potential themes as possible without imposing preconceived notions (Emrouznejad et al., 2023). Open coding broke the data into manageable chunks, followed by axial coding to refine these codes into categories and subcategories. This step will focus on identifying relationships among codes within each sample, such as causality, context, and interactions (Nowell et al., 2017). Themes that emerge from this analysis will be specific to the experiences of each group, ensuring that the analysis remains grounded in the data collected.

Selective coding integrated the core themes from each sample into a cohesive narrative for each group. This will involve methodical cross-verification within each dataset to ensure consistency and reliability of the findings. Thematic saturation was monitored separately for each group, determining when no new significant themes or insights emerge within each sample. Data collection and analysis will cease for that particular group (Nowell et al., 2017).

Once the thematic analysis has been completed for each sample, the triangulation process was used to compare and cross-verify the findings across the three samples. This process involved identifying common themes and discrepancies between the perspectives of production floor staff, middle managers, and executives. Triangulation will enhance the credibility of the findings by ensuring consistency across the themes and identifying areas where different levels of the organization may view collaboration differently (Anderson et al., 2023).

Observation notes played a crucial role in the triangulation process. These notes, which document non-verbal cues and contextual factors observed during the interviews, will be analyzed alongside the interview data. By incorporating these observational insights, the analysis

will gain a deeper understanding of the participant's experiences and the context in which their views are formed. The observations will be cross-referenced with the interview data to ensure that the themes identified are supported by multiple forms of evidence, further enhancing the robustness of the findings.

Throughout this process, the researcher will actively reflect on personal biases and influences that could affect data interpretation, ensuring that these are acknowledged and mitigated to maintain the study's trustworthiness (Nowell et al., 2017). To further ensure the accuracy of the findings, participants may be invited to review and provide feedback on the preliminary results to confirm that their perspectives are accurately represented. A detailed record of all data collection and analysis steps will be maintained to ensure transparency and allow for study replication (Fouad and Rego, 2024).

Assumptions

This study uses several key assumptions regarding supply chain collaboration in the North American sheet metal manufacturing industry. The first assumption posits that a lack of resources and infrastructure hinders effective collaboration among supply chain partners (Smith, 2023). The second assumption asserts that industry participants possess significant experience and insights into supply chain practices, enabling them to provide valuable data (Brown, 2022). The third assumption suggests that successful collaboration necessitates various support services and interventions tailored to the specific needs of supply chain partners (Jones et al., 2021). The fourth assumption posits that enhanced collaborative practices will improve operational performance and strategic outcomes (Miller, 2024). The fifth assumption holds that participants,

through their professional roles, possess the knowledge and experience necessary to provide meaningful insights into the dynamics of supply chain collaboration (Davis, 2023).

The researcher's judgment will be used to select participants based on their potential to provide rich, informative data. The sixth assumption focuses on the sampling method, acknowledging that participants may not fully or accurately describe their experiences during semi-structured interviews, potentially impacting data collection. The purpose of the study and the need to collect comprehensive data influence sampling decisions. If the sample is of the right quality and quantity, it will yield the necessary data (Smith, 2023). Participants will be key stakeholders in the sheet metal manufacturing supply chain, ensuring they have relevant experience in supply chain collaboration.

Limitations

The study acknowledged several limitations that might affect its outcomes. One limitation was the variability in supply chain collaboration practices across different companies within the sheet metal manufacturing industry. Each company may tailored its collaboration strategies to its specific needs, which could affect the generalizability of the findings (Brown, 2022). Another limitation was that the study's data were collected from a relatively small number of participants, which may limit the ability to draw broad conclusions (Miller, 2024). Participants' willingness to be truthful during semi-structured interviews was another potential limitation, as responses might be tailored to what they believe the interviewer wants to hear (Davis, 2023). Not all participants answered every interview question, potentially leading to incomplete data.

To mitigate these limitations, the researcher will establish a relationship with each participant before the interview process to ensure a more targeted recruitment process and to build trust. This trust is essential for obtaining accurate and comprehensive data. The credibility and transparency of the research process are critical to the integrity of the findings (Taylor et al., 2022). The researcher's choice of participants is based on their ability to provide informative data, ensuring that the sample is appropriate for the study's objectives (Smith, 2023).

Delimitations

This study focused on supply chain collaboration within the North American sheet metal manufacturing industry. It was delimited to examining key stakeholders such as production managers, operation managers, warehouse managers, quality control managers, corporate transportation managers, and purchasing managers (Jones et al., 2021). The study included participants with significant experience in supply chain collaboration, ensuring they can provide in-depth insights into the research topic. The data collection and analysis were conducted meticulously to ensure the reliability and validity of the findings (Nowell et al., 2017).

Purposeful sampling was used to select participants, reflecting the intentional selection of individuals who can provide the most relevant data for answering the research questions (Johnson et al., 2020). This approach helps minimize research bias and enhance the study's credibility.

Ethical Assurances

The study received approval from National University's Institutional Review Board (IRB) before data collection begins. This approval process included submitting the research proposal, consent forms, and other required documentation to ensure compliance with ethical

guidelines. Participants received detailed consent forms outlining the study's purpose, procedures, risks, benefits, and confidentiality assurances (Nowell et al., 2017). They were informed of their right to withdraw from the study at any time without any consequences.

Confidentiality was maintained by securely storing all data and ensuring participants' identities are protected throughout the research process. The researcher's role was clearly defined, including strategies to mitigate personal biases and ensure objective data analysis. The researcher maintained a detailed audit trail of all data collection and analysis steps to ensure transparency and replicability (Nowell et al., 2017). Participant feedback was solicited through member checking to confirm the accuracy and credibility of the findings. The IRB approval letter was included in the dissertation manuscript's appendix to provide evidence of ethical compliance.

Summary

In this chapter, the research methodology and design of the study were thoroughly detailed, providing a clear roadmap for understanding how the research will be conducted. The study employed a qualitative embedded single case design to investigate the factors influencing supply chain collaboration within the North American-based sheet metal manufacturing industry. This approach was chosen for its ability to provide rich, contextual insights into complex phenomena, which was essential for addressing the study's problem, purpose, and research questions. Alternative methodologies and designs, such as quantitative approaches, mixed methods designs, multiple case studies, and phenomenological approaches, were considered but ultimately deemed less appropriate for this study's specific objectives. The chosen qualitative

method allowed for an in-depth examination of collaborative practices, interpersonal relationships, and industry collaboration barriers.

The study's population and sample were defined, highlighting the relevance and appropriateness of the selected participants, who are critical stakeholders in the supply chain. The sampling method ensured that data saturation will be achieved, enhancing the reliability of the findings. Detailed procedures for data collection were outlined, emphasizing the use of semi-structured interviews and observations to gather comprehensive qualitative data. Data analysis strategies were described, including using qualitative content analysis to identify themes and patterns in the collected data.

The role of the researcher and measures to ensure the credibility and reliability of the data analysis were discussed. The chapter also addressed the study's assumptions, limitations, and delimitations, providing a transparent view of the study's scope and potential constraints. Ethical assurances were detailed, ensuring that the study was conducted according to ethical guidelines and that participants' rights and privacy were protected.

Chapter 4: Findings

The problem to be addressed in this study is the ineffective supply chain collaboration within manufacturing supplier and distributor networks. The purpose of this embedded qualitative single case study seeks to investigate the ineffective supply chain collaboration within manufacturing supplier and distributor networks, enhancing the factors influencing supply chain collaboration within the North American-based sheet metal manufacturing industry and developing strategies for improving collaboration effectiveness. The study examined experiences from three distinct organizational layers, executives, middle managers, and production floor staff, using triangulated thematic analysis to draw out themes and patterns related to communication, trust, processes, and technological alignment.

This chapter presents the findings aligned with the three research questions. First, it establishes the trustworthiness of the data, addressing credibility, transferability, dependability, and confirmability. Then, it presents the demographic profile of participants. The results section is structured around each research question, including the emergent themes with tables and representative quotes. Each theme is aligned to one of the three research questions. The chapter concludes with an evaluation of findings in the context of the conceptual framework and existing literature from Chapter 2.

Trustworthiness of Data

The study employed multiple strategies to ensure the trustworthiness of qualitative data. To ensure methodological rigor and uphold the integrity of the findings, this qualitative study applied the trustworthiness criteria established by Lincoln and Guba (1985): credibility, transferability, dependability, and confirmability. These four components are foundational for

demonstrating that qualitative research is conducted systematically, that its findings are grounded in participants' lived experiences, and that interpretations are reflective of the data rather than researcher bias (Creswell and Poth, 2018; Shenton, 2004). Each of these elements was systematically addressed through data collection, analysis, and validation procedures.

Credibility

Credibility was established through triangulation, member checking, peer debriefing, and iterative coding processes. First, triangulation was employed across data sources and participant perspectives. Interviews were conducted with participants across three distinct organizational strata, Group 1 (Executives and Directors), Group 2 (Middle Managers and Supervisors), and Group 3 (Production Floor Staff and Operators). A total of 24 participants (eight per group) contributed to the richness and diversity of the data. Following recommendations by Nowell et al. (2017), data triangulation was used to compare themes across three organizational levels, executives, middle managers, and production staff. This approach enhanced credibility by confirming the consistency of patterns across perspectives while also highlighting areas of divergence, which deepened contextual understanding and reduced interpretive bias. As previously noted, triangulation across executive, managerial, and production staff groups enabled a cross-sectional comparison of perspectives. During the analysis phase, this approach clarified where thematic perceptions aligned (e.g., communication breakdowns) and where they diverged (e.g., workflow concerns specific to floor operations). This comparative lens, consistent with Carter et al. (2014), enhanced the depth and dependability of thematic conclusions. As recommended by Carter et al. (2014), triangulating participant perspectives across organizational levels not only reduced single-source bias but also reinforced the dependability of the findings by

revealing consistent and divergent patterns within the data. This approach enabled the researcher to verify thematic accuracy by comparing patterns across executive, managerial, and frontline responses.

Second, member checking was conducted in two stages. As recommended by Birt et al. (2016), a subset of participants representing each organizational level (executive, middle management, and production floor) was purposefully selected based on their engagement and availability to validate the preliminary interpretations derived from their interviews. After themes were refined, synthesized summaries were shared again with the same participants to confirm the accuracy, clarity, and resonance of the thematic findings. This two-stage member checking process enhanced the credibility of the analysis by allowing feedback both during theme development and after thematic consolidation. This technique also supports confirmability by reducing the potential influence of researcher bias through direct validation from participants. A summary of preliminary themes, accompanied by selected verbatim quotes, was shared with six participants across all three groups via secure email. Participants were asked to confirm whether the interpretations aligned with their intended meaning and if the thematic summaries accurately reflected their experiences. Four participants responded with affirmations that the findings were “accurate” and “captured the main issues.” Two participants provided minor clarifications, such as emphasizing the importance of visual tools in cross-department coordination, which were incorporated into the final theme descriptions. As recommended by Birt et al. (2016), this process supported credibility by ensuring that participant voices were represented faithfully and reduced the risk of researcher misinterpretation.

As described by Lincoln and Guba (1985), prolonged engagement and persistent observation help establish credibility in qualitative research by enabling a fuller understanding of participant experiences and building trust. In this study, prolonged engagement was achieved through extended interviews across three distinct organizational tiers and iterative questioning strategies that probed emerging themes. Persistent observation was reflected in follow-up probing, targeted clarifications during interviews, and repeated engagement with the same participant roles across groups to ensure depth and breadth of understanding. These techniques allowed the researcher to distinguish between relevant and irrelevant information and build contextual trust.

Finally, the researcher engaged in peer debriefing by consulting qualitative research peers and faculty mentors. These consultations involved challenging the researcher's assumptions, evaluating the coding process, and verifying the alignment between the data and the emerging themes. Peer debriefing offers an external check on the research process, reduced potential researcher bias, and bolstered credibility (Lincoln and Guba, 1985).

Transferability

Transferability pertains to the extent to which the study's findings can be applied to other contexts. While qualitative research does not aim for statistical generalization, it does seek to produce analytical generalizations that allow readers to determine whether the findings are relevant to their settings (Tracy, 2010). To enhance transferability, the study employed thick description. Detailed contextual information about the organizational setting, participant roles, and industrial conditions in the North American sheet metal manufacturing sector was provided throughout the methodology and findings chapters. The interviews captured participant

perspectives across functions, procurement, engineering, IT, inventory, operations, and floor production, allowing readers to assess the applicability of insights based on comparable organizational structures or supply chain conditions.

Additionally, demographic tables were used to present anonymized participant roles, years of experience, and departmental affiliations, which helped situate findings in practical relevance. The diversity of roles among participants across the three groups provided a composite view of organizational dynamics, increasing the likelihood that others in similar industrial ecosystems could relate to the challenges and strategies discussed.

To enhance both credibility and transferability, direct participant quotes were embedded within the narrative, allowing readers to interpret the nuances of supply chain dynamics through the voices of those experiencing them. As recommended by Shenton (2004) and Lincoln and Guba (1985), rich verbatim excerpts support the reader's ability to judge relevance to their own contexts and reduce researcher bias. Following guidance from Patton (2015), rich, thick descriptions of participant roles, communication structures, and workflow practices were provided to support transferability. These contextual details allow readers to assess the applicability of the findings to other organizational settings with similar characteristics.

Moreover, by explicitly noting when specific themes were prevalent across all groups versus unique to a specific tier, the study supports a nuanced understanding of contextual variability and applicability. These transparency practices serve as tools for readers and practitioners to make informed judgments about the potential relevance of the findings in their respective environments (Morse, 2015).

Dependability

Dependability refers to the stability and consistency of the research process over time. This study achieved dependability through methodological transparency, audit trails, and qualitative data analysis software. The research design was documented comprehensively, including the steps taken in participant recruitment, data collection, thematic coding, and data triangulation. The researcher followed Braun and Clarke's (2006) six-phase framework for thematic analysis: (a) familiarization with the data, (b) generation of initial codes, (c) searching for themes, (d) reviewing themes, (e) defining and naming themes, and (f) producing the report. Each phase was implemented rigorously and is explicitly documented in the methodology section.

An audit trail was maintained throughout the coding and theme development process. This included records of codebooks, theme matrices, analytic memos, and decisions made regarding code modifications or theme consolidation. NVivo 14 software was used to systematize the coding process, generate frequency reports, and visualize co-occurrence patterns, enhancing reproducibility and transparency. A coding protocol was developed to ensure consistency across all transcripts.

Furthermore, a reflective journal was used throughout the research process. The journal contained methodological notes, evolving research insights, and records of decisions made in response to unexpected challenges or insights. This reflective documentation contributed to the study's dependability by offering a roadmap of the inquiry process that others could follow or replicate with appropriate adjustments (Nowell et al., 2017). Select excerpts illustrating coding

decisions and reflexive notes have been included in Appendix D to provide transparency and demonstrate the audit trail of analytic decisions.

To further support dependability, the coding process involved repeated cycles of review, re-coding, and memoing to assess the stability of theme application over time. As recommended by Nowell et al. (2017), iterative engagement with the transcripts was used to enhance intra-coder consistency and to monitor shifts in interpretation across phases of analysis. The researcher maintained a coding log and used analytic memos to document emergent insights, decision rationale, and code clarifications throughout the process. Although a secondary coder was not used, methodological rigor was strengthened through reflexive bracketing and systematic comparison of themes across time and participant groups. These processes allowed the researcher to verify the dependability of the coding scheme internally, ensuring that theme generation was not shaped by transient impressions or analytic drift but instead emerged through a stable and reasoned analytic process.

Confirmability

Confirmability addresses the neutrality of the research, that is, the extent to which the respondents shape the findings rather than the researcher's preconceptions. Confirmability was addressed by analyst triangulation, use of verbatim quotes, and separation of interpretation from results reporting. Several techniques enhanced confirmability, including reflexive bracketing, direct quotations, and clear documentation of analytic decisions throughout the coding process.

The researcher engaged in reflexivity throughout the data collection and analysis process. Before data collection, the researcher documented assumptions, pre-existing knowledge, and positionality concerning supply chain management. This act of bracketing protected against

undue influence on participant narratives and data interpretation (Malterud, 2001). To further enhance confirmability, findings were consistently supported by verbatim quotations from participants, offering readers direct access to the voices and perspectives that informed each theme. Quotations were carefully selected to reflect not only the most frequently mentioned issues but also divergent or minority viewpoints, thus preserving the richness and complexity of the data.

To support confirmability, the study relied on internal strategies consistent with qualitative research best practices. As recommended by Shenton (2004), peer debriefing and member checking were employed to reduce researcher bias and ensure the interpretations remained grounded in participants' intended meanings. Member checking involved sharing synthesized themes and selected quotations with several participants to verify alignment with their experiences, allowing for clarification or elaboration where needed (Birt et al., 2016). A reflective journal was maintained throughout the research process to document methodological decisions, emerging insights, and potential researcher assumptions (Nowell et al., 2017). This reflexive documentation created an internal audit trail, enabling transparency in how interpretations evolved. Triangulation across the three organizational groups (executives, middle managers, and production staff) also enhanced confirmability by allowing for the comparison of convergent and divergent perspectives (Carter et al., 2014). Collectively, these practices strengthened the objectivity and dependability of the findings. Following recommendations from Shenton (2004) and Nowell et al. (2017), external validation through peer debriefing and member checking were conducted to enhance confirmability. These techniques ensured that findings were grounded in participant perspectives and not unduly influenced by researcher bias.

Additionally, data saturation was achieved across all three groups, with repeated concepts and patterns emerging by the sixth interview and confirmed by the eighth in each group. This saturation is a hallmark of confirmability and indicates that the analysis captured the breadth and depth of participant perspectives (Guest et al., 2006). The findings were grounded in participant quotes and frequency data to avoid researcher bias. Based on guidance in Nowell et al. (2017), personal assumptions were bracketed during the analysis, and coding memos included reflexivity notes to track the researcher's thought process.

Together, these strategies support the trustworthiness and rigor of this qualitative inquiry, ensuring that the findings presented in Chapter 4 are credible and grounded in authentic participant perspectives. Triangulation, member validation, thick contextualization, methodological transparency, and reflexivity provide a comprehensive framework for establishing trustworthiness in this qualitative study. These efforts not only uphold the integrity of the research but also strengthen its credibility, transferability, dependability, and confirmability, cornerstones of qualitative validity (Creswell and Poth, 2018; Lincoln and Guba, 1985). The study delivers trustworthy insights into the systemic, relational, and strategic factors shaping supply chain collaboration in a complex manufacturing environment through this rigorous approach.

Results

The data collection process involved semi-structured interviews with 24 participants across three organizational groups: eight executives (Group 1), eight middle managers (Group 2), and eight production floor employees (Group 3). Interviews were audio-recorded, transcribed verbatim, and uploaded into NVivo 14 for qualitative data management and analysis. Each

group’s data was analyzed individually before conducting a triangulated analysis to explore convergent and divergent themes across organizational layers. Each group consisted of eight participants representing diverse roles within the North American-based sheet metal manufacturing industry. This structure enabled an in-depth understanding of supply chain collaboration challenges and practices across various organizational levels.

Participant Demographics

A total of 24 participants contributed to this study, evenly distributed across three organizational tiers. Participants represented departments including procurement, quality control, operations, inventory, engineering, packaging, and IT. They comprehensively viewed the internal and external collaboration dynamics within the North American-based sheet metal manufacturing supply chain. All participants had at least 3 years of experience in their roles, and many had worked across multiple departments or supplier-customer interfaces, enabling a nuanced understanding of systemic collaboration issues. Participants represented diverse functional areas, including operations, procurement, quality control, and logistics. Table 1 and 2 shows the role distribution across the three participant groups and demographic characteristics of interview participants.

Table 1
The Role Distribution Across the Three Participant Groups:

Participant Group	Department/Role Area	Number of Participants
Group 1–Executives and Directors	Director of Operations, Directors (Sales, Estimating, Production), Engineering Manager	8
Group 2–Middle Managers	Procurement Manager, Shipping Lead, Department Managers, Quality Engineers	8

Table 2
Demographic Characteristics of Interview Participants (N = 24):

Participant ID	Group	Job Title/Function	Years in Role	Gender	Education Level
P01	Group 1 (Executive)	Director of Mfg. and Fac.	11	Female	Bachelor's
P02	Group 1 (Executive)	Director of Sales	13	Female	Bachelor's
P03	Group 1 (Executive)	Engineering Manager	10	Male	Bachelor's
P04	Group 1 (Executive)	Inventory Control Manager	7	Female	Some College
P05	Group 1 (Executive)	Production Director	30	Male	Associate
P06	Group 1 (Executive)	Director of Operations	4	Male	Bachelor's
P07	Group 1 (Executive)	QA Manager	9	Male	Bachelor's
P08	Group 1 (Executive)	General Manager	38	Male	Master's
P09	Group 2 (Middle Mgmt.)	Procurement Manager	20	Male	Bachelor's
P10	Group 2 (Middle Mgmt.)	Shipping Manager	8	Male	High School
P11	Group 2 (Middle Mgmt.)	Production Supervisor	6	Male	Bachelor's
P12	Group 2 (Middle Mgmt.)	Lead Buyer	7	Female	Master's
P13	Group 2 (Middle Mgmt.)	Lead Mfg. Engineer	12	Male	Associate
P14	Group 2 (Middle Mgmt.)	Packaging Manager	10	Female	Associate
P15	Group 2 (Middle Mgmt.)	Scheduling Lead	11	Male	Bachelor's
P16	Group 2 (Middle Mgmt.)	Inventory Supervisor	10	Male	Associate
P17	Group 3 (Floor Staff)	Machine Operator	3	Male	High School
P18	Group 3 (Floor Staff)	Scheduler	4	Male	Bachelor's
P19	Group 3 (Floor Staff)	Import/Export Coordinator	9	Male	High School
P20	Group 3 (Floor Staff)	Manufacturing Engineer	5	Male	High School
P21	Group 3 (Floor Staff)	Shipping Tech	7	Male	Associate
P22	Group 3 (Floor Staff)	Quality Inspector	3	Male	High School
P23	Group 3 (Floor Staff)	Line Operator	5	Male	High School
P24	Group 3 (Floor Staff)	IT Technician	7	Male	Bachelor's

After the eighth participant, saturation was achieved independently within each group, as no new codes or concepts emerged during the coding of the eighth participant.

Data Analysis and Coding Process

Thematic analysis followed Braun and Clarke's (2006) six-phase approach. After familiarization with the data through iterative transcript reading, open coding was conducted line-by-line across each group's transcripts. This process generated a total of 145 initial codes: 47 from Group 1, 45 from Group 2, and 53 from Group 3, (see Appendix E for the complete list of initial open codes). Each code captured a meaningful unit of data relevant to supply chain collaboration challenges or strategies. The codes were then organized into code clusters based on conceptual similarity. Axial coding was used to refine these clusters into preliminary themes. During this process, redundant or overlapping codes (e.g., "unclear updates" and "delayed communications") were collapsed, while distinct but related codes (e.g., "manual inventory tracking" and "ERP legacy tools") were grouped under broader categories like Technological Constraints.

These codes were grouped into 21 categories across functional and relational dimensions – covered in Appendix E. Through iterative coding cycles, these categories were distilled into seven final themes based on semantic coherence and cross-participant agreement. Although the initial coding process generated 145 unique codes in NVivo, not all of these were retained in their original form – only 131 codes were used to arrive at the final acceptable seven final themes. Several codes were merged due to overlapping meaning, others were reclassified under broader categories, and some were discarded because they were too context-specific or unrelated to the main research questions, covered in Appendix F. Through iterative coding cycles, the

refined set of codes was grouped into 21 categories across functional and relational dimensions (Appendix E). These categories were then synthesized into seven final themes based on semantic coherence and cross-participant agreement. The 131 code mentions therefore represent the total number of coded references across all interviews, including both codes that ultimately informed the final themes and those that were later excluded or collapsed during the refinement process. The acceptable 131 codes were refined and merged through iterative analysis into 21 categories, which in turn contributed, often in overlapping ways, to the seven final themes. Because many categories contributed to multiple themes, there was no strict one-to-one mapping. The final column in Table 3 reflects the frequency with which each consolidated theme was mentioned (e.g., “Communication Barriers” was coded 22 times across participants), not the number of codes assigned to the theme. Table 3 shows the thematic consolidation process using responses from all three participant groups.

Table 3
Sample Code Consolidation Process Across Executive, Managerial, and Production Groups:

Initial Codes (representative, from 131 list)	Categories (formed from codes)	Final Theme	Code Frequency (n = 24)
<i>“unclear specs, vague drawings, missing details, no standards; late updates, outdated specs, delayed info, slow change rollout; conflicting instructions, miscommunication, different directions, mixed messages; floor vs office gaps, siloed updates, disconnect across teams, unclear handoffs”</i>	Communication Gaps Translation Issues Inconsistent Updates	Communication Barriers	22
<i>“old system, legacy ERP, non-intuitive interface, missing fields; retyping, spreadsheets, duplicate input, handwritten logs; not connected, separate systems, no real-time sync, data islands; tools don’t talk, fragmented</i>	System Limitations System Integration Issues Limited Training Data Inaccuracy	Technological Constraints	19

<i>apps, jumping platforms, no workflow link</i>	Workflow Misalignment	Process Misalignment	17
<i>“ops vs sales tension, different goals, clashing KPIs, urgent vs important; who owns this? lack of accountability, finger pointing, no clear lead; out of sync timing, misaligned delivery dates, overbooked machines, planning disconnect; separate plans, no joint roadmap, mismatched calendars, lack of visibility”</i>	Speed vs. Precision Lack of Standardization Conflicting Priorities		
<i>“chasing today, no long view, reactive decisions, short-term fixes; can’t see upstream, no supplier info, hidden constraints, poor data access; empty promises, starts but no finish, dropped initiatives, no follow-up; second-guessing vendors, holding back info, supplier avoidance, distrust”</i>	Trust Erosion Broken Promises Short-Term Focus Relationship Gaps Inconsistent Engagement	Commitment Issues	20
<i>“team silos, separate metrics, different incentives, no shared success; changing direction, mixed leadership signals, lack of alignment, shifting priorities; fear of new systems, sticking to old ways, passive resistance, delay behavior; culture clash, factory vs corporate mindset, regional habits, informal practices”</i>	Differing Cultures Siloed Goals Speed vs. Precision (values conflict) Hierarchical vs. Collaborative Norms Role/Norm Conflicts	Cultural Misalignment	18
<i>“design for manufacturability, upfront collaboration, input early, pre-planning engagement; co-create solutions, mutual ownership, work together, fast fix loops; early involvement; joint problem solving; escalation pathways; who to call? no escalation, stuck at level 1, unclear chain of command”</i>	Joint Planning Shared Metrics Supplier Engagement (Practices) Problem-Solving Forums Knowledge Sharing	Collaborative Strategies	20
<i>“old tech, slow tools, outdated platforms, upgrade required; forecasting gap, no analytics, reactive only, no predictive model; need for modernization; predictive tools; long-term investment planning; future readiness, capital lag, no roadmap, short planning horizon”</i>	Long-Term Tech Investment (Digital) Legacy Technology Workforce Upskilling Continuous Improvement	Future Outlook	15

Note: This table presents illustrative examples of how multiple initial codes were grouped into categories and then merged into final themes. The mapping between categories and themes is not one-to-one; some categories contribute to more than one theme, and each theme may incorporate codes from several categories. Code frequency reflects the total number of references to all codes contributing to the final theme, not just those shown in the example category.

Each theme was named to reflect participants' language and organizational meaning. The themes were only retained if they met a minimum frequency threshold of being mentioned by at least four participants in at least two groups, satisfying the criteria for salience (Nowell et al., 2017; Guest et al., 2006). Codes or categories that did not meet this threshold were excluded from the final theme set, even if they were identified during initial coding. Table 4 reflects the number of unique participants within each organizational group who referenced a given theme at least once. This participant count highlights the breadth of theme recognition across roles but does not account for how often a theme was mentioned. In contrast, Table 4b (and the code frequency totals reported earlier in Table 3) presents the number of distinct coded references, meaning the total frequency with which each theme was cited throughout all interviews. These code frequencies capture the saturation level and intensity of discussion around each theme. Therefore, while Table 4 presents unique participant engagement, Table 4b and Table 3 reflect the depth of conversation, and differences in totals across the tables are both intentional and analytically appropriate (Braun and Clarke, 2021).

Table 4*Theme Frequency by Participant Group:*

Final Theme	Executives (n = 8)	Middle Managers (n = 8)	Production Floor Staff (n = 8)	Participant Count (n = 24)
Communication Barriers	5	4	6	15
Technological Constraints	6	3	4	13
Process Misalignment	3	3	4	10
Commitment Issues	5	6	3	14
Cultural Misalignment	4	4	6	14
Collaborative Strategies	2	5	5	12
Future Outlook	4	5	3	11

Note. Table 4 reflects the number of unique participants per group who referenced each theme at least once. These counts are not code frequencies but rather individual-level recognition of the theme during interviews. See Appendix E for detailed participant-level breakdown. This table is complemented by Table 4b, which details code mention frequencies, and Figure 1, which visualizes these differences. To complement these tables, Figure 1 provides a heatmap visualization of cross-group patterns, while Figure 5 in Appendix F present mind maps of each final theme, including dropped codes and categories considered during analysis.

Table 4b*Code Mentions by Group:*

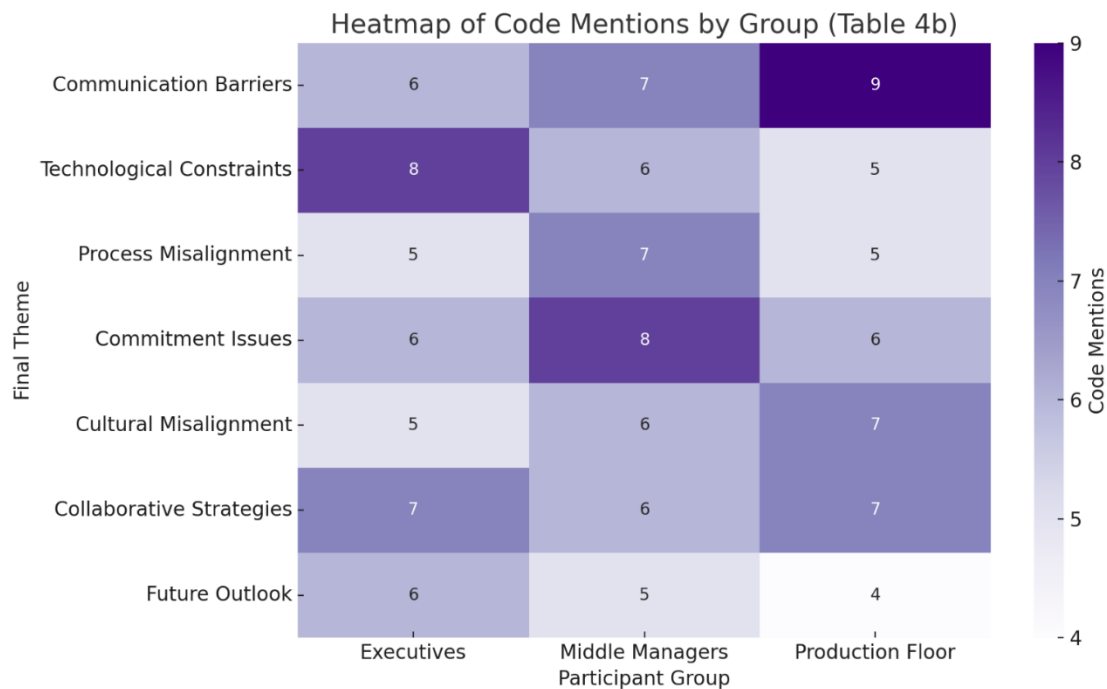
Final Theme	Executives Code Mentions	Middle Mgt. Code Mentions	Production Floor Staff Code Mentions	Total Code Mentions
Communication Barriers	6	7	9	22
Technological Constraints	8	6	5	19
Process Misalignment	5	7	5	17
Commitment Issues	6	8	6	20
Cultural Misalignment	5	6	7	18
Collaborative Strategies	7	6	7	20
Future Outlook	6	5	4	15

Table 4b presents the number of distinct code mentions per group for each theme. These values reflect how often participants across executive, middle management, and production floor groups returned to each topic during interviews. Code mentions represent the frequency with which themes recurred in participant responses, not the number of individuals who referenced them.

Table 4b summarizes the frequency of code mentions for each final theme by participant group. To provide a visual comparison, Figure 1 presents a heatmap of these frequencies, with darker shading indicating a greater number of mentions. This visualization highlights patterns in

emphasis across groups, for example, production floor staff most frequently cited Communication Barriers, whereas executives placed greater emphasis on Technological Constraints. In addition to these frequency-based summaries, the analytic process was further visualized through thematic mind maps (see Figure 5 in Appendix F), one for each of the seven final themes. Each mind map illustrates how codes and categories clustered to form the final theme. Importantly, these visualizations also include dropped codes / dropped categories, which were considered during coding but ultimately excluded from the final theme consolidation. By displaying both retained and dropped elements, the mind maps enhance transparency of the analytic process and highlight the richness of the underlying data structure. These visual representations complement Tables 4 and 4b as well as Figure 1 by offering a qualitative view of how themes were constructed.

Figure 1
Heatmap of Code Mentions by Participant Group Across Final Themes):



This panel presents mind maps for each of the seven final themes, illustrating the relationships among categories retained in analysis and those that were dropped. These visualizations complement Table 4b by providing structural transparency to the coding process and highlighting how themes were refined. Together with the heatmap in Figure 1, the mind maps underscore both the frequency and the conceptual organization of themes across participant groups. Taken together, these visualizations enhance transparency by showing not only the relative weight of each theme but also the structural decisions that shaped the final coding framework. This provides a strong foundation for the next section on Triangulation and Cross-Group Comparison, where thematic convergence and divergence across participant groups are examined in greater detail.

Triangulation and Cross-Group Comparison

Theme frequencies by organizational group are summarized in Table 4 to highlight cross-group convergence and divergence. Theme frequencies by organizational group are summarized in Table 4 to highlight cross-group convergence and divergence. To further illustrate cross-group convergence and divergence, Appendix E details the source group(s) that contributed to each category used in theme development. This mapping supports the interpretation of how shared or unique concerns shaped each final theme. Table 4 reflects how many individual participants from each group mentioned a theme at least once. To capture the intensity and recurrence of those mentions, Table 4b presents the corresponding code frequencies, indicating how often each theme was referenced across transcripts. Following the guidance of Braun and Clarke (2006) and Carter et al. (2014), thematic analysis began with independent coding of transcripts from each participant group: executives (Group 1), middle managers (Group 2), and production floor staff

(Group 3). Codes were first identified within each group to capture their unique perspectives. After group-specific analysis was complete, a comparative review was conducted to identify patterns of convergence and divergence across groups.

Divergence was noted in specific categories such as “*speed vs. precision*,” “*siloed goals*,” and “*differing cultures*,” which were discussed only by executives and middle managers but not production floor staff. Similarly, the category “*long-term tech investment*” was highlighted by executives but not other groups. These divergent elements informed the formation of broader themes like Cultural Misalignment and Future Outlook, while reinforcing the importance of multi-group triangulation during thematic consolidation. Final themes were derived only when categories overlapped conceptually across at least two groups, and triangulation was confirmed across all three when applicable. As Tables 4 and 4b demonstrate, themes were not pre-determined. Instead, categories were generated independently within each organizational tier. Categories or codes that did not meet the conceptual overlap and frequency threshold criteria were excluded from the final set, ensuring that the seven themes represented only the most salient and consistently observed patterns across participant groups. These initial codes and categories were then reviewed to identify commonalities. Final themes were developed inductively through a process of comparing these categories for conceptual alignment, allowing for cross-group triangulation where patterns were consistent across all tiers. While Table 3 presents the final thematic consolidation of all initial codes across participant groups, combining them into overarching categories that reflect shared patterns. Table 5 builds on this by consolidating individual codes into broader categories emphasized within each group (executives, middle managers, and floor staff). In other words, while Table 3 shows the

integrated thematic structure, Table 5 illustrates how each group described or emphasized the issues that contributed to those broader categories. For example, the category Communication Gaps from Table 3 was described as “Format gaps, unclear updates” by executives, “Misaligned priorities, delays” by middle management, and “Vague instructions, reactive changes” by production floor staff. This side-by-side arrangement highlights variations in emphasis between groups while maintaining alignment with the same higher-order theme. The mapping process followed Braun and Clarke’s (2006) thematic analysis approach, first identifying categories inductively within each group and then clustering them deductively into broader, cross-group themes.

Table 5
Theme Derivation Based on Within-Group Categories:

Theme	Group 1 (Executives – Category)	Group 2 (Middle Mgmt. - Category)	Group 3 (Floor Staff - Category)
Communication Barriers	Communication gaps, unclear updates	Misaligned priorities, delays	Vague instructions, reactive changes
Technological Constraints Process Misalignment	ERP non-integration, old systems Conflicting forecasts, isolated planning	Legacy platforms, limited access BOM issues, reactive coordination	Manual tracking, outdated terminals Siloed workflows, lack of clarity
Commitment Issues	Short-term supplier goals	Disconnected departments	Lack of accountability
Cultural Misalignment Collaborative Strategies	Silo culture, internal competition Tech tools, supplier dashboards	Differing role priorities Visual workflows, escalation plans	Confusion in leadership signals Cross-functional huddles
Future Outlook	Predictive analytics, AI	Forecasting tools, smart planning	Need for upgrades, modernization

While Table 5 presents the inductive categories emphasized by each group, a crosswalk was created to link these categories back to the consolidated categories shown in Table 3. A more detailed breakdown of all initial codes and their corresponding group assignments is provided in Appendix E. This appendix contains the complete code-to-category mapping used to develop the inductive categories displayed in Table 5. This alignment illustrates how the broader categories, derived through cross-group analysis in Table 3, correspond to the specific issues emphasized by executives, middle management, and production floor staff. By mapping these relationships, the analysis clarifies how group-level variations in emphasis integrate into the consolidated thematic framework.

The findings in this chapter are organized by research question and participant group. Each section presents the emergent themes supported by code frequency counts and representative participant quotes. For Research Question 1, the key themes identified were Communication Barriers, Technological Constraints, and Process Misalignment. Research Question 2 revealed Commitment Issues and Cultural Misalignment as primary obstacles to interpersonal collaboration. For Research Question 3, the themes of Collaborative Strategies and Future Outlook emerged as forward-looking enablers of improved collaboration. The analysis highlights both commonalities and distinctions across the executive, middle management, and production floor tiers. Thematic summaries at the end of each section synthesize key insights and lay the groundwork for the cross-group triangulation presented later in the chapter.

Research Question 1

What underlying factors contribute to the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?

The thematic analysis of interview transcripts across executives (Group 1), middle managers (Group 2), and production staff (Group 3) revealed three central themes contributing to ineffective supply chain collaboration: Communication Barriers, Technological Constraints, and Process Misalignment. These themes emerged consistently across organizational levels, though their manifestations and implications differed in depth and emphasis depending on the participant's role in the supply chain. This section presents a layered discussion of these themes, grounded in participant testimony, supported by code frequency counts.

Theme 1: Communication Barriers

Communication Barriers appeared as the most widely cited challenge to supply chain collaboration. Table 4 shows that 15 out of 24 participants referenced this theme across executive, middle management, and production staff groups. As reflected in Table 4b, the theme received 22 total code mentions, indicating that participants raised it in multiple instances. Commonly described elements included unclear specifications, delayed updates, and misaligned messaging within internal operations and with external partners.

From the executive level, the barriers were associated with systemic inefficiencies and a lack of standardized processes for interdepartmental and external communication. For instance, P06, a director of operations, remarked, *"We have no centralized visibility. Marketing knows one thing, sales knows another, and production finds out too late."* Similarly, P05 noted, *"Suppliers don't always get timely updates from our purchasing group, which causes all kinds of confusion downstream."* These breakdowns were attributed to information silos and departmental autonomy, with P07 stating, *"Each department has its own system. We operate like separate islands when we need to be a team."* Executives also emphasized that the absence of shared

platforms contributed to ongoing disruptions. P01 explained, *"Some departments use legacy spreadsheets while others have migrated to dashboards. That misalignment leads to miscommunication and missed commitments."* Senior leaders expressed concern that delayed communication with suppliers resulted in unanticipated inventory shortages and missed delivery targets, which ultimately impacted customer satisfaction.

Among middle managers, communication issues centered on lack of alignment between internal functions and inconsistent messaging from leadership. P11 reported, *"We often get updates at the last minute, no time to adjust production plans or inform suppliers."* P13 added, *"Engineering and operations don't speak the same language. We interpret timelines differently, and that creates delays."* P10 explained how miscommunication affected quality: *"We send prints with vague tolerances. The shop floor doesn't know what's critical, and suppliers just guess."*

Middle managers described a reactive environment where communication often occurred only after a problem had escalated. P12 said, *"We only talk when something goes wrong. There's no routine dialogue across departments unless there's a fire."* This lack of proactive communication was also seen in planning meetings that excluded key stakeholders. As P09 shared, *"We have meetings about forecasts, but no one invites packaging or quality until we're already in trouble."*

On the production floor, communication barriers were experienced as operational disruptions and day-to-day confusion. P18 described the difficulty of receiving schedule changes: *"Sometimes we're halfway through a batch and get told to switch gears. No warning, just do it."* Floor staff expressed frustration with vague instructions and a lack of follow-up. P20

explained, *"We get an email that says 'rush order,' but no context. Who is it for? What changed? We don't know."*

Additional production staff noted the psychological toll of inconsistent communication. P21 stated, *"It's hard to feel part of the team when you're the last to know."* Similarly, P17 added, *"We waste hours redoing parts that could've been right the first time if we had clearer specs."* These experiences reflected a broader perception that frontline workers were excluded from decision-making, reinforcing a top-down culture that failed to engage those closest to the work.

The triangulated analysis confirms that communication failures are not simply a logistical hurdle but a foundational flaw in collaboration infrastructure. Despite role-based differences in how the problem was framed, participants across all groups consistently identified communication barriers as a fundamental obstacle to effective supply chain collaboration. The quotes illustrate both the pervasiveness and depth of the issue, from strategic misalignment at the executive level to operational confusion on the floor.

Theme 2: Technological Constraints

Technological Constraints were acknowledged by 13 participants in Table 4, spanning all organizational levels. Table 4b reports 19 total code mentions related to this theme. Participants referenced outdated or incompatible digital systems, manual processes, and a lack of integration across enterprise platforms as major contributors to inefficiencies. These constraints not only disrupted internal coordination but also limited responsiveness to supplier issues, delayed forecasting adjustments, and contributed to errors and rework.

At the executive level, concerns were rooted in systemic fragmentation and outdated infrastructure. P01, a vice president of operations, emphasized, *“We’re running modern demands through legacy ERP platforms. The systems weren’t designed to talk to each other, and they still don’t.”* This lack of real-time visibility across departments and supplier interfaces was echoed by P03, who remarked, *“Our planning tool is not synced with the supplier portal. There’s a 48-hour lag sometimes. That’s critical in our business.”*

Leaders also criticized the slow pace of digital transformation. P05 stated, *“We’ve been talking about upgrading our procurement interface for three years, but we’re still working off Excel sheets and email chains.”* These limitations, they argued, hindered the company’s ability to respond proactively to changes in supplier capacity or customer demand.

Among middle managers, the effects of technological gaps were especially disruptive to procurement, scheduling, and quality control processes. P10, a supply chain manager, reported, *“We input data into two different systems and still get conflicting numbers. One says we’re short, the other says we’re over. It wastes hours every week reconciling that.”* Similarly, P12 explained, *“We can’t trace the material status in real-time. If the supplier changes something, we don’t see it unless they call us. That’s a huge gap.”*

Middle managers also highlighted the manual nature of many workflows. P13 shared, *“Our production release process requires printing forms and walking them to the next department. That’s how orders get missed or delayed.”* This sentiment was supported by P14, who said, *“There’s no central dashboard. Everyone uses different tools, Google Sheets, PDFs, old databases, so we’re never aligned.”*

For those on the production floor, technological limitations were experienced in the form of outdated hardware, inconsistent toolsets, and limited access to planning systems. P17, a lead operator, stated, *“Some of our machines still run off floppy disks. We have to log data by hand and hope someone uploads it correctly.”* Others described how system misalignment affected their ability to prepare efficiently. P18 said, *“We get the job sheet, but the specs might be outdated because no one updated the file. We don’t know until we’re already cutting.”*

Frontline workers also expressed frustration about lacking access to key information. P20 shared, *“I have to go ask engineering for updated prints because the system doesn’t push them to the floor. We lose time every day chasing documents.”* Similarly, P21 remarked, *“Our tooling database is on a separate network, so we have to stop what we’re doing to check compatibility manually.”* These operational barriers often compounded errors and slowed production. P19 noted, *“By the time we catch a mismatch, the parts are already halfway through. That’s just waste.”* And P22 explained, *“Even if we catch the mistake early, we have to wait for someone to fix it in the system before we can continue.”*

Despite their role-specific experiences, participants across all levels expressed a shared understanding that fragmented and outdated systems were a root cause of many delays and disconnects. The quotes reveal widespread dissatisfaction with current technologies, ranging from strategic concerns at the leadership level to hands-on frustrations from shop floor personnel.

Theme 3: Process Misalignment

Process Misalignment was identified by 10 participants, as reported in Table 4 and Table 4b reflects 17 total code mentions. This theme captures systemic disconnects in how departments

and supply chain partners plan, coordinate, and execute operational workflows. Although processes were often intended to be standardized, participants described varying assumptions, unclear handoffs, and inconsistent approaches to production planning, scheduling, and inventory control. These gaps frequently resulted in inefficiencies, rework, and delayed deliveries, particularly as data and expectations failed to flow smoothly across functional or organizational boundaries.

From the executive perspective, misalignment was often attributed to the lack of cross-functional integration and forward planning. One vice president remarked, *“Our planning cycles don’t match engineering finalized specs after production has already scheduled runs. We’re constantly rescheduling”* (P03). Another senior leader observed, *“Different teams work in their own silos with different goals. Supply chain wants speed; engineering wants accuracy. That tug-of-war slows everything down”* (P07). Executives emphasized that departmental priorities were rarely aligned in terms of timeline or metrics, which contributed to delays in decisions and reactive adjustments.

Executives also reflected on the strategic-level gaps between internal capabilities and customer expectations. One director explained, *“We make delivery promises before checking supplier capacity. Then we scramble to meet those dates”* (P04). This lack of alignment between commercial commitments and operational readiness reflected a broader disjunction between what was being promised to customers and what the backend systems could support. *“No one owns the full process,”* added another senior manager. *“Each department does its own part, but no one sees the entire flow”* (P02). These quotes reinforce that at the executive level; misalignment was perceived as a lack of system-wide visibility and strategic coordination.

Among middle managers, the focus was on tactical misalignment, particularly related to inventory management, BOM updates, and schedule adherence. *“We often catch BOM errors only after production starts,”* a planning supervisor shared. *“It’s frustrating because we then have to stop everything and redo setups”* (P11). Others described version control issues between departments. *“Engineering revises specs but doesn’t flag it clearly,”* explained a quality lead. *“By the time production sees it, we’ve already built it wrong”* (P10). Middle managers emphasized the burden of reconciling conflicting data from different systems, which slowed decision-making and increased operational risk.

Another manager stated, *“Inventory levels in our ERP don’t match what’s on the floor. Procurement thinks we have the parts, but we’re already out”* (P14). These examples illustrate how misalignment between digital records and physical stock levels exacerbated supply uncertainty. Several managers also noted that process documentation varied between shifts or locations. *“Each shift fills out reports differently. So, when problems happen, we don’t even have a consistent baseline to start solving it”* (P13). These responses highlight how misalignment extended beyond tools, it involved roles, assumptions, and habits ingrained across teams.

For floor-level employees, misalignment showed up in unclear instructions, missing materials, and reactive scheduling changes. One operator described, *“We’re told to build something, but the parts aren’t even on the line yet. Then they rush us to meet the deadline”* (P17). Others spoke of inconsistent workflow documentation. *“Some days we get printed instructions; some days it’s just verbal. Depends on who’s in charge,”* noted a technician (P22). A packager expressed frustration with last-minute changes: *“We prepare everything, then at the last minute they change the design. We have to repack everything”* (P19).

Another operator highlighted the confusion caused by parallel systems: *“The job sheet says one thing, but the whiteboard says another. Which one do we follow?”* (P21). These sentiments reflect that on the production floor, process misalignment wasn’t theoreticality resulting in delays, stress, and rework. *“It feels like we’re always catching mistakes, not preventing them,”* one assembler remarked (P20), capturing the cumulative toll of reactive problem-solving on staff morale and productivity.

Research Question 2

What challenges hinder effective interpersonal relationships between manufacturers and their supply chain partners in the North American-based sheet metal manufacturing industry?

This research question sought to explore the interpersonal dynamics and organizational barriers that compromise collaborative relationships within the sheet metal manufacturing supply chain. Based on thematic analysis across 24 interviews—8 per group—two major themes emerged: Commitment Issues and Cultural Misalignment. These themes reflect the internal and external challenges that limit mutual accountability, transparency, and shared objectives among supply chain actors. Within this research question, Communication Barriers emerged as the most frequently cited theme, with 22 coded references across interviews (see Table 4b), highlighting its central role in communication-related challenges. This theme emerged as a dominant concern within the current research question, reflecting a persistent issue that undermines relationship quality across all organizational levels. The qualitative analysis of participant narratives revealed that challenges impeding interpersonal relationships within the supply chain are deeply rooted in two dominant themes. While organizational structure and systems influence collaboration, the relational dynamics, including trust, shared accountability, and mutual understanding, emerged

as equally critical and often deficient. These themes varied in intensity and manifestation across organizational levels, offering a holistic view of interpersonal dysfunction in supply chain settings.

Theme 4: Commitment Issues

Commitment issues, as previously defined in the RQ2 summary and coding framework (see Table 3 and Table 5), referred to the lack of long-term engagement, mutual accountability, and consistent support from internal departments and external suppliers. These narratives emerged as the most dominant theme in response to Research Question 2, cited by 14 participants (Table 4) and received 20 code mentions (Table 4b). The descriptions emphasized not only weak coordination but also a transactional mindset and shallow investment in collaborative outcomes.

At the executive level, participants emphasized the difficulty of establishing enduring, reliable partnerships. One executive stated, “Many of our vendors operate like we’re just another purchase order. There’s no long-term thinking, they don’t understand how disruptions affect our entire system” (P01). Another echoed this concern, noting, “We try to build relationships, but suppliers are focused on the next order, not the bigger picture” (P04). A third executive framed this dynamic in terms of risk: “Without a sense of mutual commitment, we’re always one delay away from a crisis” (P03).

Executives also described internal commitment lapses among departments. One remarked, “Some teams prioritize their KPIs over the company’s goals. They meet their target, but downstream teams suffer” (P06). This reflects a pattern of siloed incentives, where the absence of shared accountability undermined cohesive performance. Another executive offered,

“When something goes wrong, the finger-pointing starts. No one says, ‘This is ours to fix together’” (P05).

Among middle managers, commitment issues are manifested through operational breakdowns and inconsistent support from both internal stakeholders and suppliers. A procurement manager explained, “We set expectations, but suppliers don’t take ownership. When something goes wrong, we’re scrambling to fix it” (P09). Another manager highlighted a lack of reliability, stating, “We build contingency plans around the assumption that suppliers will fail us. That says everything about trust” (P11).

One inventory manager commented on supplier behavior: *“They confirm a date, then push it back last minute. There’s no accountability. And we take the heat from production”* (P10). Another added, *“It’s exhausting having to chase people down for updates. If they were truly committed, we wouldn’t need to micromanage so much”* (P13). These operational accounts reveal how unreliable commitment from external partners adds stress and extra work for internal teams.

Middle managers also described internal departmental misalignments as a form of commitment failure. A scheduling coordinator reflected, *“Production needs to know plans ahead of time, but engineering doesn’t always deliver on time. It’s like we’re pulling teeth”* (P12). Another noted, *“Leadership says we’re all in it together, but when push comes to shove, it’s every team for themselves”* (P08). These observations speak to a deeper culture of fragmented responsibility, where collaboration falters without sustained follow-through.

On the production floor, commitment issues were felt through inconsistent information, reactive planning, and a lack of support from leadership. One operator remarked, *“They tell us to*

rush something, then leave us waiting for parts. We're blamed, but no one owns the problem" (P17). Another described how shifts were affected by upstream failures: *"We start jobs without knowing the full plan. If something's missing, we're stuck and behind"* (P18).

A packaging technician added, *"Sometimes it feels like we're an afterthought. Plans change and no one tells us until it's too late"* (P19). Another production worker noted, *"When things go wrong, they want more from us, but no one checks how that impacts our hours or workload"* (P20). These insights highlight how commitment gaps cascade down the hierarchy, leaving frontline workers to absorb the consequences of poor planning and disengaged oversight.

Further illustrating the emotional toll, one operator shared, *"It's hard to care when others don't seem to. If departments above us don't commit, why should we go the extra mile?"* (P21). Such reflections underscore that perceived lack of commitment not only affects output but also morale and engagement.

Across all organizational layers, commitment issues surfaced not just as logistical frustrations, but as relational breakdowns. Executives saw a risk in supplier disengagement, middle managers wrestled with operational consequences, and frontline staff experienced the burden of others' inaction.

Theme 5: Cultural Misalignment

Cultural misalignment, referenced by 14 participants in Table 4 and accumulated 18 code mentions in Table 4b emerged as a major inhibitor of effective interpersonal collaboration within and across organizational boundaries. Participants described how conflicting organizational values, leadership behaviors, communication practices, and decision-making styles contributed to misunderstandings, frustration, and siloed behavior. This misalignment was often not

intentional but emerged from entrenched differences in professional priorities and work styles across departments and external partners.

At the executive level, leaders repeatedly pointed to the challenges of collaborating with external suppliers who held different assumptions about time, quality, and engagement. One executive remarked, *“We work with partners in different regions who don’t always share our sense of urgency or commitment to quality. It’s not malicious, it’s just a different business culture”* (P02). Another added, *“We value precision and accountability, but some suppliers value speed and flexibility. That creates tension in projects”* (P03). This mismatch was particularly problematic when supplier behavior didn’t align with internal expectations. *“We push for standardization, but some partners resist our systems. It feels like we’re always compromising just to move forward”* (P01).

Executives also observed cultural fractures internally. One explained, *“There’s a different mentality between the commercial side and operations. Sales wants to move fast, ops wants stability, and engineering wants perfect specs”* (P05). These internal tensions created gridlock during planning meetings. Another executive shared, *“Cross-functional collaboration suffers when departments don’t value the same outcomes. Everyone’s protecting their turf”* (P04).

From the perspective of middle managers, cultural misalignment often played out in everyday interactions that led to fatigue, confusion, or disengagement. A quality control supervisor described the friction, *“Engineering focuses on precision, operations wants speed and purchasing wants cost savings. It’s like everyone’s playing a different game”* (P09). Another manager said, *“There’s a culture clash even between sites in the same company. Some teams are*

process-heavy, others are fast-and-loose. That creates breakdowns when we need consistency” (P11).

Middle managers also identified departmental “micro-cultures” as a barrier. One logistics manager noted, *“Procurement wants to plan ahead, but suppliers are often reactive. That constant mismatch wastes so much time”* (P12). Another reflected, *“We value detailed documentation, but others see it as red tape. That difference in mindset causes friction every time we review specs”* (P08).

Several middle managers noted that leadership style varied drastically by department, creating inconsistencies in expectations and accountability. A department manager explained, *“One director is hands-off, another is micromanaging every detail. It’s confusing for teams, and no one knows who’s standard to follow”* (P10). These management style clashes led to breakdowns in interdepartmental cooperation and ambiguity in decision-making.

Among production staff, cultural misalignment was experienced most directly as inconsistent communication and a lack of shared understanding. One operator stated, *“Sometimes leadership talks about quality, but the next minute they’re rushing us to hit numbers. It’s mixed messages”* (P17). Another technician added, *“We’re expected to follow strict rules, but managers make last-minute changes without explanation. It’s frustrating”* (P18). Several workers commented on the communication gap between departments: *“Engineering uses terms we don’t understand. It’s like they assume we know everything, but no one explains”* (P19).

One floor supervisor described how differing expectations led to errors: *“Ops says one thing, packaging says another, and engineering changes the design at the last minute. We’re the*

ones who deal with the confusion” (P20). Another shared, “It’s not just the message, it’s the tone. Some departments talk down to us like we’re not capable. That kills motivation” (P21).

These participant quotes reflect a triangulated view of cultural misalignment across levels. Executives perceived systemic value conflicts, middle managers identified coordination fatigue stemming from divergent priorities, and production staff experienced cultural friction as inconsistent leadership, communication breakdowns, and disengagement. Across all groups, participants expressed that cultural misalignment made interpersonal relationships more fragile and collaborative processes more error prone.

In summary, they compounded commitment and cultural issues by masking intent, disrupting problem resolution, and increasing ambiguity. The triangulated analysis showed that while the executive level perceived communication breakdowns as strategic and reputational risks, middle managers focused on misalignment and mixed messaging, and floor staff experienced the downstream impacts in the form of operational chaos and job stress. Addressing these barriers is critical to rebuilding trust and fostering durable, accountable supplier relationships.

Research Question 3

What strategies can help overcome the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?

Participants across all three organizational groups identified various actionable strategies to enhance supply chain collaboration. These strategies clustered around two key themes: Collaborative Strategies and Future Outlook. Each theme encapsulates practices perceived as effective and aspirational methods and technologies critical for long-term transformation. The

strategies suggested span behavioral, procedural, and technological dimensions, offering a multilayered approach to reforming collaboration across departmental and organizational boundaries. Responses reflected a shared recognition that solutions to long-standing issues must incorporate immediate operational improvements and forward-looking investments in systems and relationships. These themes were referenced by 12 out of 24 participants for Collaborative Strategies and 11 out of 24 for Future Outlook, as shown in Table 4. Additionally, Table 4b indicates that Collaborative Strategies received 20 distinct code mentions and Future Outlook was referenced 15 times, reflecting repeated emphasis on both immediate collaboration mechanisms and forward-looking improvements.

Theme 6: Collaborative Strategies

Collaborative strategies emerged as a dominant and widely endorsed theme, with 12 participants (Table 4) and mentioned 20 times during the interviews (Table 4b) referencing structured efforts to improve cross-functional and cross-organizational collaboration. These strategies reflected a shared recognition that fragmented decision-making, poor communication, and reactive responses could only be overcome through intentional, systematized engagement. Participants discussed a range of practices including integrated planning sessions, digital dashboards, escalation matrices, early involvement of stakeholders, and standardized tools to foster cohesion.

From the executive level, participants emphasized the value of transparency and shared visibility in real-time data. One executive remarked, *“When we brought our suppliers into our ERP view, it changed everything; they could see demand shifts before we called them. That eliminated a lot of back-and-forth”* (P02). Another executive shared, *“We set up supplier*

scorecards with monthly reviews, not just performance metrics but also improvement plans” (P05). These approaches were described as moving from transactional to strategic relationships. One leader stated, *“It’s not enough to hit your numbers, we need to align on priorities and risks. That takes trust and regular touchpoints”* (P03). Several mentioned multi-year agreements are designed not only to stabilize pricing but to provide incentives for long-term alignment. *“We started offering incentives for reliability, not just cost. That shifted the conversation”* (P04).

Middle managers emphasized tactical practices that improved communication clarity and response speed during disruptions. A production planner shared, *“We created a rapid-response checklist that teams can follow when a part is late or specs change. It helps us work together instead of just blame each other”* (P09). Another participant in quality assurance said, *“We hold weekly standups across departments now, engineering, operations, planning, all on the same call. It cuts through the confusion”* (P10). Several managers noted the value of escalation matrices, which defined exactly who to contact when a delay or issue occurred. *“Everyone knows who to call and when. It took us months to get buy-in, but it’s reduced delays by days in some cases”* (P08). One shipping manager explained, *“We started using shared Trello boards for open issues. No more chasing emails, it’s all in one place”* (P12).

These managers also stressed the role of cross-functional task forces, often formed in response to specific challenges. For example, *“When we had quality issues with a new supplier, we pulled together ops, QA, and procurement to fix it. Before, that would’ve taken weeks, now we solve it in days”* (P11). A maintenance lead noted, *“We used to work in silos. Now, we review every major downtime event with people from different teams. Everyone learns from it”* (P07). Such practices enabled proactive collaboration rather than reactive damage control.

On the production floor, participants discussed the benefits of early involvement and real-time feedback loops. A technician recalled, *“We started attending pre-production meetings. Before, we didn’t even know what was coming. Now, we flag issues before they become problems”* (P17). Another explained, *“They used to send us changes with no explanation. Now we’re part of the review, makes a huge difference”* (P19). Many noted that simply being included in planning or design reviews improved morale and reduced rework. *“It’s not just about our ideas; it’s about being seen as part of the process”* (P18). Others pointed to structured improvement cycles such as Kaizen events and lean reviews. *“We meet monthly to look at what’s working and what’s not. Even small things, like changing label placements, came from those meetings”* (P16).

Digital tools also played a crucial role in these collaborative strategies. One floor supervisor mentioned, *“We use a shared dashboard that shows daily goals and problems. Everyone can see it, operators, leads, even suppliers”* (P20). Another stated, *“Now we use tablets on the floor. If something’s off, we take a picture and log it. It goes straight to engineering. No delays”* (P22). This integration of communication tools across levels helped bridge operational and strategic gaps.

Participants agreed that while collaborative strategies require time and effort to establish, they pay dividends in responsiveness, mutual accountability, and trust. The triangulated data shows that executives focused on transparency and alignment, middle managers on coordination and speed, and floor staff on inclusion and usability. These aligned, structured practices marked a significant shift from ad hoc coordination to embedded, routine collaboration, building both resilience and adaptability in supply chain relationships.

Theme 7: Future Outlook

The Future Outlook theme reflects participants' forward-looking perspectives on how supply chain collaboration must evolve to remain competitive and resilient. Cited by 11 participants (Table 4) and generating 15 total code mentions (Table 4b), this theme encompassed investments in digital tools, predictive analytics, process modernization, and human capital strategies aimed at long-term transformation. Unlike the tactical nature of current collaborative strategies, participants described a strategic vision built around adaptability, innovation, and systemic integration.

At the executive level, leaders emphasized the necessity of predictive capabilities and system-wide modernization. One vice president stated, *"We need to stop reacting and start forecasting. That means better tools, AI-driven planning, and less reliance on spreadsheets"* (P01). Another explained, *"Our future depends on being able to anticipate shifts in customer demand and supply disruption. That's not possible without investing in systems that learn over time"* (P03). Many executives echoed the importance of data consolidation, with one saying, *"Every site has different systems. We're working toward a single digital thread, one ERP, one source of truth"* (P05). Another leader stated, *"We want to link supplier scorecards to real-time performance, not just quarterly reviews. That's how you stay competitive"* (P04).

In addition to digital investments, several executives noted the need to shift organizational mindset toward collaborative foresight. One explained, *"Success isn't just about price anymore. It's about how quickly we can respond as a network. That means getting everyone thinking long-term, not just finishing this week's orders"* (P02). Others suggested expanding innovation partnerships with key suppliers. *"We're starting to co-develop solutions*

instead of just sending specs. That's the future" (P06). These views reflect a strategic redefinition of supply chain collaboration as an innovation ecosystem rather than a transactional chain.

Among middle managers, participants spoke of concrete initiatives already in motion to modernize processes and planning. A planning manager described, *"We're piloting predictive scheduling software that accounts for historical bottlenecks. It's been a game changer in reducing last-minute chaos"* (P09). A quality manager shared, *"We're adding sensors and live feeds from machines, so quality issues are flagged in real time, not hours later"* (P08). Another said, *"We're moving toward a paperless environment. It reduces errors and improves traceability for audits"* (P12). Others focused on interoperability, stating, *"We're pushing vendors to align their platforms with ours. If we can't integrate, we can't move fast"* (P07).

Several middle managers also recognized the need to invest in workforce capabilities. A shipping lead noted, *"As systems get smarter, our people need to get smarter too. We've started doing weekly tech trainings for frontline staff"* (P10). One inventory analyst explained, *"We're trying to upskill the team to analyze trends, not just input data. The future is decision support, not just clerical"* (P11). Managers envisioned cross-functional roles that blend planning, technology, and supplier engagement. *"We don't just need planners. We need collaborators who understand the whole system"* (P13).

On the production floor, participants expressed a strong desire for modernization and inclusion in future-planning efforts. A technician stated, *"We're always the last to know when changes are coming. If we had more visibility, we could help avoid problems before they start"* (P18). Another participant noted, *"We need tools that talk to each other. Right now, I'm still*

writing stuff down on paper. That doesn't make sense anymore” (P20). Several described fatigue from inefficiencies: *“I waste an hour every day checking two systems that should just be one. It's not the future, it's broken*” (P19). But participants were hopeful: *“They're asking for our input now. Before, it was all top-down. I think that's changing*” (P16).

Others linked modernization to morale and retention. *“People want to feel like their work matters. When we get looped in early and get good tools, it shows we're valued*” (P22). Another added, *“New hires expect tech. If we want to keep people, we need to upgrade, not just machines but the way we work*” (P17). This feedback underscores how future readiness is not only about systems but about culture, engagement, and shared ownership of progress.

Across all organizational levels, the future outlook theme reflected shared urgency and alignment around modernizing supply chain collaboration. Executives envisioned long-term supplier partnerships and digital transformation. Middle managers emphasized the process of automation, interoperability, and workforce upskilling. Floor staff highlighted inclusion, usability, and responsiveness as indicators of a forward-facing organization.

Participants understood that sustainable collaboration in the future requires more than technology. It involves rethinking how people, tools, and decisions interact across the entire supply chain network. As one executive summarized, *“Collaboration is no longer optional. It's a strategic capability, and the ones who do it best will win.”* (P06)

Comparison of Results to the Literature Review

The themes identified align with existing literature on supply chain collaboration. The triangulated thematic findings from Research Questions 1, 2, and 3 reveal systemic and relational challenges within the North American-based sheet metal manufacturing industry's supply chain.

This section interprets those findings in alignment with the conceptual framework and literature discussed in Chapter 2 (Barratt, 2004; Cao and Zhang, 2011; Simatupang and Sridharan, 2005).

Rather than existing in isolation, the thematic findings reveal that process misalignment, fragmented technology systems, and misaligned organizational values often operate in combination to impede collaboration. This interaction reflects the “systems view” of collaboration described by Lambert and Cooper (2000), where disruptions in one dimension, such as technology interoperability, can cascade into process inefficiencies and strained interorganizational relationships (Fawcett et al., 2012; Handfield and Bechtel, 2002). Similar to findings by Gunasekaran et al. (2017) and Morgan and Hunt (1994), this study supports the notion that both operational integration and relational trust must be addressed concurrently to achieve sustainable supply chain performance.

The technological challenges observed, such as limited data integration and outdated ERP systems, align with the literature identifying digital connectivity as a core enabler of responsiveness and visibility (Christopher, 2016; Sheffi and Rice, 2005). Fragmented or incompatible systems have been shown to hinder coordination and real-time decision-making, as noted by Akkermans et al. (2003) and Huo et al. (2014), reinforcing the importance of synchronized technological infrastructure.

Relational dimensions, including trust, cultural alignment, and communication clarity, also emerged as central to collaboration effectiveness, consistent with social capital theory (Nahapiet and Ghoshal, 1998) and interorganizational trust frameworks (Cousins et al., 2006; Dyer and Singh, 1998). Prior research has demonstrated that misaligned values and inconsistent

communication erode relational stability, weakening the willingness to share information or invest in joint problem-solving (Zacharia et al., 2009; Paulraj et al., 2008).

The collaborative strategies described under RQ3, such as joint planning and shared dashboards, represent attempts to mitigate these communication deficiencies. These findings align with calls in the literature for digital integration and visibility tools to enhance coordination and resilience (Gunasekaran et al., 2017; Sheffi and Rice, 2005). For instance, strategies emphasizing shared dashboards and real-time ERP integration resonate with findings by Gunasekaran et al. (2017), who argued that digital collaboration tools enhance responsiveness and resilience. These approaches reflect the core tenets of long-term orientation and strategic interdependence discussed by Ganesan (1994).

Finally, the overall pattern across themes demonstrates a convergence of structural, technological, and relational barriers and enablers in supply chain collaboration within complex supply networks. This supports conceptual models of supply chain collaboration as a multi-dimensional construct (Simatupang and Sridharan, 2002; Cao and Zhang, 2011), where effective outcomes emerge from the integration of trust, visibility, aligned goals, and mutual accountability.

Research Question 1

What factors hinder effective collaboration across manufacturing suppliers and distributor networks?

The themes that emerged under Research Question 1 (communication barriers, technological constraints, and process misalignment) align closely with the study's conceptual framework, which integrates Social Network Theory (SNT) and Resource Dependence Theory

(RDT). Each theme demonstrates how theoretical constructs manifest in supply chain collaboration, while also reinforcing findings from prior studies. These challenges align with prior literature emphasizing the importance of open communication and interoperable systems to maintain trust, role clarity, and integration across organizational tiers (Morgan and Hunt, 1994; Simatupang and Sridharan, 2005).

The themes of Communication Barriers, Technological Constraints, and Process Misalignment collectively represent deeply embedded operational inefficiencies within supply chain collaboration. At their core, these inefficiencies stem from fragmented information systems, siloed communication channels, and misaligned processes.

Theme 1: Communication Barriers

The communication barriers identified across executive, middle management, and production staff responses reflect fundamental tenets of Social Network Theory. According to Bourdieu (1986), the strength of relational ties directly influences the flow of information within networks. When ties are weak or fragmented, the exchange of information becomes inconsistent, leading to misaligned decisions and inefficiencies. Participants' accounts of siloed communication and lack of transparency across organizational levels exemplify this theoretical construct. At their core, these issues stem from fragmented information systems and siloed planning processes. When analyzed through the lens of the conceptual framework, the findings reinforce the notion that collaborative activities are bound to fail without integrated technology and shared goals.

The theme of communication barriers aligns closely with the conceptual construct of communication effectiveness and partially with trust. Participants' experiences with

miscommunication, delayed updates, and unclear directives support Ellinger et al.'s (2012) findings that communication lapses hinder collaboration and trust-building. Participants described delayed information flow, vague instructions, and miscommunication between departments and tiers. These dynamics reflect a breakdown in consistent, transparent messaging, which undermines trust and prevents alignment of goals, key conditions for effective collaboration. The absence of clear feedback loops and protocol-driven updates highlighted the erosion of reliability and accountability within the network, hallmarks of ineffective communication structures. These observations affirm that without a foundation of transparent communication, supply chain systems become reactive and fragmented.

Simatupang and Sridharan (2002) emphasized that information sharing and transparency are essential enablers of supply chain collaboration. Similarly, Cao and Zhang (2011) found that consistent communication protocols reduce misalignment and increase mutual understanding across partners. The breakdowns reported by participants confirm these models, echoing findings from Whipple et al. (2011), who observed that fragmented information flow leads to distrust and diminished coordination across stakeholders.

Theme 2: Technological Constraints

Technological limitations emerged as a barrier that maps strongly to Resource Dependence Theory. Pfeffer and Salancik (1978) argued that organizations must manage dependencies on external resources, including technology infrastructure, to mitigate risks. In this study, executives and managers described outdated systems and lack of interoperability with customer platforms as key challenges. These dependencies created inefficiencies, echoing RDT's argument that control over resources is critical to reducing vulnerability. Technological

constraints undermined *role clarity and communication effectiveness* throughout the operational period covered by this study. Participants described incompatible systems, lack of shared access to real-time data, and confusion over data ownership, all contributing to misaligned workflows and unclear responsibilities. The reliance on outdated ERP systems and manual processes identified by participants mirrors challenges described by Rai et al. (2006), where a lack of integration impairs responsiveness and efficiency. The findings reinforce the view that digital integration and shared platforms are critical to synchronized collaboration and decision-making. This misalignment obstructs efficient coordination and weakens interdependent functions critical to collaboration.

Mentzer et al. (2011) argued that technological integration is foundational for enabling synchronized processes across the supply chain. When ERP systems and data streams are not unified, it leads to delays and inconsistent decisions, as evidenced in this study. Gunasekaran et al. (2017) also asserted that digital collaboration tools enhance responsiveness and operational visibility, reinforcing the need for integrated technologies in collaborative networks.

Theme 3: Process Misalignment

Process misalignment directly reflects a breakdown in role clarity. Participants reported frequent disruptions from last-minute changes, unclear escalation paths, and siloed procedures that impeded cross-functional coordination. These issues indicate a lack of standardized processes and poor role definition, especially across functional and organizational boundaries. This theme aligns with the “coordination” and “alignment of goals” aspects of the conceptual framework. Participants highlighted that unaligned planning cycles and conflicting KPIs between departments and suppliers contribute to fragmentation. Simatupang and Sridharan (2005)

similarly noted that when goals and accountability are misaligned, supply chain partnerships deteriorate. The findings affirm that goal alignment is foundational to achieving operational cohesion. Process misalignment also reflects both SNT and RDT, highlighting the importance of aligned structures in resource-dependent relationships. Participants described conflicting production schedules, mismatched quality expectations, and unclear accountability, which created operational friction. According to RDT, such misalignment intensifies interdependence risks by forcing one party to adjust its operations to compensate for inefficiencies in another's processes (Pfeffer & Salancik, 1978).

Germain et al. (2008) identified role ambiguity and misaligned workflows as common sources of coordination failure. This aligns with the participant narratives in this study, where production and middle managers highlighted the disconnect between planning decisions and operational execution. The findings support Cao and Zhang's (2011) argument that clearly defined roles and shared mental models are necessary for effective collaboration.

Research Question 2

What organizational or systemic issues contribute to persistent collaboration breakdowns in the supply chain network?

Research Question 2 investigated the benefits of enhancing collaboration across supplier and distributor networks. Two themes emerged: Commitment Issues and Cultural Misalignment, both of which align with Social Network Theory (SNT) and Resource Dependence Theory (RDT). The RQ2 themes focus on relational and behavioral obstacles. Commitment issues reflected the perceived absence of shared accountability and inconsistent follow-through, while cultural misalignment highlighted differences in expectations, decision norms, and work values

across organizational levels and locations. Both themes relate closely to the trust and long-term engagement constructs in the framework and mirror the literature's attention to relational governance, mutual investment, and shared norms (Cao and Zhang, 2011; Whipple et al., 2011).

Theme 4: Commitment Issues

The theme of Commitment Issues aligns directly with the conceptual construct of trust, a foundational element in the study's framework. Participants described recurring concerns about lack of follow-through, inconsistent engagement, and short-term thinking by both internal departments and external partners. Executives highlighted gaps in supplier reliability and internal accountability, while floor-level staff described leadership disengagement from operational follow-through. This demonstrated a systemic absence of long-term, reciprocal commitment needed for effective collaboration. This aligns with Morgan and Hunt's (1994) commitment-trust theory of relationship marketing, which posits that long-term partnership success stems from both parties being committed to shared goals and mutual benefit. Commitment is central to SNT's emphasis on relational strength. Executives and managers described how wavering commitment undermined trust, delayed decision-making, and disrupted collaborative gains. This reflects Morgan and Hunt's (1994) commitment-trust theory, which argued that mutual commitment is essential for sustaining partnerships. From an RDT perspective, fluctuating commitment increases dependency risks by creating uncertainty in resource flows (Pfeffer & Salancik, 1978). Prior studies confirm that inconsistent commitment erodes supply chain performance, as highlighted by Gundlach et al. (1995), who found that long-term collaboration relies on consistent resource dedication.

These findings are consistent with Morgan and Hunt's (1994) Commitment-Trust Theory, which asserts that mutual trust and commitment are critical to interorganizational collaboration. As noted by Whipple et al. (2011), weak commitment erodes the willingness of parties to adapt or invest in shared problem-solving. The pattern of disengagement and lack of sustained collaboration observed in this study echoes Simatupang and Sridharan's (2005) conclusions that supply chain relationships lacking consistent partner commitment experience greater conflict and inefficiency.

Theme 5: Cultural Misalignment

Cultural Misalignment also maps closely to the trust construct and intersects with role clarity in the framework. Participants described mismatched expectations between U.S. and Mexico-based operations, such as differing interpretations of urgency, initiative, and communication norms. Executives often framed these discrepancies as leadership style differences, while middle management and floor staff cited cultural misalignment as a source of confusion and friction. These dynamics undermined consistency and predictability, both essential for collaborative trust. This finding aligns with Hofstede's (2001) dimensions of organizational culture and with Lambert and Cooper's (2000) supply chain integration model, which emphasizes that successful collaboration depends on shared mental models. Cultural misalignment reflects SNT's construct of shared norms and values within networks. Middle managers and production staff emphasized that differing organizational cultures between suppliers and distributors created misunderstandings and inefficiencies. This aligns with Bourdieu's (1986) notion of social capital, where cultural cohesion strengthens collaboration. From an RDT perspective, cultural divergence creates friction in managing interdependencies,

increasing transaction costs and limiting synergy. Das and Teng (2000) similarly noted that cultural alignment is a predictor of alliance sustainability. Schein's (2010) work on organizational culture reinforces the idea that misalignment can inhibit collaboration despite formal agreements.

This theme reflects findings by Huo et al. (2015), who noted that cultural misalignment in global supply chains disrupts shared understanding and goal alignment. Hofstede's cultural dimensions theory (1980) also supports the idea that differences in power distance and uncertainty avoidance can cause operational misalignment. Furthermore, Prajogo and Olhager (2012) emphasized that cohesive organizational culture is critical to synchronized planning and communication. The data in this study confirm that cultural fragmentation, left unaddressed, contributes to systemic breakdowns in collaboration.

Research Question 3

What strategies are perceived to enhance future collaboration within the supply chain network?

Research Question 3 examined the challenges of sustaining collaboration over time. Two themes emerged: Collaborative Strategies and Future Outlook. These themes reveal how firms navigate sustainability of partnerships within the constructs of SNT and RDT. Themes under RQ3 shift toward enabling practices and forward-looking solutions. Collaborative strategies included structured cross-functional mechanisms and early involvement practices, while the Future Outlook emphasized systemic modernization through ERP tools, predictive analytics, and strategic investments. These themes align most closely with the framework constructs of long-term engagement and shared goals and reflect the literature's emphasis on both technological and

organizational evolution for sustainable collaboration (Waller and Fawcett, 2013; Rai et al., 2006).

Theme 6: Collaborative Strategies

The theme of Collaborative Strategies is strongly aligned with the shared goals, interdependence, and trust constructs within the conceptual framework. Participants emphasized the necessity of cross-functional alignment, suggesting that collaborative tools such as shared dashboards, visual workflow boards, and escalation matrices helped break silos and streamline coordination. These strategies encouraged synchronized decision-making and empowered teams to engage in proactive problem-solving, reinforcing mutual accountability. Collaborative Strategies align with the entire framework but especially “technology alignment” and “long-term orientation.” The strategies proposed by participants, joint planning, shared dashboards, escalation protocols, reflect efforts to build integrated and resilient systems. These approaches mirror the structured, tech-enabled collaborations promoted by Barratt (2004) and Sheffi and Rice (2005). Their presence in participant responses indicates a shift toward deliberate system-wide planning.

The emphasis on structured collaboration is consistent with the findings of Cao and Zhang (2011), who described collaborative capabilities as essential to achieving competitive advantage in supply chain environments. Similarly, Simatupang and Sridharan (2005) stressed the importance of collaborative planning, forecasting, and replenishment (CPFR) models in improving inter-organizational performance. Participants’ accounts of needing real-time visibility and structured communication reflect these principles and affirm that enabling infrastructure is a critical foundation for collaboration. Collaborative strategies directly reflect

SNT's concept of network structures facilitating coordination. Executives described joint governance mechanisms, middle managers emphasized structured communication forums, and production staff referenced operational-level adjustments. This aligns with Granovetter's (1985) idea of embeddedness, where relationships provide governance beyond contracts. From an RDT lens, strategies such as joint investment and shared logistics reduce dependency risks by redistributing control of key resources (Pfeffer & Salancik, 1978). These findings are supported by Dyer and Singh (1998), who argued that interorganizational collaboration strategies create relational rents and sustainable competitive advantage.

Theme 7: Future Outlook

Future outlook reflects the anticipatory dimension of both SNT and RDT. From the SNT perspective, expectations about network evolution influence current relational behaviors, as participants described aspirations for digital integration and long-term supplier partnerships. From an RDT standpoint, planning for future disruptions and resource constraints is critical for reducing vulnerability. This aligns with the work of Christopher and Holweg (2011), who emphasized that resilient supply chains require forward-looking collaboration. Similarly, Cousins and Menguc (2006) highlighted that strategic alignment toward future goals strengthens long-term partnerships. The Future Outlook theme maps to the joint learning, adaptability, and information sharing constructs. Participants described the need to invest in digital transformation initiatives, predictive analytics, and standardized data-sharing platforms. These initiatives were seen not just as technical upgrades, but as foundational steps toward improving collaboration through real-time responsiveness and shared situational awareness. The forward-looking perspective highlighted how learning from current limitations shaped a more integrated vision

for future supply chain coordination. These insights build on the conceptual framework for this study, particularly the principles of trust, role clarity, and long-term engagement. Collaborative efforts that institutionalize shared planning, democratize visibility, and equip all levels with the tools to participate meaningfully tend to outperform those that rely on top-down directives or siloed technologies. Narasimhan and Nair (2005) observed that the key to supply chain excellence is balancing power, voice, and process rigor across all tiers.

This theme resonates with findings from Rai et al. (2006), who argued that information technology integration directly enhances supply chain collaboration by supporting agility and data-driven responsiveness. Additionally, Narasimhan et al. (2008) emphasized the role of learning orientation in enabling continuous improvement and long-term coordination in complex networks. Participants' recognition that future collaboration depends on system upgrades and capability building reinforces the literature's argument that adaptability and strategic foresight are integral to sustainable supply chain relationships. This theme reinforces the forward-facing dimension of "relationship orientation" and "communication effectiveness." Participants' vision for transparent processes, upskilling, and future readiness reflects a long-term commitment to partnership success. As Ganesan (1994) noted, long-term orientation is predictive of sustained collaborative performance. The findings suggest optimism and willingness to address systemic barriers through continuous improvement and mutual investment.

Summary

Chapter 4 presented the results of a qualitative thematic analysis exploring the underlying factors, interpersonal challenges, and improvement strategies related to supply chain collaboration in the North American-based sheet metal manufacturing industry. Data were

gathered from three distinct organizational levels, executive/upper management, middle management/supervisory, and production floor staff, enabling robust triangulation and layered interpretation. The chapter began with an overview of participant demographics and a detailed discussion on the trustworthiness of the data, addressing credibility, transferability, dependability, and confirmability through methodical coding, cross-checking, and triangulated saturation.

For Research Question 1, which explored the underlying causes of ineffective collaboration, three core themes emerged: Communication Barriers, Technological Constraints, and Process Misalignment. Participants described delayed updates, incompatible systems, and disjointed workflows as critical impediments to alignment. These themes were substantiated across all stakeholder levels and were consistent with literature emphasizing the need for standardized communication and systems integration.

Research Question 2 examined the interpersonal challenges hindering collaboration. Two central themes, Commitment Issues and Cultural Misalignment, influence trust and role clarity within and between organizations. Across groups, participants cited short-term mindsets, siloed priorities, and unclear expectations as root causes of strained relationships. Communication barriers also persisted here as an overlapping concern, reinforcing the systemic nature of these breakdowns.

Research Question 3 addressed strategies for improvement, identifying two themes: Collaborative Strategies and Future Outlook. Participants shared current best practices, such as cross-functional task forces, early involvement of shop-floor staff, ERP dashboard use, and long-

term supplier engagement. Future-oriented insights included predictive analytics, digital integration, and cultural transformation through role alignment and strategic partnerships.

In the Comparison of Results to the Literature Review, the chapter interpreted the themes through the lens of the conceptual framework, particularly trust, role clarity, and long-term engagement, and connected them to a broad base of scholarly literature. This synthesis confirmed that breakdowns in collaboration are not random or isolated but are systemic and embedded in both interpersonal and technological structures. Moreover, the triangulated methodology revealed that while the manifestations of these issues vary by role, the underlying causes are shared, reinforcing the need for comprehensive, multilevel solutions. Together, these findings offer a nuanced and empirically grounded view of how supply chain collaboration breaks down, and more importantly, how it can be repaired. The final chapter will discuss these results in greater depth, drawing implications for practice, theory, and future research.

Chapter 5: Discussion, Recommendations, and Study Summary

The qualitative embedded single case study seeks to investigate the ineffective supply chain collaboration within manufacturing supplier and distributor networks, enhancing the factors influencing supply chain collaboration within the North American-based sheet metal manufacturing industry and developing strategies for improving collaboration effectiveness. The problem to be addressed in this study is the ineffective supply chain collaboration within manufacturing, supplier, and distributor networks. The aim of this research was to enhance understanding and contribute to the body of knowledge by offering insights into the organizational, relational, and technological factors that hinder or enable collaboration across supply chain tiers. Specifically, the researcher sought to examine (a) What underlying factors contribute to the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry? (b) What challenges hinder effective interpersonal relationships between manufacturers, and their supply chain partners in the North American-based sheet metal manufacturing industry? and (c) What strategies can help overcome the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?

A qualitative case study design guided this research. Data collection involved semi-structured interviews with executives, middle managers, and production floor staff, triangulated with organizational records to strengthen credibility and ensure trustworthiness. Thematic analysis followed Braun and Clarke's six-step process to identify patterns across the data and connect them to the research questions. The findings revealed seven major themes, Communication Barriers, Technological Constraints, Process Misalignment, Commitment

Issues, Cultural Misalignment, Collaborative Strategies, and Future Outlook. These themes highlighted how relational, organizational, and technological challenges intersect to shape collaboration effectiveness across supplier and distributor networks. Participants identified gaps in communication protocols, reliance on outdated systems, and cultural differences as persistent barriers, while also pointing to leadership alignment and collaborative strategies as enablers for improvement.

While the study provided meaningful insights into the factors that hinder or enable supply chain collaboration, it was not without limitations. The research was conducted within a single North American sheet metal manufacturing case, and thus the findings may not be fully generalizable to other industries or geographic regions. In addition, the study relied on qualitative perceptions rather than quantitative measures of performance, which limits the scope of measurable outcomes. Despite these boundaries, the study contributes to the body of knowledge by offering a nuanced understanding of supply chain collaboration and identifying practical strategies for enhancing supplier and distributor relationships.

This chapter provides a discussion of the findings in relation to the research questions, problem, and purpose. The results are interpreted in the context of the conceptual framework, Social Network Theory and Resource Dependence Theory, as well as the literature reviewed in Chapter 2. The chapter also outlines the implications of the findings, recommendations for practice, and suggestions for future research. The chapter concludes with a synthesis that connects the study's findings back to the broader significance of supply chain collaboration in manufacturing networks.

Discussion

The findings of this qualitative case study demonstrate that collaboration within manufacturing, suppliers, and distributor networks often rely more heavily on informal, trust-based ties than on formalized integration mechanisms. Participants consistently described instances where personal relationships, long-term trust, and informal channels allowed them to respond quickly during disruptions, even when official systems lagged or broke down. These accounts suggest that in practice, interpersonal connections can become the backbone of collaborative resilience in turbulent environments.

This emphasis on informal ties both aligns with and challenges established scholarship. For example, Simatupang and Sridharan (2005) emphasized the role of formal information-sharing protocols and structured integration in driving supply chain collaboration. However, the present findings diverge from this perspective by showing that, under stress, managers often substitute informal relationships for these formal mechanisms, effectively placing greater reliance on personal trust than on system integration. This divergence highlights a gap between theoretical prescriptions, which prioritize structural mechanisms, and lived practice, which demonstrates the primacy of relational capital when time-sensitive decisions must be made.

At the same time, the findings reinforce the utility of Resource Dependence Theory (Pfeffer & Salancik, 1978) by illustrating how organizations lean on trusted partners to reduce uncertainty and secure access to critical resources during disruptions. Managers described deliberately strengthening ties with suppliers not just to guarantee flows of material, but also to ensure mutual responsiveness when external shocks emerge. These patterns reveal that while

structural tools exist, collaborative practice is often enacted through the interdependence of people and relationships.

From the lens of Social Network Theory (Bourdieu, 1986), the findings underscore how network position and relational trust shape collaborative outcomes. Weak ties and siloed communications were seen to hinder information flows, while bridging connections across tiers improved responsiveness and visibility. This alignment suggests that while prior theory highlights the value of structural integration, in practice, the quality of relational linkages determines whether integration efforts succeed or falter.

Overall, the implications point toward the necessity of designing supply chain strategies that balance formal integration systems with intentional investments in relational trust-building. Overreliance on either approach may be insufficient: structured systems ensure consistency and transparency, while interpersonal trust enables rapid adaptation when systems are stressed. This balance is particularly important in industries where disruptions are frequent, and the cost of collaboration breakdowns is high.

In summary, the implications of these findings demonstrate that while existing research and theoretical perspectives provide a robust foundation, the lived experiences of participants extend and refine those frameworks. Social networks were not merely supportive of collaboration but often substituted for formal integration; resource dependence created stability but also heightened perceptions of fragility; and supply chain integration remained aspirational rather than fully enacted. These insights affirm the relevance of existing theories while signaling the need for refinements that capture the nuances of practice in contemporary supply chain networks.

Research Question 1

RQ1 asked: “*What underlying factors contribute to the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?*” Thematic analysis identified three key themes: Communication Barriers, Technological Constraints, and Process Misalignment. Together, these themes reflect persistent breakdowns in the relational, technological, and procedural infrastructure of supply chain collaboration.

RQ1 Theme 1, Communication Barriers. Communication barriers were consistently described by participants as a major impediment to effective collaboration across the supply chain network. Participants highlighted delayed updates, vague instructions, and siloed information exchanges as recurring challenges that undermined organizational coordination. These issues were not confined to one tier of the supply chain but rather spanned executive, middle management, and production staff, underscoring the systemic nature of communication breakdowns. As detailed in Chapter 4, participants across managerial levels expressed frustration that decisions were often finalized before input could be provided. This dynamic created a sense of exclusion and constrained opportunities to influence or adjust operational plans. Such delays in communication reinforced perceptions of top-down control and highlighted ongoing challenges in building collaborative decision-making processes within the supply chain network. The convergence of these perspectives illustrates how poor communication permeated all organizational layers, creating uncertainty and inefficiency.

From a Social Network Theory (SNT) perspective, these findings emphasize the absence of bridging ties that could span structural holes (Bourdieu, 1986). In practice, these gaps limited the circulation of information, reinforcing localized problem-solving and reducing overall

network resilience. The weak or absent cross-boundary connections reported by participants resulted in localized problem-solving, which reduced network resilience. Without shared communication protocols, individual actors reverted to siloed decision-making, further fragmenting the supply chain. These findings align with Christopher's (2016) assertion that resilient supply chains require seamless, multi-directional communication to anticipate and mitigate disruptions. The participants' accounts extend this literature by illustrating that participants perceived breakdowns in upward and lateral communication as contributing to operational inefficiencies, delays, and frustration among employees.

The results also resonate with Resource Dependence Theory (RDT) (Pfeffer & Salancik, 1978), which suggests that organizations must actively manage interdependencies through effective information exchange. While prior research underscored the importance of information visibility for relational trust (Simatupang & Sridharan, 2005), the present findings demonstrate that communication opacity diminishes the credibility and recognition, forms of symbolic capital, that sustain trust and cooperation within networks.

Importantly, the implications of these findings are twofold. First, practitioners must invest in cross-boundary communication roles and escalation protocols to prevent information "blackouts" during disruptions. As one executive participant (P07) observed, "*We had no defined pathway to escalate issues, by the time word traveled, it was too late to prevent problems.*" Second, formalizing standardized communication routines can mitigate the tendency for actors to default to isolated problem-solving, which jeopardizes both efficiency and trust in supply chain relationships. While the data strongly underscores the critical role of communication in shaping collaboration, one limitation is the potential for recall bias in

participants' accounts. Some participants may have emphasized breakdowns more vividly due to the frustrations they experienced, while minimizing instances of effective communication. However, the consistency of responses across all organizational tiers enhances confidence in the robustness of this theme.

RQ1 Theme 2, Technological Constraints. Participants repeatedly described outdated technologies, fragmented systems, and manual workarounds as significant obstacles to effective supply chain collaboration. These technological shortcomings created bottlenecks in communication, slowed decision-making, and constrained firms' ability to respond to disruptions. Participants across hierarchical levels described outdated ERP systems, reliance on spreadsheets, and fragmented technologies as critical obstacles to effective collaboration (see Chapter 4). These technological shortcomings consistently slowed decision-making, created inefficiencies, and undermined responsiveness to disruptions. The recurrence of this theme demonstrates that technology gaps are not isolated experiences but systemic issues affecting organizational performance across multiple tiers of the supply chain.

From a theoretical perspective, these findings reinforce Resource Dependence Theory (RDT) by showing how inadequate systems heighten organizational dependency on manual workarounds and external support, leaving firms vulnerable to inefficiency and error (Pfeffer & Salancik, 1978). Similarly, they extend Supply Chain Integration (SCI) literature by demonstrating how fragmented IT systems obstruct the visibility, coordination, and responsiveness emphasized as essential for integration (Christopher, 2016; Lambert & Cooper, 2000). This study's findings also highlight a practical tension: while prior research emphasizes the strategic benefits of integrated IT systems, participants revealed that budget limitations,

delayed upgrades, and manual data re-entry remain persistent barriers. Thus, the results illustrate how technological constraints function as both operational and relational challenges, reducing trust, slowing information flow, and constraining collaboration.

The findings highlight the implications of fragmented technological systems, as participants repeatedly described how disconnected platforms and outdated ERPs obstructed seamless data flows across supply chain tiers. The evidence from participants demonstrates that technological constraints are not isolated IT challenges but systemic barriers that weaken supply chain collaboration. Outdated systems, fragmented platforms, and manual workarounds disrupted communication flows, slowed decision-making, and increased firms' vulnerability to disruption. These constraints consistently forced organizations into reactive problem-solving rather than proactive coordination, eroding both efficiency and trust across supply chain tiers. Taken together, the findings highlight that technological interoperability is a structural enabler of collaboration, directly shaping whether firms can sustain resilience in turbulent environments.

The implications of these findings extend beyond the technical domain, pointing to strategic and organizational consequences. Resource Dependence Theory (Pfeffer & Salancik, 1978) illustrates how firms without control over technological infrastructure become increasingly reliant on external partners, magnifying risks during disruptions. Similarly, Social Network Theory (Bourdieu, 1986; Uzzi, 1997) suggests that fragmented systems weaken relational ties by undermining the reliability of information exchange, thereby eroding trust. From a Supply Chain Integration perspective (Christopher, 2016; Lambert, 2008), disconnected systems prevent visibility and coordination, leaving firms unable to align priorities or respond collectively.

Practically, the findings call for deliberate investment in interoperable platforms, predictive analytics, and user-centered design to support seamless collaboration. Equally important is change management, participants' references to "tool fatigue" and failed IT rollouts emphasize that technology adoption must be incremental, supported by training, and co-designed with end users. Firms that treat technological integration as a collaborative capability, rather than a one-off IT upgrade, are more likely to build resilience, maintain trust, and achieve long-term coordination across their networks.

The interpretation of technological constraints must be viewed within the contextual boundaries of this study. Participant accounts reflected subjective experiences of system failures and frustrations, which may not capture the full technical or managerial rationale behind IT decisions. Executives often framed constraints in terms of budgetary trade-offs, while production staff emphasized day-to-day workflow disruptions; these perspectives, though triangulated, represent partial vantage points. Additionally, the findings are shaped by the maturity of the firms under study, which may differ significantly from organizations with more advanced digital infrastructures. As such, while the evidence strongly underscores the importance of technological interoperability, the degree of impact may vary depending on industry sector, resource availability, and prior IT modernization efforts.

RQ1 Theme 3, Process Misalignment. The findings revealed that process misalignment posed a significant barrier to effective collaboration within manufacturing supplier–distributor networks. Across organizational levels, participants described how inconsistent procedures, conflicting priorities, and mismatched workflows led to inefficiencies, duplication of effort, and

strained relationships. This pattern suggests that misalignment is not an isolated operational issue but a systemic barrier that disrupts collaboration across the supply chain.

From the perspective of Resource Dependence Theory (RDT) (Pfeffer & Salancik, 1978), process misalignment increases firms' reliance on ad hoc negotiation and reactive adjustments rather than coordinated strategies. This dependency reduces efficiency and heightens vulnerability during disruptions. Similarly, Social Network Theory (SNT) (Bourdieu, 1986) underscores how weakened relational ties and unclear bridging connections exacerbate miscommunication. When processes are not aligned, trust and tacit knowledge flows are undermined, leading to rework and misunderstandings. Finally, from a Supply Chain Integration (SCI) perspective (Christopher, 2016; Lambert & Cooper, 2000), aligned processes are prerequisites for synchronization. The absence of standardized procedures prevents visibility from translating into coordinated action, ultimately weakening collaborative performance.

These findings reinforce Simatupang and Sridharan's (2005) argument that visibility without harmonized processes results in inefficiencies. While prior studies emphasized the enabling role of alignment, this study demonstrates the opposite: its absence not only erodes efficiency but also generates friction, leaving organizations vulnerable to delays and resource waste. The implication is that process misalignment actively undermines collaboration rather than simply representing an operational inconvenience. A single participant quote illustrates this dynamic: *"If we had a neutral forum to compare processes and agree on one version, we could have saved months of frustration"* (P07). This statement encapsulates the recurring tension between divergent workflows and the need for alignment mechanisms that reduce rework and conflict.

Taken together, the findings highlight that process misalignment is both a structural and relational barrier. Structurally, it creates inefficiencies and obstructs integration. Relationally, it reduces trust and hinders the flow of knowledge across boundaries. Addressing misalignment therefore requires not only technical solutions, such as standardized systems, but also relational strategies, such as alignment workshops, shared governance mechanisms, and forums for cross-level communication. Without these, supply chain visibility becomes a source of friction rather than an enabler of collaboration and resilience.

Research Question 2

RQ2 asked: *“What challenges hinder effective interpersonal relationships between manufacturers and their supply chain partners in the North American-based sheet metal manufacturing industry?”* Two themes emerged: Commitment Issues and Cultural Misalignment. These findings highlight the human and cultural dimensions of collaboration, extending beyond structures and technologies into deep relational capital.

RQ2 Theme 4, Commitment Issues. A recurring barrier highlighted by participants was the erosion of trust and commitment across different levels of the supply chain network. Several executives, managers, and production floor staff expressed skepticism regarding the reliability of shared data, partner intentions, and leadership follow-through. For example, one executive (P04) stated, *“Even when partners shared forecasts, we were never sure whether they were holding back information for their own advantage.”* Similarly, a middle manager (P12) explained, *“We often had to double-check everything ourselves because we couldn’t assume what was sent to us was complete or timely.”* On the production floor, participants described how this mistrust filtered down: *“We’d hear management say one thing, but by the time it got to us, it was*

different. After a while, you stop believing what you're told" (P21). Collectively, these accounts illustrate how fragile trust eroded commitment and undermined collaboration, despite the presence of formal structures and systems.

These findings reflect Bourdieu's (1986) Social Network Theory, where trust operates as a form of *social capital* that lowers transaction costs and enables efficient information sharing. When commitment breaks down, trust deficits force actors to rely on redundant checks and siloed decision-making. This aligns with Uzzi's (1997) assertion that embeddedness enhances cooperation only when mutual trust is intact. Within Resource Dependence Theory (Pfeffer & Salancik, 1978), diminished trust heightens power asymmetries, creating coercive rather than cooperative relationships. For instance, smaller suppliers may comply reluctantly with dominant partners' requests while simultaneously withholding discretionary information, reinforcing dependency cycles that weaken resilience. From a Supply Chain Integration perspective, prior studies (Christopher, 2016; Simatupang & Sridharan, 2005) emphasize that visibility and coordination depend on relational trust. The present findings extend this literature by demonstrating that even with technological systems in place, commitment breakdowns negated the benefits of visibility.

The implications evidence suggests that commitment deficits are not simply interpersonal challenges but structural vulnerabilities that compromise collaborative efficiency. Without trust-based commitment, shared forecasts, joint planning, and collaborative problem-solving become unreliable. This creates systemic fragility in supply chains, where formal structures exist but lack the relational glue necessary for effective execution.

A limitation of this theme is that trust and commitment were often described subjectively, shaped by individual perceptions and prior experiences. While some participants reported high levels of mistrust, others described more positive relationships, suggesting variability across contexts. Nevertheless, triangulation across executives, middle managers, and production staff confirms that deficits in commitment are widely experienced and represent a persistent barrier to sustainable supply chain collaboration.

RQ2 Theme 5, Cultural Misalignment. The findings highlight that cultural misalignment across organizational levels created persistent barriers to effective collaboration. Executives often emphasized financial constraints and corporate policies, while middle managers and frontline staff described daily operational frustrations tied to incompatible systems and fragmented practices. These differences revealed not simply technological gaps but a deeper cultural divide regarding priorities and expectations. For instance, one participant noted how recurring IT failures forced teams to revert to manual processes, illustrating how operational challenges reinforced perceptions of leadership detachment. Such experiences point to a lack of shared norms that undercut collaborative trust and efficiency.

From a Resource Dependence Theory (RDT) perspective, cultural misalignment intensified organizational vulnerabilities by reinforcing dependencies on external systems and corporate-level decisions. When local teams lacked influence over integration priorities, they were constrained in responding to disruptions, leading to inefficiencies and rework. Similarly, Social Network Theory (SNT) sheds light on how cultural divides weakened relational trust. Instead of reciprocal exchanges, disconnects between executives, managers, and frontline staff produced fragmented ties that slowed the flow of tacit knowledge. Supply Chain Integration

(SCI) literature also underscores that cultural alignment is foundational to achieving visibility and synchronization. Without shared norms and mutual understanding, integration efforts remain superficial, reducing collaboration to transactional compliance rather than strategic partnership.

The implications of these findings suggest that cultural barriers must be addressed alongside technological ones. Misalignment was not limited to IT tools but reflected broader differences in how collaboration was conceptualized across levels of the supply chain. Firms must therefore recognize that sustainable integration requires alignment in values, expectations, and day-to-day practices. A recurring pattern in the data showed that even when new systems were introduced, adoption faltered when cultural gaps persisted.

The limitations to this theme stem from the subjective framing of “culture” in participant accounts, which often reflected personal frustrations with leadership or technology rather than explicitly articulated organizational values. Nonetheless, triangulation across roles reinforces the conclusion that cultural misalignment is a pervasive barrier that amplifies both technological and relational challenges in supply chain collaboration.

Research Question 3

RQ3 asked: “*What strategies can help overcome the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?*” Two enabling themes were identified: Collaborative Strategies and Future Outlook.

RQ3 Theme 6, Collaborative Strategies. Participants consistently emphasized that structured, intentional strategies were essential for moving beyond transactional coordination and toward authentic collaboration. Rather than relying solely on ad hoc interactions, firms sought deliberate frameworks that embedded cooperation into routine supply chain operations.

Executives frequently referenced initiatives such as joint business planning and supplier development programs as mechanisms for aligning goals across partners. Middle managers highlighted the importance of escalation pathways and early involvement in design reviews to address operational bottlenecks before they escalated into broader disruptions. On the production floor, participants described the tangible benefits of direct engagement, with operators sharing input that reduced rework and supplier representatives stationed on-site to accelerate problem resolution. These accounts collectively illustrate how collaborative strategies bridged organizational boundaries and reinforced a proactive, rather than reactive, approach to supply chain management.

From the perspective of Resource Dependence Theory (RDT) (Pfeffer & Salancik, 1978), collaborative strategies reduce uncertainty by creating interdependence mechanisms that balance power asymmetries. Initiatives such as joint planning and escalation pathways provided structured opportunities for suppliers and distributors to co-manage risks, avoiding scenarios where weaker partners were left vulnerable to disruptions. Similarly, Social Network Theory (SNT) (Bourdieu, 1986; Uzzi, 1997) underscores how intentional collaboration strengthens relational trust and reciprocity across networks. Practices such as supplier scorecards, joint training, and shared communication channels cultivated relational capital that deepened cooperation and resilience across the supply chain. The findings also align strongly with the existing literature on supply chain collaboration. Simatupang and Sridharan (2005) emphasize the necessity of joint decision-making, information sharing, and incentive alignment as the foundation of collaborative advantage. Likewise, Christopher (2016) and Lambert (2008) argue that collaboration must be institutionalized through structured mechanisms, such as joint

planning sessions, shared metrics, and clear escalation protocols, rather than left to informal or ad hoc coordination. The participant accounts of “trialing escalation pathways” and “sitting down monthly with distributors to map forecasts” illustrate how these theoretical constructs are operationalized in practice, reinforcing that collaboration thrives when supported by structured, ongoing mechanisms.

The implications for practice are twofold. First, collaboration requires formal mechanisms that embed transparency and accountability into supply chain operations. Without structured forums or escalation pathways, misalignments often remain hidden until they evolve into costly disruptions. Second, collaborative strategies are not static; they evolve as trust and communication deepen across partnerships. For example, early involvement in product design represented a higher-order form of collaboration, moving beyond joint scheduling to co-create value across supply chain tiers. One executive (P05) reflected, “*When we brought suppliers into NPI planning, we cut time-to-market by months,*” while a production manager (P33) observed, “*Just having a clear escalation path cut down days of waiting for answers.*” These reflections demonstrate that collaboration is both strategic and operational, requiring investment at multiple organizational levels to sustain.

At the same time, several limitations emerged regarding the implementation of collaborative strategies. The study revealed variability in how such strategies were applied across partners. While some suppliers fully embraced joint planning and engagement, others resisted due to constraints such as limited bandwidth, competing priorities, or misaligned incentives. This inconsistency suggests that while collaborative strategies are widely recognized as beneficial, their effectiveness depends heavily on alignment of goals, mutual trust, and leadership

commitment across the supply chain network. Without these foundational elements, even well-intentioned strategies risk faltering in execution.

RQ3 Theme 7, Future Outlook. The findings on future outlook underscore the necessity of preparing supply chain networks for long-term sustainability and adaptability. While executives emphasized the role of predictive analytics, digital twins, and modernization, managers highlighted the tension between short-term firefighting and long-term planning. On the production floor, employees reinforced the importance of practical tools that function reliably in daily workflows. Taken together, these perspectives reflect a shared recognition that technological foresight and leadership commitment are vital to maintaining competitiveness in uncertain environments.

From the perspective of Resource Dependence Theory (RDT), participants' calls for predictive tools and scenario planning align with the principle of reducing vulnerabilities by diversifying dependencies and anticipating disruptions rather than reacting to them (Pfeffer & Salancik, 1978). Similarly, Social Network Theory (SNT) highlights how long-term collaboration, built on shared innovation platforms and trust, strengthens resilience across networks (Bourdieu, 1986; Coleman, 1990). Research further supports this orientation: Ivanov and Dolgui (2020) demonstrate that predictive supply chain technologies such as digital twins transform resilience by enabling adaptive scenario planning, while Simatupang and Sridharan (2005) stress aligning incentives for long-term value creation rather than short-term gains.

The implications of these findings are clear: firms must integrate foresight into both strategic and operational levels. Executives need to champion modernization strategies, middle managers must embed predictive planning into their routines, and production staff should be

actively engaged in piloting and refining new tools. Without this alignment, new technologies risk underutilization or abandonment, reinforcing skepticism from past failed rollouts. The challenge, however, lies in uneven adoption. While some organizations and partners embrace innovation, others face budgetary limitations, cultural resistance, or operational constraints. This variability suggests that modernization will not follow a linear path but requires persistence, coordination, and sensitivity to both technical and social dimensions. Overall, the future outlook theme highlights that sustainable supply chain collaboration depends not only on digital transformation but also on leadership commitment, partner alignment, and adaptive planning across tiers of the supply chain.

Cross-Cutting Implications – Theoretical and Practical Integration

The findings across all research questions reveal that barriers, trust deficits, cultural gaps, and future strategies are deeply interdependent. Communication, technology, and processes (RQ1) determine the structural capacity for collaboration, while trust and culture (RQ2) shape the relational climate within those structures. Strategies and future-oriented approaches (RQ3) signal the pathways forward for sustaining collaboration.

From the perspective of Social Network Theory (SNT) (Bourdieu, 1986; Uzzi, 1997), the results affirm that collaboration is fundamentally about relational capital, where trust, norms, and influence dictate outcomes. When participants described repeated verification steps and siloed communication, these reflected weak or eroded ties that failed to support effective collaboration. Conversely, examples of joint problem-solving and direct engagement reinforced the SNT premise that strong ties foster knowledge sharing and resilience.

Resource Dependence Theory (RDT) (Pfeffer & Salancik, 1978) provides a complementary lens. The study's findings demonstrate that dependencies created by technology, processes, and suppliers either constrained or enabled collaboration. For example, executives and managers described how outdated systems and fragmented platforms reinforced dependency loops, leaving smaller firms vulnerable to dominant partners' requests. At the same time, collaborative initiatives such as supplier councils and escalation pathways illustrate how interdependence can be structured to balance asymmetries and reduce coercive dependence. Together, SNT and RDT highlight that supply chain collaboration is not only a structural alignment problem but also a relational and cultural one. Structural integration without relational trust produces shallow, transactional ties, while relational capital without structural alignment risks inefficiency and fragility.

These results are consistent with prior scholarship emphasizing the centrality of trust and interdependence in supply chains. Uzzi (1997) observed that embedded ties enhance cooperation only when mutual trust is intact, a point mirrored in participant concerns about reliability of shared forecasts. Similarly, Christopher (2016) and Simatupang and Sridharan (2005) stressed that visibility and coordination cannot succeed without relational trust, a finding echoed across all levels of this study. In contrast, the evidence on technological misalignment expands earlier work by showing that interoperability failures not only disrupt operations but also erode confidence in relational ties, underscoring that technology and trust are inseparable in practice.

The integration of these findings suggests that organizations must adopt a dual focus. Structurally, firms need interoperable technologies, standardized processes, and transparent coordination mechanisms. Relationally, they must invest in trust-building practices, such as joint

training, embedded liaison roles, and supplier development programs. Without this combined approach, collaboration risks becoming superficial, with technology reinforcing silos rather than enabling shared visibility. For practitioners, this means that investments in predictive analytics, digital platforms, or new coordination processes will only be effective if they are accompanied by intentional strategies that strengthen relational capital. Trust must be treated as a strategic capability, not a by-product, and dependency structures must be deliberately balanced to prevent coercion.

Theoretically, this study extends supply chain collaboration research by reinforcing that collaboration is both a structural alignment challenge and a relational-cultural one. By demonstrating how SNT and RDT converge in practice, the findings show that neither framework alone is sufficient: effective collaboration requires both the network-level strength of relational ties and the careful management of interdependencies.

Recommendations for Practice

Building on the theoretical and practical implications discussed above, the next step is to consider how the findings can inform action. While the discussion highlights the broader meaning of the results, the following section translates these insights into specific, actionable strategies that leaders, managers, and practitioners can apply within manufacturing supplier and distributor networks. Grounded in the lived experiences of executives, middle managers, and production floor staff, these recommendations directly address persistent challenges such as communication barriers, technological constraints, and cultural differences that undermine effective collaboration. These recommendations are organized according to the study's key themes and research questions.

Address Communication Barriers: Findings revealed that communication gaps, including inconsistent information flow, delayed reporting, and lack of shared visibility, undermined collaboration across supply chain partners. Executives noted breakdowns in structured updates, managers described reliance on informal communication channels, and production staff expressed frustration with contradictory instructions. Collectively, these experiences show how fragmented communication creates uncertainty and reduces responsiveness.

The literature in Chapter 2 reinforces these challenges. Simatupang and Sridharan (2005) emphasized that collaborative performance depends on effective information sharing and consistent communication, while Christopher (2016) highlighted visibility as a cornerstone of supply chain integration. Social Network Theory (Bourdieu, 1986) further explains that weak communication ties reduce trust and coordination, fragmenting networks into isolated “information silos.”

Based on these findings and frameworks, organizations should adopt structured communication protocols, such as standardized reporting templates, scheduled cross-tier coordination meetings, and shared digital platforms for real-time updates. These measures directly address the disconnects participants described, minimize the risk of contradictory or delayed information, and strengthen relational trust. By combining theory with lived experiences, this recommendation underscores that overcoming communication barriers requires both technical tools and relational reinforcement.

Overcome Technological Constraints: Participants across executive, managerial, and production levels consistently described fragmented systems, outdated ERPs, and mismatched

vendor platforms as barriers that undermined collaboration. Executives highlighted limited modernization budgets and reliance on vendor-controlled systems, while managers and staff pointed to daily frustrations such as “portal friction,” “EDI mismatches,” and slow IT response times. These findings reveal that technological gaps were not isolated IT problems but systemic barriers that constrained information flow and eroded confidence in shared data.

The literature reviewed in Chapter 2 reinforces these findings. Christopher (2016) emphasized that technology alignment is a prerequisite for synchronization in supply chains, while Lambert and Cooper (2000) stressed that shared systems are essential to enable integration. Resource Dependence Theory (Pfeffer & Salancik, 1978) further explains how reliance on outdated or vendor-controlled systems amplifies vulnerabilities, making organizations dependent on external actors for critical functions. When technology fails to provide seamless integration, firms expend additional resources on workarounds, reinforcing inefficiency and limiting collaborative advantage.

Grounded in both participant experiences and established literature, this study recommends a phased approach to technology modernization. Leaders should prioritize investments in interoperable platforms and ERP upgrades that enable real-time data sharing across partners. Equally important is providing comprehensive training and user support so that employees at all organizational levels can effectively use these tools. Such measures address the dual challenge revealed in the findings: outdated technology that obstructs collaboration and insufficient user support that prevents full system adoption.

Reduce Process Misalignment: The findings highlighted widespread process misalignment, where inconsistent procedures, conflicting priorities, and gaps between

documented standards and actual practice caused significant inefficiency. Executives described suppliers following divergent workflows, managers pointed to conflicting scheduling priorities, and production workers expressed frustration at daily resets caused by mismatched expectations. These accounts underscore how misalignment undermined efficiency at every organizational level.

The literature supports these observations. Simatupang and Sridharan (2005) argued that process alignment is essential to collaborative performance, while Christopher (2016) emphasized that visibility only creates value when supported by consistent workflows. Resource Dependence Theory (Pfeffer & Salancik, 1978) explains how misalignment increases vulnerability by forcing firms into reactive problem-solving, while Social Network Theory (Bourdieu, 1986) shows how inconsistent practices weaken relational trust.

Informed by these findings and frameworks, managers should prioritize joint process-mapping workshops with suppliers and distributors to identify redundancies, streamline workflows, and harmonize expectations. Performance metrics and accountability structures should accompany these efforts to ensure sustained alignment. This recommendation reflects participants' frustrations while anchoring the solution in established theory: process alignment reduces uncertainty, supports trust, and creates the foundation for collaborative advantage.

Navigate Cultural Differences: Cultural gaps emerged as barriers that shaped both trust and collaboration effectiveness. Executives highlighted differences in decision-making speed across organizations, managers reported “portal friction” when dealing with corporate or vendor-imposed systems, and production staff noted variations in work practices that created confusion

and inefficiency. Collectively, these findings show how cultural misalignment amplifies misunderstandings and slows coordination.

The literature aligns closely with these findings. Social Network Theory (Bourdieu, 1986; Uzzi, 1997) emphasizes that trust, reciprocity, and relational norms are essential for effective collaboration. Christopher (2016) further noted that cultural alignment is as important as technical integration for supply chain resilience. Without relational trust-building, technical solutions fail to translate into collaborative advantage.

Building on participant insights and established theory, organizations should invest in cross-cultural awareness initiatives and trust-building activities. Examples include collaborative problem-solving sessions, cross-company workshops, and cultural competency training. These measures create shared understanding across diverse partners, mitigate misunderstandings, and strengthen relational capital. In line with both the data and the literature, this recommendation underscores that navigating cultural differences is central to sustaining collaboration in complex supply networks.

Adopt Future-Oriented Collaborative Strategies: Participants consistently emphasized the importance of planning for long-term resilience rather than reacting to immediate disruptions. Executives stressed the need for predictive tools, digital twins, and investment in modernization. Middle managers described the tension between short-term firefighting and long-term foresight, while production staff voiced skepticism about past “half rollouts” that undermined trust in new tools. Together, these findings reveal the need to embed strategic foresight into collaborative practices.

The literature strongly reinforces these findings. Simatupang and Sridharan (2005) highlighted that sustainable collaboration depends on aligning incentives for long-term value creation. Ivanov and Dolgui (2020) showed that predictive technologies enhance resilience by enabling scenario planning and adaptive strategies. Resource Dependence Theory (Pfeffer & Salancik, 1978) explains how diversification reduces dependency risks, while Social Network Theory (Bourdieu, 1986) highlights the role of strong ties in fostering resilient collaboration.

Informed by these insights, organizations should develop future-oriented strategies that combine long-term partnership frameworks with predictive planning and resilient technologies. Executives must champion long-term modernization, middle managers should integrate foresight into daily routines, and production teams should actively participate in piloting and refining new tools. Establishing joint contingency planning mechanisms will further improve adaptability and continuity during disruptions. This recommendation integrates both empirical findings and theoretical insights, highlighting that future-oriented collaboration requires persistence, coordination, and shared investment across all supply chain levels.

Together, these recommendations translate the study's findings into practical strategies that directly target the barriers and enablers of collaboration identified in this research. They emphasize actionable steps that organizations can take to improve performance, resilience, and sustainability across supplier, distributor networks.

Recommendations for Future Research

The findings of this qualitative study provide a foundation for expanding scholarly inquiry into supply chain collaboration and organizational alignment. While the present study examined the benefits and challenges of enhancing collaboration across suppliers, manufacturers,

and distributors, the results also highlighted new questions and complexities that require further exploration. As Creswell and Creswell (2018) emphasize, qualitative findings often serve as springboards for future research by exposing patterns, contradictions, and contextual dynamics that quantitative approaches alone cannot capture.

Future researchers may build upon this study by refining its conceptual underpinnings, addressing its methodological limitations, and replicating its scope across different industries, geographies, or organizational structures. More specifically, the integration of Social Network Theory (Bourdieu, 1986), Resource Dependence Theory (Pfeffer & Salancik, 1978), and leading supply chain integration frameworks (Christopher, 2016; Lambert, 2008; Simatupang & Sridharan, 2005) provides fertile ground for further investigation. While this study triangulated perspectives from executives, middle managers, and production-floor staff, additional research could expand to cross-cultural contexts, longitudinal designs, and mixed-method approaches.

In this section, recommendations for future research are presented in a consolidated format that emphasizes how the identified themes can be extended and deepened. Rather than dividing suggestions into separate categories, the discussion highlights replication opportunities across industries, extensions of the themes identified in this study, and methodological considerations that can guide future inquiries.

Similar Studies

The current study focused on supply chain professionals within manufacturing-distributor networks in North America. Future researchers may replicate this study in other industries such as healthcare, automotive, or information technology, where collaboration and supply dependencies present unique dynamics. For example, in the healthcare sector, collaboration

between suppliers and hospitals is heavily influenced by regulatory compliance and patient safety requirements, which may alter how communication barriers or process misalignments manifest (Kumar et al., 2020). Similarly, the IT sector, with its rapid innovation cycles, may place greater emphasis on technological constraints and cultural misalignments than traditional manufacturing systems.

Replication across geographical regions may also yield valuable insights. Cultural norms, institutional arrangements, and governance structures significantly influence collaboration outcomes (Hofstede, 2011). For instance, supplier and manufacturer trust-building mechanisms in East Asia may differ from those in Europe or North America, highlighting the need for cross-cultural comparative studies. Researchers could also examine how collaboration unfolds in emerging markets, where resource dependence is heightened and infrastructural constraints may exacerbate existing challenges.

Finally, socio-economic variation deserves attention. Studies might examine how small- and medium-sized enterprises (SMEs) engage in collaboration differently from large multinational corporations. SMEs often face sharper resource constraints, making trust, commitment, and cultural alignment even more critical for survival (Wong, Boon-Itt, & Wong, 2011). A comparative approach across firm sizes could deepen the understanding of how scalability affects collaborative success.

Future Research Directions

This study identified three categories of barriers, communication, technological, and process misalignment, as central to collaboration challenges in the North American sheet metal supply chain. Future research should extend these findings by examining how these barriers

evolve in multi-tiered networks and under conditions of heightened uncertainty, such as during supply disruptions or geopolitical instability. Such research would test the generalizability of the barriers identified here while clarifying their long-term effects.

In addition to barriers, this study highlighted the importance of trust, cultural alignment, and commitment in shaping collaboration effectiveness. Future studies could investigate how generational differences in leadership and management styles influence supplier–buyer commitment, as well as how organizational culture interacts with national or regional cultural dynamics. Comparative research across industries or geographic contexts would help determine whether the patterns found in this sector are consistent elsewhere.

Finally, participants emphasized the importance of forward-looking strategies, including the adoption of predictive tools, modernization of systems, and development of structured collaborative mechanisms. Future research could evaluate the organizational conditions under which such strategies achieve their intended outcomes, particularly whether leadership engagement and cross-role involvement influence adoption success. Studies that track these initiatives over time would be especially valuable in determining whether collaborative practices create sustainable improvements in supply chain resilience and performance.

Study Summary

This qualitative case study has demonstrated that effective supply chain collaboration is not merely a set of operational practices but a deeply embedded relational and structural process shaped by communication, cultural alignment, and technological integration. The findings confirmed that when collaborative networks encounter barriers such as fragmented communication channels, limited resource alignment, and misaligned cultural values, the

resulting impact is a reduction in trust, efficiency, and long-term resilience. Conversely, themes related to joint planning, shared dashboards, and strategic foresight illustrated that firms that actively invest in collaboration strategies can create stronger relational capital and mitigate uncertainty across the supply chain (Christopher, 2016; Lambert, 2014).

The study's results also underscore the relevance of Social Network Theory (Bourdieu, 1986) in explaining how power, trust, and information flow shape collaborative outcomes. Participants' reflections revealed that executives and middle managers often controlled communication channels, which limited knowledge-sharing with production staff. This finding illustrates the unequal distribution of social capital and information access across organizational tiers, a dynamic consistent with Bourdieu's assertion that structural positions within a network determine one's access to resources and influence. These insights expand the literature by showing how social capital gaps not only affect intra-firm relations but also extend to inter-firm supply chain interactions, where uneven resource distribution may slow responsiveness and innovation (Granovetter, 1985; Borgatti & Li, 2009).

Further, the study reinforced Resource Dependence Theory (Pfeffer & Salancik, 1978) by showing how firms' dependence on key partners drives behaviors such as overcommitment, risk aversion, and occasionally cultural misalignment. For instance, executives expressed pressure to satisfy large customers, often leading to siloed decisions that neglected broader supply chain visibility. This reflects Pfeffer and Salancik's argument that firms seek stability by managing interdependencies, but in doing so may inadvertently create vulnerabilities if collaboration is not equitably structured. These findings contribute to current SCM research by highlighting that

resilience in complex networks requires not just operational integration, but also active negotiation of power and dependency relationships (Hillman et al., 2009).

The findings also extend the growing body of work on supply chain integration models (Simatupang & Sridharan, 2005; Cao & Zhang, 2011), which argue that collaboration requires alignment of trust, information sharing, incentives, and decision synchronization. Participant accounts demonstrated that while technological tools such as ERP systems and dashboards improved visibility, they were insufficient in the absence of relational trust and shared cultural understanding. This convergence of structural, technological, and relational factors illustrates that collaboration cannot be reduced to transactional efficiency alone, it is a multidimensional construct requiring alignment across people, processes, and platforms.

Importantly, this study provided practical confirmation of themes often addressed conceptually in supply chain literature: communication barriers, technological gaps, cultural misalignment, commitment issues, and the role of forward-looking collaborative strategies. By triangulating perspectives across executives, middle managers, and production staff, the study reinforced the need to recognize that supply chain collaboration operates at multiple organizational levels simultaneously. For example, production staff participants repeatedly voiced frustrations about misaligned goals and lack of feedback, reinforcing the idea that top-down strategies must be translated into daily practices to achieve sustainable outcomes.

In conclusion, this research contributes to both theory and practice by illustrating that supply chain collaboration is a systemic process shaped by relational, structural, and technological dimensions. It reinforces the applicability of established theories while also providing evidence-based insights into the practical barriers and enables firms' encounter.

Ultimately, the findings demonstrate that organizations that embrace collaborative strategies not only enhance operational efficiency but also build long-term resilience and adaptability in a rapidly changing global environment (Mentzer et al., 2001; Gunasekaran et al., 2017).

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Appendix A

Interview Questionnaire

Section 1: Introduction and Background

1. Can you briefly describe your role within your organization and how it relates to supply chain management?
2. How long have you been involved in supply chain management, particularly in collaboration with suppliers and distributors?
3. What does supply chain collaboration mean to you, and how is it currently practiced in your organization?

Section 2: Current State of Supply Chain Collaboration

4. Can you describe the current level of collaboration between your organization and its suppliers/distributors?
5. What key practices or strategies does your organization use to foster collaboration within the supply chain?
6. How do you measure the effectiveness of supply chain collaboration in your organization?

Section 3: Benefits of Supply Chain Collaboration

7. What are the most significant benefits your organization has experienced through enhanced collaboration with suppliers/distributors?
8. How has collaboration impacted your organization's operational efficiency and overall performance?

9. Can you provide specific examples where collaboration led to innovation or competitive advantage?

10. In what ways has collaboration influenced your organization's ability to respond to market changes or disruptions?

Section 4: Challenges in Supply Chain Collaboration

11. What are the main challenges your organization faces when collaborating with suppliers and distributors?

12. How do differences in organizational culture and goals affect collaboration efforts?

13. What roles do technology and data sharing play in your collaboration efforts, and what challenges have you encountered in these areas?

14. Can you discuss any legal or contractual challenges that have arisen during collaboration?

Section 5: Strategies for Improvement

15. What strategies have you implemented to overcome challenges in supply chain collaboration?

16. How does your organization ensure that collaboration is mutually beneficial for all parties involved?

17. In your experience, what are the key factors that contribute to successful supply chain collaboration?

18. What improvements or innovations do you believe could enhance collaboration further?

Section 6: Future Outlook

19. How do you see the future of supply chain collaboration evolving in your industry?
20. What emerging trends or technologies do you think will most significantly impact supply chain collaboration in the coming years?
21. What advice would you give to other organizations looking to enhance their supply chain collaboration efforts?

Section 7: Closing

22. Is there anything else you would like to add regarding supply chain collaboration or any insights you believe are important to this study?

Appendix B

Pilot Testing Data Analysis

Table 6

*Data Analysis from Transcript of Pilot Testing Interview Questions – from Five Participants.
Thematic Coding Summary:*

Theme	Sub-theme	Code	Example Quote	Source/File
Collaboration Strategies	Communication and Alignment	Open communication	“We prioritize open communication channels, regular meetings, data sharing...”	Interview 1
Collaboration Strategies	Technology Use	Technology integration	“We use collaborative platforms to track inventory and forecast demands...”	Interview 4
Collaboration Strategies	Goal Setting	Shared goals and performance metrics	“We align our objectives and performance metrics...”	Interview 3
Benefits	Operational Efficiency	Streamlined processes	“Collaboration has helped us streamline processes and reduce delays...”	Interview 4
Benefits	Customer Value	Enhanced customer satisfaction	“Improved efficiency, better product quality... enhance customer satisfaction.”	Interview 2
Challenges	Communication	Communication gaps	“Main challenges include communication gaps, inconsistent data sharing...”	Interview 1
Challenges	Cultural Misalignment	Differences in organizational culture	“Differences in culture and goals reduce efficiency and productivity...”	Interview 1
Challenges	Technology Limitations	Data compatibility and privacy issues	“Challenges like data security concerns, privacy issues arise...”	Interview 1
Improvement Strategies	Trust Building	Establishing trust	“Building trust through team building and shared objectives...”	Interview 1
Improvement Strategies	Conflict Resolution	Conflict resolution mechanisms	“Encouraging open feedback and resolving conflicts actively...”	Interview 1
Technology and Innovation	Emerging Tools	AI, Blockchain, IoT	“Emerging technologies include AI, Blockchain, and IoT...”	Interview 1

Technology and Innovation	Predictive Capabilities	Advanced analytics and real-time monitoring	“AI and predictive analytics help us forecast and adapt...”	Interview 2
Future Outlook	Resilience and Agility	Proactive decision making	“Supply chain collaboration will evolve towards a data-driven, real-time approach...”	Interview 1
Success Factors	Partnership Strength	Long-term commitment and transparency	“Success relies on trust, clear communication, and shared goals...”	Interview 5

Building on these detailed findings, Figure 2 and 3 presents a visual mind map summarizing the core themes and their interconnections. It integrates the identified collaboration strategies, benefits, challenges, improvement approaches, technological enablers, and success factors, offering a consolidated view of the study’s outcomes.

Figure 2
Visual Mind Map – Enhancing Supply Chain Collaboration

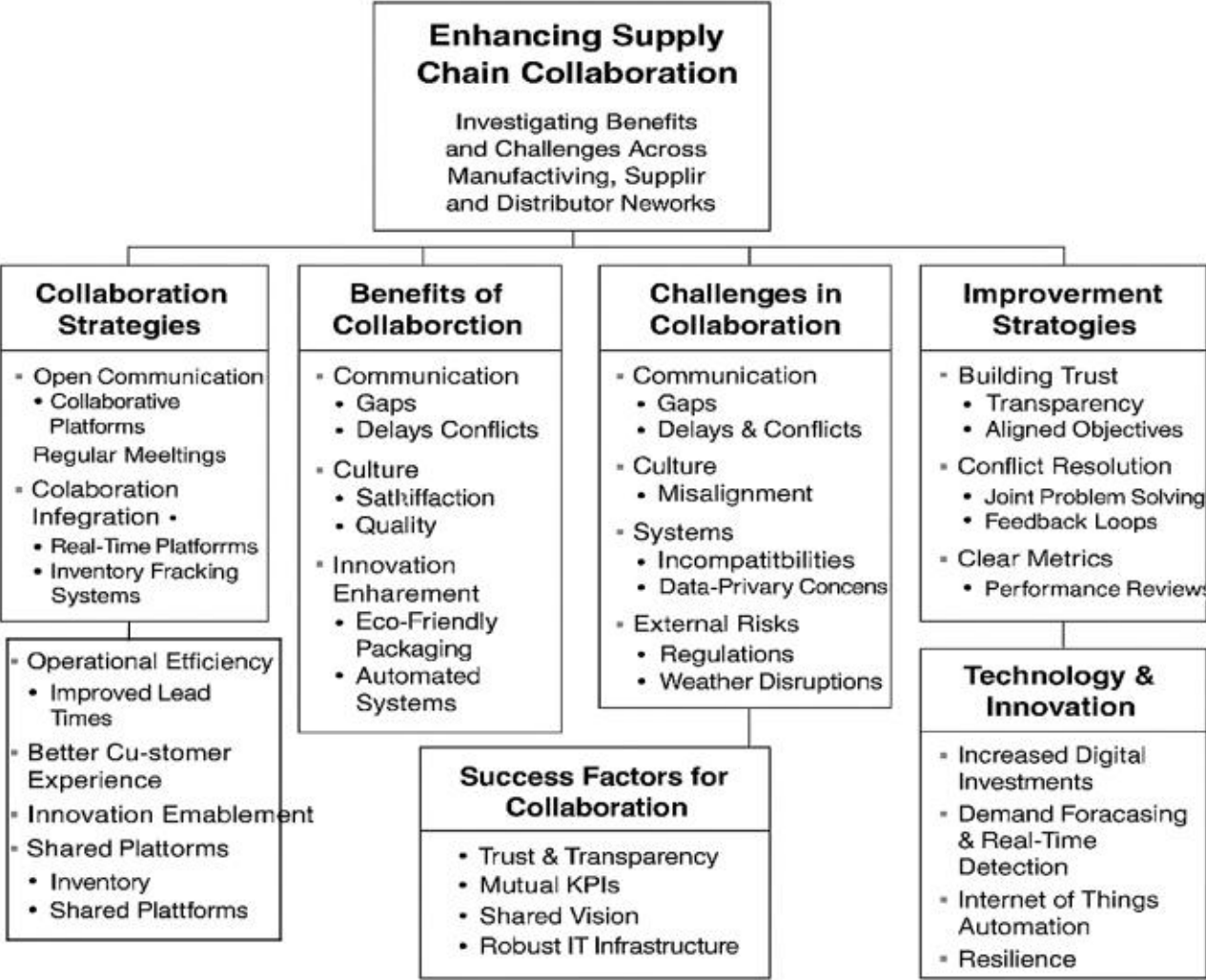
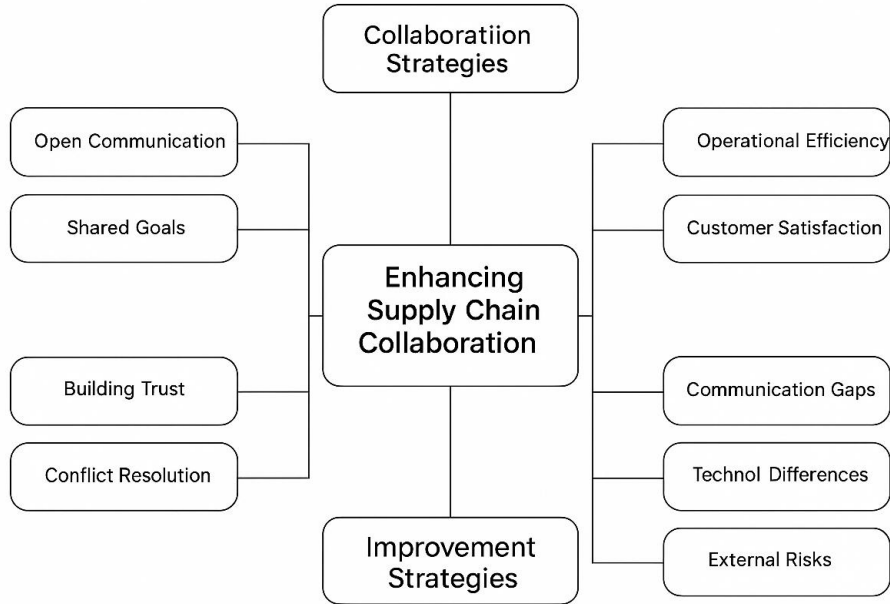


Figure 3
Visual Mind Map – Enhancing Supply Chain Collaboration



Thematic Analysis Summary Report

1. Collaboration Strategies

- Open Communication: Regular meetings and real-time communication platforms ensure alignment.
- Technology Integration: Collaborative software and cloud systems improve visibility.
- Shared Goals: Alignment of KPIs and production targets across the supply chain.

2. Benefits of Collaboration

- Operational Efficiency: Faster processes, fewer delays, and better inventory management.
- Customer Satisfaction: Improved quality and service foster loyalty.
- Innovation Enablement: Examples include eco-friendly packaging and robotics.

3. Challenges in Collaboration

- Communication Gaps: Miscommunication, delays, and information silos.
- Cultural Differences: Conflicting priorities and work styles.

- Technology Gaps: Incompatibility, security, and data integrity issues.

4. Improvement Strategies

- Building Trust: Through transparency, shared goals, and celebrations of success.
- Conflict Resolution: Structured joint problem-solving and open feedback mechanisms.
- Clear Metrics: KPIs, scorecards, and performance reviews enable accountability.

5. Technology and Innovation

- AI and Predictive Tools: For forecasting and disruption detection.
- IoT and Automation: Real-time monitoring and robotics streamline operations.
- Blockchain and Digital Twins: Improve traceability and collaborative resilience.

6. Future Outlook

- Digitalization: Movement toward real-time, data-driven ecosystems.
- Reshoring and Local Partnerships: Reducing dependency on global sources.
- Sustainability: Ethics and ESG compliance as collaboration priorities.

7. Success Factors for Collaboration

- Trust and Transparency
- Mutual KPIs and Shared Vision
- Robust IT Infrastructure and Long-term Commitment

Mapping Research Questions to Themes

This section maps each research question (RQ) to the relevant themes and sub-themes identified through thematic analysis. The purpose is to show alignment between the qualitative data and the study's objectives, providing clarity on how findings address each RQ.

RQ1

What underlying factors contribute to the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?

Mapped Themes and Sub-Themes:

- Challenges: Communication gaps, Cultural differences, Technology limitations, External pressures
- Future Outlook: Legacy system limitations, Lack of integration

Supporting Quotes:

- “We face communication gaps, inconsistent data sharing, and misaligned goals, especially during high demand.” – Interview 1
- “Differences in organizational culture and goals create misunderstanding and slow collaboration.” – Interview 4

RQ2

What challenges hinder effective interpersonal relationships between manufacturers, and their supply chain partners in the North American-based sheet metal manufacturing industry?

Mapped Themes and Sub-Themes:

- Challenges: Lack of trust, Misalignment in priorities, Cultural barriers
- Success Factors: Importance of trust, transparency, and feedback

Supporting Quotes

- “If one party prioritizes speed while the other focuses on quality, it can cause tension.” – Interview 4
- “Trust and transparency are the foundation for long-term success.” – Interview 5

RQ3

What strategies can help overcome the ineffectiveness of supply chain collaboration within the North American-based sheet metal manufacturing industry?

Mapped Themes and Sub-Themes

- Improvement Strategies: Trust-building, Conflict resolution, Goal alignment
- Technology and Innovation: Real-time data use, AI, IoT, Blockchain
- Success Factors: Mutual KPIs, Strong partnerships

Supporting Quotes

- “We built trust through transparency, aligned our goals, and used collaborative platforms to share updates in real time.” – Interview 4
- “Advanced analytics and AI platforms help us forecast disruptions and enhance decision-making.” – Interview 3

Appendix C

IRB - Notice of Not Research



9388 Lightwave Ave.
San Diego, CA 92123
irb@nu.edu

Notice of Not Research/Not Human Subjects

February 24, 2025

To: Mfon Bassey

Project Title: Enhancing supply chain collaboration: Investigating the benefits and challenges across manufacturing supplier and distributor networks.

NU IRB Number: IRB-FY24-25-342

Determination: No IRB Oversight Required

No IRB Required - Research activities may begin as of February 24, 2025

Regulations:

The Department of Health and Human Services (DHHS) Code of Federal Regulations (45 CFR 46) defines research as, "a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

The Department of Health and Human Services (DHHS) Code of Federal Regulations (**45 CFR 46.102(f)**) defines a human subject as a living individual about whom an investigator (whether professional or student) conducting research obtains (1) Data through intervention or interaction with the individual, or (2) *Identifiable private information.*

Dear Mfon Bassey:

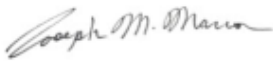
In determining whether or not a project requires review by the IRB, our first step is to determine if the project involves research and human subjects, as the IRB only reviews applications which involve both.

In applying the aforementioned regulations to this project, it has been determined that this project does not require IRB review. It does not appear that the proposed project involves human subjects research.

For questions related to this correspondence, please contact the IRB office ((858) 642-8384 or irb@nu.edu). If at any point you believe this research project involves human subjects, please contact the IRB office to request a

review.

Sincerely,



Dr. Joseph Marron, IRB Chair



Dr. Brianne Mongeon, Director, HRPP & IRB



Jenessa Eberhardt, Associate Director, HRPP & IRB

Appendix D

Reflective Journal Excerpts

The following excerpts illustrate the use of a reflective journal maintained during the data collection and analysis phases of the study. These notes were used to track evolving interpretations, bracket researcher assumptions, and support an audit trail to enhance dependability (Nowell et al., 2017; Lincoln and Guba, 1985).

February 25, 2025: Early Interview Observations

“I noticed early in the executive interviews that several participants emphasized ‘forecasting inaccuracies’ and ‘engineering speed’ as barriers. I expected communication to emerge, but this depth of detail around planning misalignment was surprising. I’ll need to ensure I’m not forcing themes based on prior assumptions—memoing helps me catch these biases.”

March 12, 2025: Emergence of Group Differences

“Middle managers repeatedly referred to BOM discrepancies and data transparency. Their comments feel distinct from the broader ERP complaints of executives, or the vague instruction concerns from floor staff. I’m beginning to see that each group is describing the same challenge (tech breakdown) but from very different lenses. Triangulation will help me layer these nuances together.”

March 30, 2025: Refining Codes into Themes

“Originally had too many codes overlapping between ‘ERP limitations’ and ‘information gaps’. After re-reading transcripts and using constant comparison, I’ve merged these under a single theme: ‘Technological Constraints’. I used the reflective journal to question whether I was separating things based on my knowledge of ERP systems rather than participant emphasis.”

April 5, 2025: Cross-Group Saturation

“By the sixth interview in each group, I noticed no new themes emerging—especially around commitment gaps and communication breakdowns. Used this journal entry to confirm that saturation is reached. The final two interviews in each group confirmed repetition of prior codes.”

April 18, 2025: Finalizing Theme Language

“Struggled with whether to title one theme ‘trust issues’ or ‘commitment issues. Trust felt too loaded and general. Journal reflection helped clarify that participants framed their concern in terms of reliability and follow-through, settled on ‘Commitment Issues’ to preserve their meaning. Noted justification in audit trail.”

April 25, 2025: Bracketing and Reflexivity

“I came into this project assuming tech limitations would be the primary factor. Reflective notes helped me see I was initially underestimating the relational and cultural challenges raised by Group 3. This helped me bracket those assumptions and let the data guide me. Documented this bias explicitly here to maintain transparency.”

Appendix E

Theme Recognition by Participant Group

The table below details which participants referenced each of the seven final themes during their interviews. This appendix supports the frequencies reported in Table 4 by documenting the presence of each theme at the individual participant level. Participants are grouped by role: Executives (P01–P08), Middle Managers (P09–P16), and Production Floor Staff (P17–P24). A participant is marked as having referenced a theme if the topic was identified during coding of their transcript.

Final Theme	Executives (P01–P08)	Middle Managers (P09–P16)	Production Floor Staff (P17–P24)	Total Participants
Communication Barriers	P01, P03, P04, P06, P08	P09, P13, P16	P17, P18, P19, P21, P22, P24	15
Technological Constraints	P01, P02, P05, P06, P08	P10, P14, P15	P17, P19, P22, P23	13
Process Misalignment	P02, P05, P06	P10, P13, P14	P18, P20, P22	10
Commitment and Trust Issues	P01, P04, P05, P07, P08	P09, P10, P13, P15, P16	P17, P18, P21, P24	14
Cultural Misalignment	P02, P04, P07, P08	P09, P10, P11, P14, P16	P17, P19, P21	13
Collaborative Strategies	P01, P04, P05, P06	P10, P11, P14, P16	P17, P20, P22, P24	12
Future Outlook	P03, P05, P07, P08	P09, P13, P16	P18, P19, P21	11

Note: This appendix reflects individual-level thematic recognition across the three organizational tiers and supports the frequency counts shown in Table 4. A participant is included if their interview contained coded content aligned with the theme, regardless of how many times the theme was mentioned.

Complete List of Initial Codes (n = 131)

The table below presents the 131 initial codes generated through line-by-line inductive coding of transcripts from executive, middle management, and production staff participants. These codes reflect specific language, concerns, or observations captured from participant narratives prior to thematic grouping.

Code ID	Initial code description	Categories
Code-001	unclear specs, vague drawings, missing details, no standards	Unclear specifications
Code-002	late updates, outdated specs, delayed info, slow change rollout	Delayed updates
Code-003	conflicting instructions, miscommunication, different directions, mixed messages	Misaligned messages
Code-004	floor vs office gaps, siloed updates, disconnect across teams, unclear handoffs	Cross-team misunderstandings
Code-005	old system, legacy ERP, non-intuitive interface, missing fields	Outdated ERP systems
Code-006	retyping, spreadsheets, duplicate input, handwritten logs	Manual data entry
Code-007	not connected, separate systems, no real-time sync, data islands	Lack of integration
Code-008	tools don't talk, fragmented apps, jumping platforms, no workflow link	Disconnected tools
Code-009	ops vs sales tension, different goals, clashing KPIs, urgent vs important	Conflicting priorities
Code-010	who owns this? lack of accountability, finger pointing, no clear lead	Unclear process ownership
Code-011	out of sync timing, misaligned delivery dates, overbooked machines, planning disconnect	Scheduling mismatches
Code-012	separate plans, no joint roadmap, mismatched calendars, lack of visibility	Disconnected planning
Code-013	chasing today, no long view, reactive decisions, short-term fixes	Short-term focus
Code-014	can't see upstream, no supplier info, hidden constraints, poor data access	Lack of visibility
Code-015	empty promises, starts but no finish, dropped initiatives, no follow-up	Low follow-through
Code-016	second-guessing vendors, holding back info, supplier avoidance, distrust	No supplier trust

Code-017	team silos, separate metrics, different incentives, no shared success	Siloed goals
Code-018	changing direction, mixed leadership signals, lack of alignment, shifting priorities	Leadership inconsistency
Code-019	fear of new systems, sticking to old ways, passive resistance, delay behavior	Resistance to change
Code-020	culture clash, factory vs corporate mindset, regional habits, informal practices	Differing norms
Code-021	design for manufacturability, upfront collaboration, input early, pre-planning engagement	Early involvement
Code-022	co-create solutions, mutual ownership, work together, fast fix loops	Joint problem solving
Code-023	who to call? no escalation, stuck at level 1, unclear chain of command	Escalation pathways
Code-024	old tech, slow tools, outdated platforms, upgrade required	Need for modernization
Code-025	forecasting gap, no analytics, reactive only, no predictive model	Predictive tools
Code-026	future readiness, capital lag, no roadmap, short planning horizon	Long-term investment planning
Code-027	version confusion, drawing mismatch, obsolete prints, wrong rev used	Unclear specifications
Code-028	BOM errors, outdated parts list, missing alternates, unapproved substitutions	Unclear specifications
Code-029	data latency, slow dashboards, stale reports, lagging status fields	Predictive tools
Code-030	manual approvals, email ping-pong, lost threads, unclear signoffs	Process misalignment
Code-031	poor handoffs, no owner on next step, task drift, queue stagnation	Process misalignment
Code-032	ad-hoc workflows, tribal knowledge, undocumented steps, hero culture	Process misalignment
Code-033	unclear escalation, stuck at level one, who to call?, stalled issues	Escalation pathways
Code-034	meeting overload, no decisions, rehashing topics, actionless reviews	Communication barriers
Code-035	KPI confusion, metric overload, vanity numbers, misaligned targets	Conflicting priorities
Code-036	planning in silos, no SandOP cadence, forecast blind spots, surprise changes	Disconnected planning
Code-037	unstable forecasts, wide swings, late re-allocations, whiplash planning	Predictive tools

Code-038	supplier lead-time volatility, date slips, capacity surprises, expediting spiral	Scheduling mismatches
Code-039	shipping bottlenecks, dock congestion, missed pickups, last-minute staging	Scheduling mismatches
Code-040	packaging mismatches, unclear labels, wrong specs, rework at dock	Process misalignment
Code-041	quality alerts late, delayed CAPA, repeat defects, slow containment	Process misalignment
Code-042	incomplete receiving, mislabels at intake, missed scans, count variances	Process misalignment
Code-043	inventory inaccuracies, ghost stock, negative balances, bin confusion	Lack of visibility
Code-044	scanner downtime, device failures, dead batteries, network drops	Need for modernization
Code-045	access gaps, permissions issues, locked reports, tool gatekeeping	Need for modernization
Code-046	training gaps, new tool anxiety, click paths unclear, low adoption	Resistance to change
Code-047	change fatigue, too many initiatives, shifting tools, shallow rollouts	Resistance to change
Code-048	partner tech mismatch, portal friction, EDI gaps, file-format issues	Disconnected tools
Code-049	cybersecurity caution, sharing hesitancy, restricted access, slow vetting	No supplier trust
Code-050	cost vs reliability tradeoffs, cheapest wins, hidden risks, service erosion	Conflicting priorities
Code-051	single-source exposure, no alternates, supplier dependency, fragility risk	No supplier trust
Code-052	contract ambiguity, vague SLAs, unclear penalties, dispute escalations	No supplier trust
Code-053	NDA constraints, limited sharing, doc redactions, slow approvals	No supplier trust
Code-054	regulatory shifts, tariff shocks, compliance burden, documentation load	Commitment and trust issues
Code-055	customs delays, broker hiccups, paperwork errors, border holds	Scheduling mismatches
Code-056	capacity blind spots, machine downtime surprises, maintenance clashes, schedule breaks	Scheduling mismatches
Code-057	setup churn, frequent changeovers, sequence breaks, lost machine time	Scheduling mismatches
Code-058	poor pre-kitting, missing components, line waits, scramble starts	Process misalignment
Code-059	downstream surprises, last-minute order tweaks, rush jobs, overtime bursts	Scheduling mismatches

Code-060	unclear prioritization, too many expedites, conflicting hot lists, chaos planning	Conflicting priorities
Code-061	floor feedback ignored, no operator voice, repeat pain points, low trust	Communication barriers
Code-062	maintenance coordination gaps, late PM windows, reactive fixes, avoidable breakdowns	Scheduling mismatches
Code-063	supplier quality variance, inconsistent specs, process drift, audit gaps	No supplier trust
Code-064	weak scorecards, infrequent reviews, soft feedback, no consequences	No supplier trust
Code-065	incomplete root cause, symptom fixes, no verification, recurrence risk	Process misalignment
Code-066	late engineering involvement, design handed off, manufacturability misses, rework loops	Early involvement
Code-067	poor DFM, tight tolerances, special processes, unnecessary complexity	Early involvement
Code-068	drawing change lag, ECO delays, dual versions, shop confusion	Early involvement
Code-069	inventory buffers unclear, safety stock guesswork, min/max noise, erratic replenishment	Lack of visibility
Code-070	MRP noise, exception floods, false signals, alert fatigue	Predictive tools
Code-071	planning horizons short, week-to-week focus, no seasonality, myopic views	Short-term focus
Code-072	warehouse layout issues, long walks, double handling, slotting inefficiencies	Process misalignment
Code-073	5S erosion, cluttered areas, search time, misplaced tools	Process misalignment
Code-074	visual controls weak, stale boards, outdated status, low engagement	Communication barriers
Code-075	undocumented temp fixes, workarounds linger, technical debt, process creep	Process misalignment
Code-076	onboarding gaps, role confusion, slow ramp, inconsistent expectations	Communication barriers
Code-077	leadership turnover, changing priorities, stop-start programs, morale dips	Leadership inconsistency
Code-078	incentive misfit, local optimization, subgoal success, global harm	Siloed goals
Code-079	email-first culture, low face time, tone misreads, escalation by CC	Communication barriers
Code-080	cross-shift drift, partial pass-downs, night/day misalign, restart waste	Communication barriers
Code-081	holiday/season blind spots, staffing mismatches, supplier closures, demand spikes	Scheduling mismatches

Code-082	freight market swings, carrier shortages, rate shocks, limited lanes	Scheduling mismatches
Code-083	TMS gaps, manual tendering, limited tracking, status blackouts	Need for modernization
Code-084	poor ASN discipline, surprise arrivals, receiving jams, dock rework	Process misalignment
Code-085	labeling inconsistencies, barcode misprints, nonstandard formats, scan fails	Process misalignment
Code-086	export compliance gaps, ECCN confusion, license delays, origin mistakes	Commitment and trust issues
Code-087	sustainability tradeoffs, packaging waste, overwrap habits, missed eco options	Future outlook
Code-088	cost creep, small fees add up, surcharge surprises, landed-cost blind	Conflicting priorities
Code-089	payment friction, long terms, cash constraints, supplier strain	No supplier trust
Code-090	forecast gaming, sandbagging numbers, buffer hiding, trust erosion	No supplier trust
Code-091	partner churn, too many vendors, shallow ties, onboarding drag	No supplier trust
Code-092	unclear vendor tiers, critical vs casual, misfocused attention, diluted effort	No supplier trust
Code-093	weak risk registers, stale heat maps, no owners, shelfware plans	No supplier trust
Code-094	crisis-only collaboration, reactive huddles, no drills, slow recoveries	Communication barriers
Code-095	lessons not captured, post-mortems skipped, repeat mistakes, knowledge loss	Communication barriers
Code-096	travel limits, fewer plant visits, thin relationships, context gaps	Cultural misalignment
Code-097	language barriers, translation delays, nuance lost, misunderstanding risk	Cultural misalignment
Code-098	time-zone lag, day-late loops, handoff gaps, decision latency	Cultural misalignment
Code-099	over-customization, one-offs proliferate, SKU sprawl, planning burden	Process misalignment
Code-100	MOQ constraints, forced buys, inventory bloat, cash tied up	Process misalignment
Code-101	long tooling lead, fixture delays, NPI drag, launch slips	Scheduling mismatches
Code-102	VAVE underused, cost-down ideas stall, no owner, missed savings	Future outlook
Code-103	pilot-to-scale gap, works in trial, fails at volume, process drift	Process misalignment

Code-104	stale policies, outdated SOPs, mismatched reality, audit findings	Process misalignment
Code-105	weak governance, unclear councils, duplicate committees, slow decisions	Process misalignment
Code-106	escalation noise, too many pings, alarm fatigue, real issues buried	Escalation pathways
Code-107	partial digitization, hybrid paper trails, double entry, traceability gaps	Disconnected tools
Code-108	access to analytics limited, power-user bottlenecks, ad-hoc extracts, stale cubes	Predictive tools
Code-109	metric lag, monthly-only views, blind mid-cycle, slow course-correct	Predictive tools
Code-110	shadow spreadsheets, personal trackers, version chaos, hidden truth	Disconnected tools
Code-111	ad-hoc vendor comms, DMs everywhere, no thread of record, lost context	Communication barriers
Code-112	onboarding suppliers slow, long questionnaires, unclear expectations, portal friction	No supplier trust
Code-113	change boards rigid, slow approvals, innovation bottleneck, workarounds bloom	Resistance to change
Code-114	pilot metrics fuzzy, success undefined, no go/no-go, pet projects persist	Process misalignment
Code-115	training not reinforced, one-and-done sessions, no refreshers, skill fade	Resistance to change
Code-116	floor IT support thin, ticket queues grow, long SLAs, DIY fixes	Need for modernization
Code-117	hardware mismatched, old scanners, incompatible OS, patchy updates	Need for modernization
Code-118	API fragility, brittle integrations, silent failures, data drift	Disconnected tools
Code-119	master data mess, duplicate vendors, part aliases, unit confusion	Lack of visibility
Code-120	calendar misalignment, fiscal vs production, quarter-end crunch, conflicting freezes	Disconnected planning
Code-121	customer change storms, spec tweaks late, color swaps, label edits	Process misalignment
Code-122	engineering queues long, drawing backlog, ECO bottleneck, priority fog	Early involvement
Code-123	obsolescence surprises, end-of-life notices, last-buy scrambles, redesign rush	Future outlook
Code-124	supplier audits rare, limited visibility, process blind, trust by hope	No supplier trust
Code-125	supplier score weight skewed, price over quality, short-term wins, long-term costs	No supplier trust

Code-126	make-buy toggles slow, analysis backlog, missed arbitrage, stuck decisions	Future outlook
Code-127	warehouse capacity tight, overflow trailers, offsite stashes, search time	Process misalignment
Code-128	kitting accuracy low, wrong quantities, missing fasteners, line stops	Process misalignment
Code-129	QA sampling misfit, risk not aligned, overcheck some, undercheck others	Process misalignment
Code-130	CAPA ownership fuzzy, task ping-pong, timeline slips, weak closure	Process misalignment
Code-131	rework masking issues, pass-through fixes, hidden scrap, cost leakage	Process misalignment

Category	Initial Codes
Unclear specifications	unclear specs, vague drawings, missing details, no standards
Delayed updates	late updates, outdated specs, delayed info, slow change rollout
Misaligned messages	conflicting instructions, miscommunication, different directions, mixed messages
Cross-team misunderstandings	floor vs office gaps, siloed updates, disconnect across teams, unclear handoffs
Outdated ERP systems	old system, legacy ERP, non-intuitive interface, missing fields
Manual data entry	retyping, spreadsheets, duplicate input, handwritten logs
Lack of integration	not connected, separate systems, no real-time sync, data islands
Disconnected tools	tools don't talk, fragmented apps, jumping platforms, no workflow link
Conflicting priorities	ops vs sales tension, different goals, clashing KPIs, urgent vs important
Unclear process ownership	who owns this? lack of accountability, finger pointing, no clear lead
Scheduling mismatches	out of sync timing, misaligned delivery dates, overbooked machines, planning disconnect
Disconnected planning	separate plans, no joint roadmap, mismatched calendars, lack of visibility
Short-term focus	chasing today, no long view, reactive decisions, short-term fixes
Lack of visibility	can't see upstream, no supplier info, hidden constraints, poor data access
Low follow-through	empty promises, starts but no finish, dropped initiatives, no follow-up

Category	Initial Codes
No supplier trust	Second, guessing vendors, holding back info, supplier avoidance, distrust
Siloed goals	team silos, separate metrics, different incentives, no shared success
Leadership inconsistency	changing direction, mixed leadership signals, lack of alignment, shifting priorities
Resistance to change	fear of new systems, sticking to old ways, passive resistance, delay behavior
Differing norms	culture clash, factory vs corporate mindset, regional habits, informal practices
Early involvement	design for manufacturability, upfront collaboration, input early, pre-planning engagement
Joint problem solving	co-create solutions, mutual ownership, work together, fast fix loops
Escalation pathways	who to call? no escalation, stuck at level 1, unclear chain of command
Need for modernization	old tech, slow tools, outdated platforms, upgrade required
Predictive tools	forecasting gap, no analytics, reactive only, no predictive model
Long-term investment planning	future readiness, capital lag, no roadmap, short planning horizon

Note: Codes were kept in their original semantic form to preserve participant language and minimize researcher bias. These initial codes were subsequently grouped into 21 categories and then condensed into the seven final themes shown in Table 3 and Appendix E.

Top 21 sub-Categories		Group 1 - Executive	Group 2 - Middle Mgt.	Group 3 - Production Floor
SubCat ID	Sub-Categories	Frequency	Frequency	Frequency
SC-001	Unclear specifications	2	3	0
SC-002	Delayed updates	2	3	0
SC-003	Misaligned messages	2	4	0
SC-004	Cross-team misunderstandings	2	5	2
SC-005	Outdated ERP systems	3	3	1
SC-006	Manual data entry	3	3	1
SC-007	Lack of integration	3	3	2
SC-008	Disconnected tools	3	2	2
SC-009	Conflicting priorities	3	3	2
SC-010	Unclear process ownership	3	3	0
SC-011	Scheduling mismatches	3	3	2
SC-012	Disconnected planning	3	3	2
SC-013	Short-term focus	3	3	2
SC-014	Lack of visibility	3	3	0
SC-015	Low follow-through	3	2	1
SC-016	No supplier trust	3	3	1
SC-017	Siloed goals	3	3	2
SC-018	Leadership inconsistency	3	3	1
SC-019	Resistance to change	3	3	2
SC-020	Differing norms	3	3	1
SC-021	Early involvement	3	3	1
SC-022	Joint problem solving	3	2	2
SC-023	Escalation pathways	3	3	3
SC-024	Need for modernization	3	3	2
SC-025	Predictive tools	3	3	2
SC-026	Long-term investment planning	3	3	2

Group 1 - Executive		Group 2 - Middle Mgt.		Group 3 - Production Floor	
Code	sub-Category	Code	sub-Category	Code	sub-Category
Code-001	Unclear specifications	Code-001	—	Code-001	—
Code-002	Delayed updates	Code-002	—	Code-002	—
Code-003	Misaligned messages	Code-003	Misaligned messages	Code-003	—
Code-004	Cross-team misunderstandings	Code-004	Cross-team misunderstandings	Code-004	Cross-team misunderstandings
Code-005	Outdated ERP systems	Code-005	Outdated ERP systems	Code-005	—
Code-006	Manual data entry	Code-006	—	Code-006	Manual data entry
Code-007	Lack of integration	Code-007	—	Code-007	Lack of integration
Code-008	Disconnected tools	Code-008	—	Code-008	Disconnected tools
Code-009	Conflicting priorities	Code-009	Conflicting priorities	Code-009	—
Code-010	Unclear process ownership	Code-010	—	Code-010	—
Code-011	Scheduling mismatches	Code-011	Scheduling mismatches	Code-011	Scheduling mismatches
Code-012	Disconnected planning	Code-012	Disconnected planning	Code-012	—
Code-013	Short-term focus	Code-013	—	Code-013	—
Code-014	Lack of visibility	Code-014	Lack of visibility	Code-014	—
Code-015	Low follow-through	Code-015	—	Code-015	Low follow-through
Code-016	No supplier trust	Code-016	No supplier trust	Code-016	—
Code-017	Siloed goals	Code-017	Siloed goals	Code-017	—
Code-018	Leadership inconsistency	Code-018	Leadership inconsistency	Code-018	Leadership inconsistency
Code-019	Resistance to change	Code-019	Resistance to change	Code-019	Resistance to change
Code-020	Differing norms	Code-020	—	Code-020	Differing norms
Code-021	Early involvement	Code-021	—	Code-021	—
Code-022	Joint problem solving	Code-022	—	Code-022	Joint problem solving
Code-023	Escalation pathways	Code-023	Escalation pathways	Code-023	Escalation pathways
Code-024	Need for modernization	Code-024	—	Code-024	Need for modernization
Code-025	Predictive tools	Code-025	—	Code-025	Predictive tools
Code-026	Long-term investment planning	Code-026	Long-term investment planning	Code-026	—
Code-027	—	Code-027	Cross-team misunderstandings	Code-027	—
Code-028	Outdated ERP systems	Code-028	—	Code-028	Outdated ERP systems
Code-029	Manual data entry	Code-029	Manual data entry	Code-029	—
Code-030	Lack of integration	Code-030	Lack of integration	Code-030	—
Code-031	Disconnected tools	Code-031	—	Code-031	Disconnected tools
Code-032	Conflicting priorities	Code-032	—	Code-032	Conflicting priorities
Code-033	Unclear process ownership	Code-033	Unclear process ownership	Code-033	—
Code-034	Scheduling mismatches	Code-034	—	Code-034	—
Code-035	Disconnected planning	Code-035	—	Code-035	Disconnected planning
Code-036	Short-term focus	Code-036	Short-term focus	Code-036	Short-term focus
Code-037	Lack of visibility	Code-037	—	Code-037	—
Code-038	Low follow-through	Code-038	—	Code-038	—
Code-039	No supplier trust	Code-039	—	Code-039	No supplier trust
Code-040	Siloed goals	Code-040	—	Code-040	Siloed goals
Code-041	Leadership inconsistency	Code-041	—	Code-041	—
Code-042	Resistance to change	Code-042	—	Code-042	Resistance to change
Code-043	Differing norms	Code-043	Differing norms	Code-043	—
Code-044	Early involvement	Code-044	Early involvement	Code-044	—
Code-045	Joint problem solving	Code-045	—	Code-045	—
Code-046	Escalation pathways	Code-046	—	Code-046	Escalation pathways
Code-047	Need for modernization	Code-047	Need for modernization	Code-047	—
Code-048	Predictive tools	Code-048	Predictive tools	Code-048	—
Code-049	Long-term investment planning	Code-049	—	Code-049	Long-term investment planning
Code-050	—	Code-050	Unclear specifications	Code-050	—
Code-051	—	Code-051	Delayed updates	Code-051	—
Code-052	—	Code-052	Misaligned messages	Code-052	—
Code-053	—	Code-053	Cross-team misunderstandings	Code-053	Cross-team misunderstandings
Code-054	—	Code-054	Outdated ERP systems	Code-054	—
Code-055	—	Code-055	Manual data entry	Code-055	—
Code-056	—	Code-056	Lack of integration	Code-056	—
Code-057	—	Code-057	Disconnected tools	Code-057	—
Code-058	—	Code-058	Conflicting priorities	Code-058	—
Code-059	—	Code-059	Unclear process ownership	Code-059	—
Code-060	—	Code-060	Scheduling mismatches	Code-060	Scheduling mismatches
Code-061	—	Code-061	Disconnected planning	Code-061	—
Code-062	—	Code-062	Short-term focus	Code-062	—
Code-063	—	Code-063	Lack of visibility	Code-063	—
Code-064	—	Code-064	Low follow-through	Code-064	—
Code-065	—	Code-065	No supplier trust	Code-065	—
Code-066	—	Code-066	Siloed goals	Code-066	Siloed goals
Code-067	—	Code-067	Leadership inconsistency	Code-067	—
Code-068	—	Code-068	Resistance to change	Code-068	—

Group 1 - Executive		Group 2 - Middle Mgt.		Group 3 - Production Floor	
Code	sub-Category	Code	sub-Category	Code	sub-Category
Code-069	—	Code-069	Differing norms	Code-069	—
Code-070	—	Code-070	Early involvement	Code-070	Early involvement
Code-071	—	Code-071	Joint problem solving	Code-071	Joint problem solving
Code-072	—	Code-072	Escalation pathways	Code-072	—
Code-073	—	Code-073	Need for modernization	Code-073	Need for modernization
Code-074	—	Code-074	Predictive tools	Code-074	Predictive tools
Code-075	—	Code-075	Long-term investment planning	Code-075	—
Code-076	—	Code-076	Unclear specifications	Code-076	—
Code-077	—	Code-077	Delayed updates	Code-077	—
Code-078	—	Code-078	Misaligned messages	Code-078	—
Code-079	—	Code-079	Cross-team misunderstandings	Code-079	—
Code-080	—	Code-080	Outdated ERP systems	Code-080	—
Code-081	—	Code-081	Manual data entry	Code-081	—
Code-082	—	Code-082	Lack of integration	Code-082	Lack of integration
Code-083	—	Code-083	Disconnected tools	Code-083	—
Code-084	—	Code-084	Conflicting priorities	Code-084	Conflicting priorities
Code-085	—	Code-085	Unclear process ownership	Code-085	—
Code-086	—	Code-086	Scheduling mismatches	Code-086	—
Code-087	—	Code-087	Disconnected planning	Code-087	Disconnected planning
Code-088	—	Code-088	Short-term focus	Code-088	Short-term focus
Code-089	—	Code-089	Lack of visibility	Code-089	—
Code-090	—	Code-090	Low follow-through	Code-090	—
Code-091	—	Code-091	No supplier trust	Code-091	—
Code-092	—	Code-092	Siloed goals	Code-092	—
Code-093	—	Code-093	Leadership inconsistency	Code-093	—
Code-094	—	Code-094	Resistance to change	Code-094	—
Code-095	—	Code-095	Differing norms	Code-095	—
Code-096	—	Code-096	Early involvement	Code-096	—
Code-097	—	Code-097	Joint problem solving	Code-097	—
Code-098	—	Code-098	Escalation pathways	Code-098	Escalation pathways
Code-099	—	Code-099	Need for modernization	Code-099	—
Code-100	—	Code-100	Predictive tools	Code-100	—
Code-101	—	Code-101	Long-term investment planning	Code-101	Long-term investment planning
Code-102	Unclear specifications	Code-102	—	Code-102	—
Code-103	Delayed updates	Code-103	—	Code-103	—
Code-104	Misaligned messages	Code-104	—	Code-104	—
Code-105	Cross-team misunderstandings	Code-105	—	Code-105	—
Code-106	Outdated ERP systems	Code-106	—	Code-106	—
Code-107	Manual data entry	Code-107	—	Code-107	—
Code-108	Lack of integration	Code-108	—	Code-108	—
Code-109	Disconnected tools	Code-109	—	Code-109	—
Code-110	Conflicting priorities	Code-110	—	Code-110	—
Code-111	Unclear process ownership	Code-111	—	Code-111	—
Code-112	Scheduling mismatches	Code-112	—	Code-112	—
Code-113	Disconnected planning	Code-113	—	Code-113	—
Code-114	Short-term focus	Code-114	—	Code-114	—
Code-115	Lack of visibility	Code-115	—	Code-115	—
Code-116	Low follow-through	Code-116	—	Code-116	—
Code-117	No supplier trust	Code-117	—	Code-117	—
Code-118	Siloed goals	Code-118	—	Code-118	—
Code-119	Leadership inconsistency	Code-119	—	Code-119	—
Code-120	Resistance to change	Code-120	—	Code-120	—
Code-121	Differing norms	Code-121	—	Code-121	—
Code-122	Early involvement	Code-122	—	Code-122	—
Code-123	Joint problem solving	Code-123	—	Code-123	—
Code-124	Escalation pathways	Code-124	—	Code-124	—
Code-125	Need for modernization	Code-125	—	Code-125	—
Code-126	Predictive tools	Code-126	—	Code-126	—
Code-127	Long-term investment planning	Code-127	—	Code-127	—
Code-128	—	Code-128	Unclear specifications	Code-128	—
Code-129	—	Code-129	Delayed updates	Code-129	—
Code-130	—	Code-130	Misaligned messages	Code-130	—
Code-131	—	Code-131	Cross-team misunderstandings	Code-131	—

Initial Open Codes by Participant Group

Code #	Group	Open Code Description
1	Executives	Format inconsistencies
2	Executives	Delays in updates
3	Executives	Lack of system integration
...
32	Executives	Supplier forecasting misalignment
33	Middle Mgt.	BOM inaccuracies
34	Middle Mgt.	Lack of system access
...
62	Middle Mgt.	Disconnected communication loops
63	Floor Staff	Manual data entry
64	Floor Staff	Unclear scheduling
...
145	Floor Staff	Limited instruction feedback loop

Note: This appendix lists all 145 initial open codes generated during line-by-line thematic analysis, including 47 from Group 1 (Executives), 45 from Group 2 (Middle Management), and 53 from Group 3 (Production Floor). Each code reflects a distinct concept or concern identified during inductive coding prior to theme consolidation.

Figure 4

Triangulated Theme Support Across Executive, Middle Management, and Production Groups. All themes shown were independently derived from at least two participant groups and confirmed during cross-group analysis:

Final Theme	Participant Group		
	Executives	Middle Managers	Production Floor
Communication Barriers	1	1	1
Technological Constraints	1	1	1
Process Misalignment	1	1	1
Commitment Issues	1	1	1
Cultural Misalignment	0	1	1
Collaborative Strategies	1	1	1
Future Outlook	1	1	1

Note: Heatmap visualizing theme support across participant groups. Each cell indicates whether a given group (Executives, Middle Managers, or Production Floor Staff) supported a particular theme (1 = yes, 0 = no).

Category-to-Theme Mapping by Participant Group (diverging themes across groups)

The table below presents how each of the 21 categories was distributed across the three participant groups (Executives, Middle Managers, Production Floor Staff) and shows how these categories contributed to the seven final themes. This mapping provides clarity on where themes were commonly shared across organizational levels and where divergence emerged.

Category	Participant Group(s)	Final Theme
Unclear specifications	Executives, Floor Staff	Communication Barriers
Delayed updates	Executives, Middle Managers	Communication Barriers
Misaligned messages	Middle Managers, Floor Staff	Communication Barriers
Cross-team misunderstandings	All Groups	Communication Barriers
Outdated ERP systems	Executives, Middle Managers	Technological Constraints
Manual data entry	Middle Managers, Floor Staff	Technological Constraints
Lack of integration	Executives, Floor Staff	Technological Constraints
Disconnected tools	Executives	Technological Constraints
Conflicting priorities	Executives, Middle Managers	Process Misalignment
Unclear process ownership	Middle Managers, Floor Staff	Process Misalignment
Scheduling mismatches	Executives, Floor Staff	Process Misalignment
Disconnected planning	All Groups	Process Misalignment
Short-term focus	Executives	Commitment Issues
Lack of visibility	Middle Managers	Commitment Issues
Low follow-through	Floor Staff	Commitment Issues
No supplier trust	Executives, Middle Managers	Commitment Issues
Siloed goals	Executives	Cultural Misalignment
Leadership inconsistency	Middle Managers	Cultural Misalignment
Resistance to change	Floor Staff	Cultural Misalignment
Differing norms	Executives, Middle Managers	Cultural Misalignment
Early involvement	Executives, Middle Managers	Collaborative Strategies
Joint problem solving	All Groups	Collaborative Strategies
Escalation pathways	Middle Managers, Floor Staff	Collaborative Strategies
Need for modernization	Executives, Floor Staff	Future Outlook
Predictive tools	Executives	Future Outlook
Long-term investment planning	Executives, Middle Managers	Future Outlook

***Note:** Categories were identified through semantic coding and grouped under final themes based on conceptual similarity and functional relevance. Some categories appeared across multiple groups, illustrating shared experiences; others were unique to specific roles, highlighting divergences in perspective.*

Appendix F

Mind Map Figures (Visual Representation)

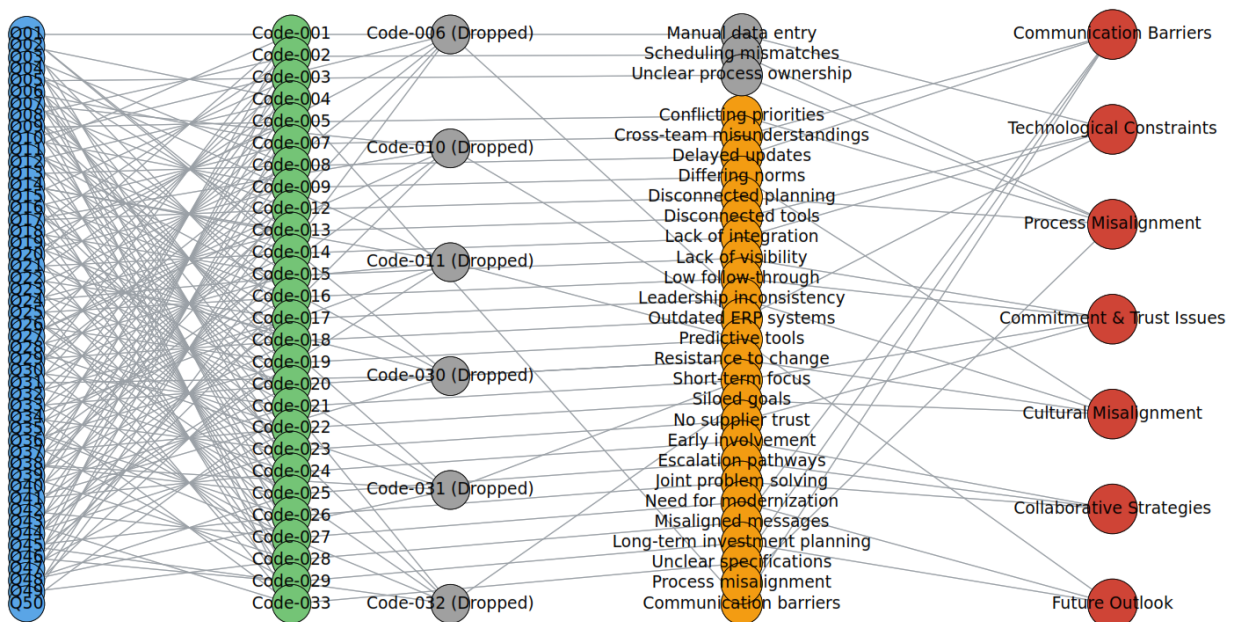
As illustrated in Figure 5, the coding process advanced from granular participant statements to increasingly abstracted categories. The color-coded mind maps complement Table 3 by showing not only the frequencies of the final themes but also the structural interconnections and dropped items at each stage of analysis.

- Blue nodes represent participant quotes (Q1–Qn) drawn directly from interview transcripts.
- Green nodes represent the initial codes (Code-001 ... Code-145) derived during the first cycle of open coding.
- Orange nodes represent the categories, which cluster related codes into conceptual groups.
- Red nodes represent the final themes, which integrate categories into broader analytical categories.
- Grey nodes indicate dropped items — codes or categories excluded from further analysis due to low frequency, lack of relevance, or misalignment with higher-level categories.

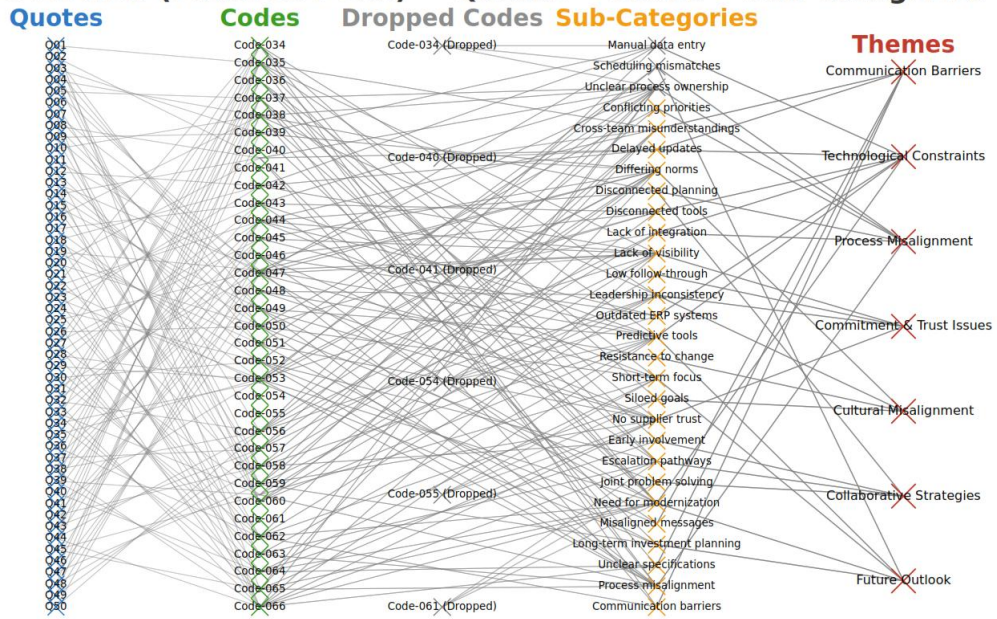
Arrows indicate the hierarchical progression from quotes → codes → categories → themes. Code frequency (n = 24) for each final theme is noted in Table 3 and corresponds directly to the red nodes in the diagram.

Figure 5
Thematic Conolidation Mind Map

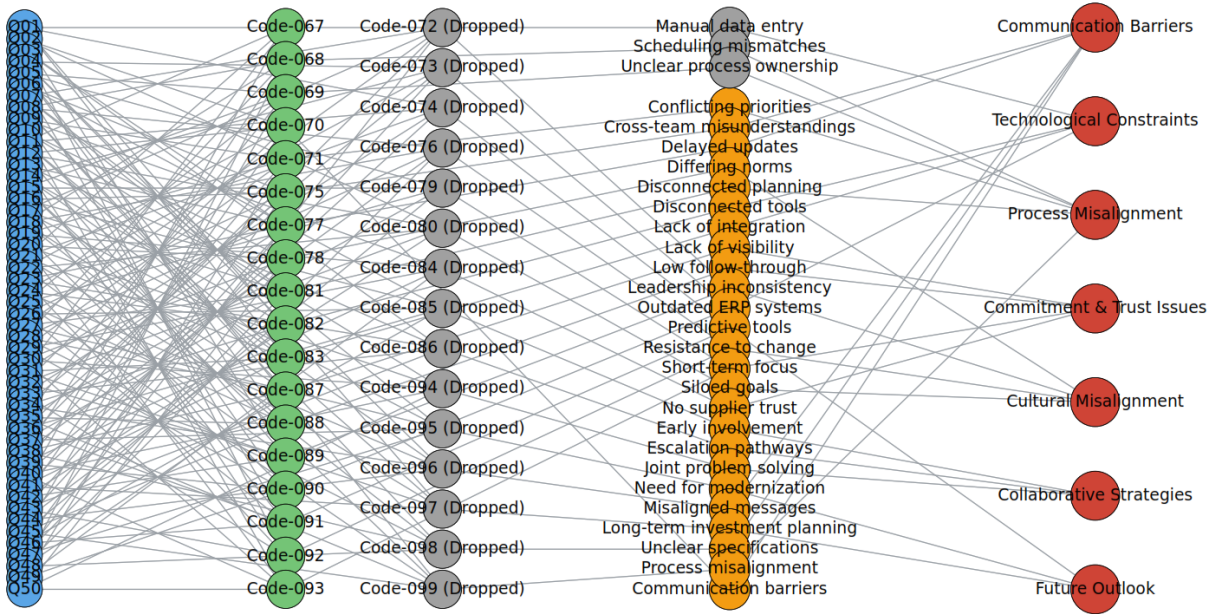
Master Overview (Panel 001-033) — Quotes → Codes → Sub-Categories → Themes



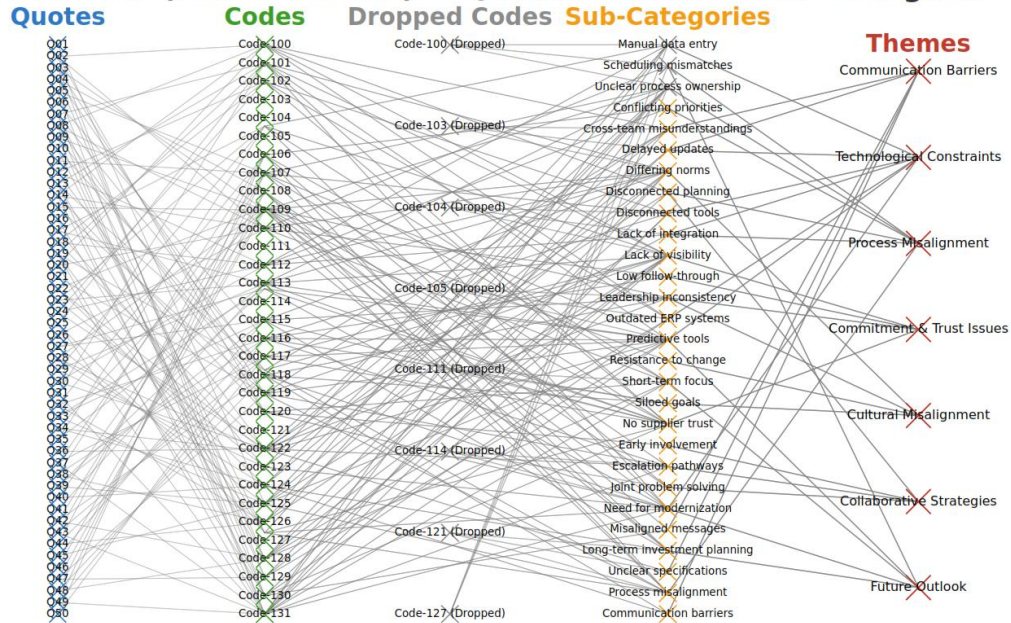
Master Overview (Panel 034-066) — Quotes → Codes → Sub-Categories → Themes



Master Overview (Panel 067-099) — Quotes → Codes → Sub-Categories → Themes



Master Overview (Panel 100-131) — Quotes → Codes → Sub-Categories → Themes



Master Overview (Panel 132-145) — Quotes → Codes → Sub-Categories → Themes (No theme linkage on this panel; 10 codes dropped; 3 sub-categories dropped)

