

Midocean University
College of Management
Master's in Project Management



**The Role of Project Management Maturity in Enhancing
the Resilience of Smart Supply Chains: An Applied Study
on Manufacturing Companies in the Kingdom of Saudi
Arabia**

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Dedication

To those who instilled values in me and provided me with
wisdom,

To those whose prayers were the secret to my success and
my support throughout all stages of my life,

To my generous parents, I dedicate the fruits of my labor and
work, in gratitude and appreciation.

To those who supported and encouraged me in my academic
career,

To my brothers, friends, and colleagues,

To all of you, I dedicate this humble work, in gratitude for all
your sincere support.

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Praise be to God, by whose grace good deeds are accomplished, and with whose help and guidance I have completed this modest work.

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Abstract

This study aimed to investigate the role of Project Management Maturity in enhancing the resilience of smart supply chains in manufacturing companies in the Kingdom of Saudi Arabia. Specifically, the research examined the influence of Project Management Maturity, Digital Integration in Project Management, Risk Management, and Organizational Agility on the resilience of smart supply chains. The study adopted a quantitative research methodology, utilizing a structured questionnaire as the primary data collection instrument. Data were collected from a sample of 262 participants representing managers, project professionals, supply chain specialists, and operational leaders working in manufacturing companies across Saudi Arabia. The collected data were analyzed

using appropriate statistical techniques to evaluate the proposed research hypotheses and determine the relationships among the study variables. The findings revealed statistically significant positive relationships between all four independent variables and smart supply chain resilience. Project Management Maturity was found to strengthen organizational governance, standardize project execution, improve strategic coordination, and enhance operational performance. Digital Integration in Project Management significantly improved organizational visibility, communication, and real-time decision-making capabilities. Risk Management contributed to proactive disruption prevention, effective contingency planning, and business continuity, while Organizational Agility enabled manufacturing firms to respond rapidly to environmental uncertainty and technological change. Collectively, these capabilities substantially enhanced the resilience of smart supply chains and strengthened organizational adaptability within the Saudi manufacturing sector. Based on these findings, the study recommends strengthening project management maturity frameworks, expanding digital transformation initiatives, enhancing enterprise-wide risk management systems, promoting organizational agility, investing in employee capability development, improving knowledge management practices, and aligning project management strategies with the industrial transformation objectives of Saudi Vision 2030. The study contributes both theoretically and practically by providing an integrated framework for understanding how mature project management capabilities support resilient and digitally enabled supply chains in modern manufacturing organizations.

Keywords :Project Management Maturity - Smart Supply Chain Resilience - Digital Integration -Risk Management - Organizational Agility - Manufacturing Companies -Saudi Vision 2030 .

Chapter One

Introduction

The modern world is witnessing a radical transformation in business management and operational processes due to rapid technological advancements, including digitalization, artificial intelligence, the Internet of Things, and advanced analytics. This transformation has

directly impacted supply chains, which now face greater challenges in responding to market fluctuations, environmental changes, and unforeseen operational risks. In this context, the concept of smart supply chain resilience has emerged as a vital element to ensure organizations can adapt to these changes quickly and efficiently by employing modern technologies that enable risk prediction and faster, more accurate decision-making (Agustian, 2023).

Project management is one of the fundamental pillars that directly influences the success of smart supply chains. It involves resource allocation, process planning, progress monitoring, and ensuring the achievement of the organization's strategic objectives. The concept of project management maturity refers to the extent to which an organization can effectively and sustainably apply project management principles and methodologies, including planning, execution, monitoring, and continuous improvement. The higher the level of organizational maturity in project management, the greater the ability of companies to integrate technology and smart techniques into their supply chains, achieving greater resilience in the face of internal and external challenges and changes (Dubey, 2024).

The importance of this study stems from the urgent need to understand the relationship between project management maturity and the resilience of smart supply chains in the Saudi Arabian manufacturing sector, a cornerstone of the national economy that is undergoing a transformation towards digitalizing processes and improving operational efficiency. Despite the growing interest in digital transformation and smart technology, companies' ability to fully leverage these technologies depends heavily on their level of organizational maturity in project management and whether they can strategically employ this management approach to support supply chain resilience and mitigate operational risks (ValaskovaCorresponding, 2025).

This study aims to provide a comprehensive overview of how to enhance the resilience of smart supply chains by raising the level of project management maturity. This will be achieved through an analysis of organizational capabilities, planning and execution efficiency, and the effectiveness of control and monitoring systems. It also aims to explore the relationship between organizational maturity and supply chain performance in a dynamic industrial environment characterized by intense competition and the need for rapid responses to changes in demand, fluctuations in raw materials, and logistical challenges (Amankwah-Amoah, 2021).

The study reflects the need to integrate modern project management concepts with smart supply chain technologies to achieve clear strategic objectives, such as improving efficiency,

reducing costs, increasing competitiveness, and enhancing resilience to unforeseen risks. The findings of this study are expected to provide practical recommendations to decision-makers in the Saudi manufacturing sector on the best ways to enhance the resilience of smart supply chains and integrate organizational maturity with modern technologies to ensure sustainable performance and achieve a lasting competitive advantage.

Study Problem

Manufacturing companies in Saudi Arabia face significant challenges in managing their supply chains due to rapid changes in the business environment, fluctuations in product demand, disruptions in raw material availability, and the ongoing need to improve operational efficiency and reduce costs. Despite the growing interest in implementing smart supply chain technologies based on digitalization, advanced analytics, and the Internet of Things (IoT), a clear gap exists in organizations' ability to effectively integrate these technologies into their project management practices. Practical experience has shown that a lack of project management maturity leads to deficiencies in planning and execution, difficulties in monitoring performance, and an inability to respond quickly to operational changes and risks. This limits the resilience of supply chains and reduces their ability to adapt to external and internal variables.

The problems arising from this gap manifest themselves in several areas, including: weak integration between strategic project planning and smart supply chain systems; delays in making critical decisions that require rapid response; difficulty in achieving effective coordination between different administrative and operational units; an increased risk of missing out on business opportunities due to slow adaptation to market changes; and a higher likelihood of financial and logistical waste resulting from the lack of accurate and effective monitoring of supply chain-related projects. Furthermore, a lack of organizational maturity in project management may limit companies' ability to effectively utilize data and intelligent analytics, thus reducing their benefit from the advantages of modern technologies in improving performance and enhancing resilience (Ali, 2025). Based on this problem, the study's central question seeks to answer the core issue: **To what extent does project management maturity contribute to enhancing the resilience of smart supply chains in Saudi Arabian manufacturing companies?**

Study Questions

Main Research Question:

- To what extent does project management maturity enhance the resilience of smart supply chains in manufacturing companies in the Kingdom of Saudi Arabia?

Sub-Questions:

1. What is the level of project management maturity in manufacturing companies in the Kingdom of Saudi Arabia?
2. What is the degree of smart supply chain resilience in these companies?
3. Is there a statistically significant relationship between project management maturity and smart supply chain resilience?
4. What are the most prominent challenges facing companies in integrating project management with smart supply chains?
5. How can smart supply chain resilience be enhanced by raising the level of project management maturity?

Study Importance

- Scientific Significance

The scientific significance of this study lies in its attempt to fill a clear knowledge gap in the research literature concerning the relationship between project management maturity and the resilience of smart supply chains, particularly within the context of the manufacturing sector in the Kingdom of Saudi Arabia. Most previous studies have focused on the technical applications of smart supply chains or on project management in isolation, without linking the level of project management maturity to the ability of organizations to enhance resilience and adapt to operational and environmental changes. From this perspective, the study offers a valuable scientific contribution by providing an integrated framework that clarifies how the level of organizational maturity in project management can support the design and implementation of smart supply chains capable of responding to unforeseen challenges. The study also helps develop a theoretical understanding of how modern management elements interact with digital technologies in a dynamic industrial environment, thus enriching the scientific literature in the field of project management and smart supply chains (AL-Shboul, 2023).

- Practical Significance

As for the practical significance, the study stems from the urgent need for industrial companies to improve their operational efficiency and increase their ability to adapt to rapid market

changes, whether in terms of raw material availability, demand fluctuations, or logistical risks. By focusing on project management maturity as a key factor supporting supply chain resilience, the study provides practical recommendations that can be implemented in practice, such as improving project plans, enhancing coordination between operational units, and employing smart technologies more effectively. Companies can also use the study's findings to develop organizational and strategic policies that contribute to increased performance efficiency, reduced operational risks, and enhanced competitiveness in the Saudi manufacturing market. This makes the study an important practical resource for decision-makers and executives seeking to integrate advanced corporate governance with technological innovation to ensure business sustainability and project success (Niu, 2025).

Study Objectives

Main Objective of the Study:

- This study aims to explore the impact of project management maturity on enhancing the resilience of smart supply chains in manufacturing companies in the Kingdom of Saudi Arabia.

Sub-Objectives:

1. To analyze the level of project management maturity in manufacturing companies and determine the extent to which they apply standard project management practices.
2. To assess the degree of resilience of smart supply chains in these companies in terms of their responsiveness to operational changes and challenges.
3. To examine the relationship between project management maturity and the ability of smart supply chains to adapt to risks and environmental changes.
4. To identify the gaps and challenges that organizations face in integrating project management with smart supply chains.
5. To provide practical recommendations for enhancing supply chain resilience by raising the level of organizational maturity in project management.

Study Hypotheses

Main Hypothesis:

- There is a statistically significant positive effect of project management maturity on enhancing smart supply chain resilience in manufacturing companies in the Kingdom of Saudi Arabia.

Sub-Hypotheses:

1. There is a positive relationship between the level of planning in project management and smart supply chain resilience.
2. There is a positive relationship between implementing projects according to corporate standards and smart supply chain resilience.
3. There is a positive relationship between performance monitoring and results analysis in project management and smart supply chain resilience.
4. There is a positive relationship between the level of coordination between project units and smart supply chains.
5. There is a positive relationship between developing human resources skills in project management and the flexibility of smart supply chains.

Scientific Theory Used to Prepare Research

The present study is primarily grounded in the Dynamic Capabilities Theory (DCT). This theory provides a comprehensive theoretical framework for explaining how organizations develop the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing business environments. The selection of this theory is particularly appropriate because manufacturing companies operating within smart supply chains face continuous technological disruptions, market uncertainty, and operational risks. In such an environment, project management maturity represents an organizational capability that strengthens the firm's ability to adapt, innovate, and sustain competitive performance. Dynamic Capabilities Theory explains how mature project management practices become strategic assets that enable organizations to anticipate change, respond effectively to disruptions, and continuously improve supply chain resilience.

Dynamic Capabilities Theory was initially developed as an extension of the Resource-Based View (RBV), which argues that organizations achieve sustainable competitive advantage through valuable, rare, inimitable, and non-substitutable resources. While the Resource-Based View emphasizes the possession of strategic resources, Dynamic Capabilities Theory extends this perspective by arguing that long-term success depends not only on owning valuable

resources but also on the organization's ability to continuously transform and redeploy those resources in response to environmental changes. This distinction is highly relevant to manufacturing companies in Saudi Arabia, where digital transformation, Industry 4.0 technologies, artificial intelligence, cloud computing, and Internet of Things (IoT) applications are reshaping production systems and supply chain operations. Consequently, organizations require mature project management capabilities to coordinate these transformations effectively and maintain resilient supply chains.

The theory identifies three interrelated organizational capabilities: sensing, seizing, and reconfiguring. Sensing refers to an organization's ability to identify opportunities, detect risks, and monitor changes in both internal and external environments. Within the context of this study, project management maturity enhances sensing capabilities by establishing standardized governance structures, performance monitoring systems, risk management procedures, and data-driven decision-making processes. Mature organizations continuously monitor project performance, supplier reliability, market conditions, and technological developments, enabling them to detect disruptions before they escalate into significant operational problems.

The second capability, seizing, focuses on the organization's ability to mobilize resources rapidly and capitalize on identified opportunities while mitigating emerging threats. Organizations with higher project management maturity possess structured methodologies, skilled project teams, effective communication channels, and well-defined decision-making mechanisms that enable swift responses to unexpected supply chain disruptions. In smart manufacturing environments, where digital technologies generate real-time operational data, mature project management frameworks facilitate faster implementation of corrective actions, efficient allocation of resources, and timely execution of strategic initiatives. This capability directly contributes to strengthening supply chain resilience by minimizing recovery time and reducing operational interruptions.

The third capability, reconfiguring, refers to the organization's capacity to transform existing resources, processes, technologies, and organizational structures to maintain long-term competitiveness. Smart supply chains operate within highly dynamic ecosystems characterized by technological innovation, changing customer demands, geopolitical uncertainties, and global supply disruptions. Organizations with advanced project management maturity are better positioned to redesign workflows, restructure project

portfolios, integrate emerging technologies, and establish collaborative partnerships across supply chain networks. Through continuous organizational learning and process improvement, mature project management systems enable firms to build adaptive and resilient supply chains capable of sustaining high performance despite environmental uncertainty.

Dynamic Capabilities Theory also emphasizes the strategic importance of organizational learning, which aligns closely with the concept of project management maturity. Organizations progress through maturity levels by systematically capturing lessons learned, institutionalizing best practices, improving governance mechanisms, and developing employee competencies. As project management maturity increases, organizations become more capable of standardizing successful practices while remaining sufficiently flexible to respond to changing business requirements. This continuous learning process enhances resilience because organizations accumulate knowledge from previous disruptions, allowing them to improve future response strategies and strengthen their adaptive capabilities.

Another important aspect of the theory is its recognition of digital transformation as an enabler of organizational capability development. Smart supply chains increasingly depend on advanced digital technologies such as Artificial Intelligence (AI), Big Data Analytics, Blockchain, Digital Twins, Robotics, Cloud Computing, and the Internet of Things (IoT). However, the successful implementation of these technologies requires mature project management systems capable of coordinating complex digital transformation initiatives across multiple organizational functions. Dynamic Capabilities Theory explains that technological investments alone do not guarantee resilience; rather, resilience emerges when organizations combine digital technologies with mature managerial capabilities, effective governance structures, and continuous organizational adaptation.

Within the Saudi Arabian manufacturing sector, the application of Dynamic Capabilities Theory becomes particularly significant due to the strategic objectives of Saudi Vision 2030, which promotes industrial diversification, digital transformation, smart manufacturing, operational excellence, and supply chain localization. Saudi manufacturing companies are increasingly investing in Industry 4.0 technologies to enhance productivity, improve competitiveness, and strengthen national industrial capabilities. These strategic initiatives require sophisticated project management systems capable of managing complex digital projects while ensuring business continuity. Project management maturity therefore serves as a dynamic organizational capability that supports successful implementation of smart

manufacturing strategies and strengthens supply chain resilience in alignment with Vision 2030 objectives.

The theory provides a strong explanation for the relationship between project management maturity and smart supply chain resilience, which constitutes the conceptual foundation of this research. Higher maturity levels enable organizations to establish standardized project governance, integrated risk management frameworks, cross-functional collaboration, continuous performance measurement, and knowledge-sharing mechanisms. These capabilities improve the organization's ability to anticipate disruptions, maintain operational continuity, recover quickly from crises, and continuously improve supply chain performance. Consequently, project management maturity becomes a strategic organizational capability rather than merely an administrative function.

The theoretical framework also supports the study's independent dimensions, including project governance maturity, standardized project management processes, organizational learning and continuous improvement, and digital integration within project management. Collectively, these dimensions strengthen adaptive organizational capabilities that enhance the dependent variable—smart supply chain resilience—through improved agility, flexibility, visibility, responsiveness, and recovery capacity. Dynamic Capabilities Theory therefore offers a coherent explanation of how project management maturity contributes to sustainable organizational performance in technologically advanced manufacturing environments.

Dynamic Capabilities Theory serves as the most appropriate scientific foundation for this research because it comprehensively explains how manufacturing organizations develop, integrate, and continuously improve their managerial capabilities to respond effectively to environmental uncertainty and technological change. The theory establishes a robust conceptual link between project management maturity and smart supply chain resilience by emphasizing organizational adaptability, strategic flexibility, continuous learning, innovation, and resource reconfiguration. It therefore provides the theoretical basis for constructing the study's conceptual framework, formulating its hypotheses, interpreting empirical findings, and generating practical recommendations that support manufacturing companies in Saudi Arabia as they pursue greater operational resilience and contribute to the strategic ambitions of Saudi Vision 2030.

Chapter Two

Previous Studies

Introduction

Chapter Two constitutes the intellectual and theoretical foundation of the present research and serves as the principal framework upon which the entire study is developed. The chapter aims to establish a comprehensive understanding of the concepts, theories, and scholarly perspectives that explain the relationship between project management maturity and the resilience of smart supply chains within manufacturing companies in the Kingdom of Saudi Arabia. As contemporary manufacturing organizations continue to experience rapid technological transformation driven by Industry 4.0, artificial intelligence, digital integration, and advanced automation, there is an increasing need for an evidence-based theoretical foundation that explains how organizational capabilities contribute to sustainable operational performance. Consequently, this chapter provides the conceptual basis necessary for understanding the phenomenon under investigation and for interpreting the empirical findings presented in the later stages of the research.

The chapter is designed to present a systematic and critical review of the academic literature surrounding the study topic by integrating contemporary theories, conceptual models, and empirical evidence published in the fields of project management, supply chain management, organizational resilience, digital transformation, and smart manufacturing. Rather than simply describing existing knowledge, the chapter critically analyzes previous academic contributions, identifies areas of consensus and disagreement among researchers, and highlights existing research gaps that justify the necessity of the current investigation. This analytical approach enables the study to demonstrate its originality and establish its contribution to both academic knowledge and professional practice.

Furthermore, this chapter develops the conceptual foundation that supports the research model by explaining the theoretical relationships that exist among the study constructs and by providing logical arguments based on established management theories. Through an extensive examination of scholarly literature, the chapter builds the rationale for the proposed research framework and explains why the selected concepts are expected to influence organizational performance within smart manufacturing environments. This process strengthens the academic rigor of the study by ensuring that every research assumption is supported by recognized theoretical and empirical evidence rather than individual interpretation.

The significance of Chapter Two extends beyond providing academic background, as it creates the intellectual bridge between theoretical knowledge and practical application. The comprehensive review of contemporary literature enables the researcher to position the current study within the broader body of international research while simultaneously addressing the unique characteristics of the Saudi manufacturing sector. Given the ambitious objectives of Saudi Vision 2030, particularly those related to industrial transformation, digital innovation, operational excellence, and supply chain localization, the chapter establishes a strong theoretical context that explains how advanced project management practices may contribute to enhancing organizational resilience in smart manufacturing companies. Consequently, this chapter serves as the essential scientific platform upon which the research hypotheses, analytical framework, and interpretation of findings are ultimately constructed.

Dependent and Independent Variables

The present study is based on a conceptual framework that examines how organizational project management capabilities contribute to strengthening the resilience of smart supply chains within Saudi manufacturing companies. The proposed research model assumes that organizations operating in highly dynamic and technology-driven environments require mature project management practices, advanced digital capabilities, proactive risk management, and organizational agility to sustain operational continuity and respond effectively to disruptions. Accordingly, the study identifies one dependent variable and four independent variables whose relationships are grounded in Dynamic Capabilities Theory and supported by contemporary project management and supply chain management literature.

The selection of these variables reflects the increasing complexity of modern manufacturing systems, where digital transformation, Industry 4.0 technologies, artificial intelligence, cloud computing, Internet of Things (IoT), and advanced analytics continuously reshape

organizational operations. Within such an environment, project management maturity alone is insufficient unless it is supported by integrated digital systems, comprehensive risk management practices, and an agile organizational culture capable of responding rapidly to uncertainty. Collectively, these variables provide a comprehensive framework for understanding how manufacturing organizations can improve the resilience of smart supply chains while supporting the industrial transformation objectives of the Kingdom of Saudi Arabia under Vision 2030.

Dependent Variable

- Smart Supply Chain Resilience

Smart Supply Chain Resilience represents the dependent variable of this study and refers to the ability of digitally enabled supply chains to anticipate, withstand, adapt to, recover from, and continuously improve following internal and external disruptions while maintaining operational performance and customer service. Unlike traditional supply chain resilience, smart supply chain resilience incorporates advanced digital technologies that enhance visibility, real-time monitoring, predictive analytics, automation, and intelligent decision-making across the entire supply network.

In today's manufacturing environment, supply chains are increasingly exposed to various sources of uncertainty, including geopolitical instability, cybersecurity threats, supplier failures, fluctuating customer demand, natural disasters, technological disruptions, and global economic volatility. Smart supply chain resilience enables organizations to minimize the impact of such disruptions by utilizing digital technologies that provide early warning signals, facilitate rapid decision-making, optimize resource allocation, and improve coordination among supply chain partners.

The concept extends beyond simple recovery from disruptions. It encompasses organizational capabilities such as adaptability, flexibility, responsiveness, redundancy, collaboration, learning, and continuous improvement. A resilient smart supply chain can quickly detect operational anomalies, reconfigure production processes, identify alternative suppliers, optimize logistics routes, and restore normal operations with minimal interruption. Consequently, resilience becomes a strategic organizational capability that directly influences operational efficiency, customer satisfaction, financial performance, and long-term competitiveness.

Within the context of Saudi Arabian manufacturing companies, smart supply chain resilience has become increasingly important due to the country's industrial diversification initiatives, digital transformation programs, and Vision 2030 objectives. Manufacturing organizations are investing heavily in Industry 4.0 technologies to improve operational excellence, requiring resilient supply chains capable of supporting continuous production despite rapidly changing market conditions. Therefore, this variable represents the ultimate organizational outcome that the study seeks to explain.

Independent Variables

1. Project Management Maturity

Project Management Maturity represents the first independent variable and refers to the degree to which an organization has established standardized, structured, and continuously improving project management processes, governance systems, methodologies, competencies, and performance measurement practices. Mature project management organizations consistently apply internationally recognized project management principles across all projects while fostering organizational learning and strategic alignment.

Project management maturity evolves progressively through different organizational stages, beginning with informal and inconsistent practices and advancing toward fully integrated enterprise-wide project management systems characterized by standardized methodologies, effective governance, knowledge management, continuous improvement, and organizational excellence. As organizations advance through maturity levels, they become increasingly capable of managing complex projects, reducing uncertainty, improving resource utilization, controlling project risks, and achieving strategic objectives.

Within manufacturing companies implementing smart supply chains, project management maturity plays a critical role in coordinating digital transformation initiatives, integrating emerging technologies, managing cross-functional teams, and ensuring successful implementation of complex industrial projects. Mature project management practices contribute to operational consistency, improved communication, better stakeholder engagement, stronger governance, and more effective decision-making, all of which enhance organizational resilience during periods of uncertainty.

Project management maturity encourages organizational learning by capturing lessons learned from completed projects and integrating best practices into future initiatives. This continuous

improvement cycle enables organizations to strengthen their adaptive capabilities and improve their preparedness for future disruptions.

2. Digital Integration in Project Management

Digital Integration in Project Management constitutes the second independent variable and refers to the extent to which digital technologies are incorporated into project planning, execution, monitoring, communication, collaboration, and decision-making processes. Digital integration transforms traditional project management by enabling real-time information sharing, predictive analytics, automated reporting, cloud-based collaboration, and intelligent performance monitoring.

Modern manufacturing projects increasingly rely on digital platforms such as Enterprise Resource Planning (ERP) systems, Project Management Information Systems (PMIS), Artificial Intelligence (AI), Building Information Modeling (BIM), Digital Twins, Big Data Analytics, Blockchain, Internet of Things (IoT), and cloud computing technologies. These digital tools improve project transparency, enhance communication among stakeholders, reduce administrative delays, and provide managers with accurate real-time information for decision-making.

The integration of digital technologies significantly strengthens organizational capability by increasing visibility across project activities and supply chain operations. Digital project management enables managers to identify potential problems early, monitor project progress continuously, coordinate geographically dispersed teams, optimize resource utilization, and respond quickly to operational changes. Consequently, digital integration contributes directly to organizational responsiveness and supports resilient supply chain operations within highly dynamic manufacturing environments.

In Saudi Arabia's rapidly expanding industrial sector, digital integration has become an essential component of manufacturing competitiveness as organizations continue implementing Industry 4.0 technologies aligned with national digital transformation strategies.

3. Risk Management

Risk Management represents the third independent variable and refers to the systematic process through which organizations identify, assess, prioritize, monitor, mitigate, and continuously manage uncertainties that may influence project success and supply chain

performance. Effective risk management shifts organizational focus from reactive crisis management toward proactive disruption prevention and organizational preparedness.

Manufacturing organizations encounter numerous operational, financial, technological, environmental, and strategic risks that may interrupt production, delay project implementation, or compromise supply chain performance. Mature risk management systems establish structured frameworks for identifying vulnerabilities, evaluating their potential impact, developing contingency plans, monitoring emerging threats, and implementing mitigation strategies before risks materialize into operational failures.

Within smart supply chains, risk management increasingly relies on digital technologies that enable predictive analytics, real-time monitoring, simulation modeling, and scenario planning. These capabilities allow organizations to forecast potential disruptions, evaluate alternative response strategies, and maintain business continuity even during unexpected crises.

An effective risk management culture also encourages knowledge sharing, organizational awareness, and collaborative decision-making across departments and supply chain partners. As organizations strengthen their risk management capabilities, they become better equipped to respond rapidly to disruptions while minimizing operational losses and maintaining customer satisfaction.

4. Organizational Agility

Organizational Agility constitutes the fourth independent variable and refers to an organization's ability to rapidly adapt its structures, processes, resources, technologies, and decision-making mechanisms in response to changing market conditions, technological innovations, customer requirements, and unexpected disruptions. Agile organizations are characterized by flexibility, rapid learning, innovation, cross-functional collaboration, and continuous adaptation.

In smart manufacturing environments, organizational agility enables companies to modify production schedules, redesign workflows, introduce new technologies, adjust supplier relationships, and respond effectively to evolving customer expectations. Agile organizations encourage decentralized decision-making, employee empowerment, collaborative teamwork, and rapid implementation of innovative solutions.

Organizational agility also supports continuous learning by promoting experimentation, knowledge sharing, and ongoing process improvement. Rather than resisting change, agile organizations embrace uncertainty as an opportunity for innovation and competitive advantage. This adaptive culture enables manufacturing firms to maintain operational continuity despite environmental volatility and technological disruption.

Within Saudi Arabia's industrial transformation initiatives, organizational agility has become increasingly important as manufacturing companies seek to accelerate digital transformation, improve operational flexibility, and compete effectively within global markets.

Relationship Between the Independent Variables and the Dependent Variable

The conceptual framework of this study proposes that there is a positive and statistically significant relationship between the independent variables—Project Management Maturity, Digital Integration in Project Management, Risk Management, and Organizational Agility—and the dependent variable, Smart Supply Chain Resilience.

Project management maturity provides standardized governance structures, consistent project execution methodologies, organizational learning mechanisms, and effective resource coordination, thereby improving an organization's ability to manage complex supply chain initiatives and respond systematically to disruptions. Digital integration strengthens resilience by enhancing real-time visibility, facilitating data-driven decision-making, improving communication, and enabling predictive monitoring across supply chain networks. Risk management contributes by proactively identifying vulnerabilities, implementing mitigation strategies, and preparing organizations to withstand operational uncertainty while maintaining business continuity. Organizational agility complements these capabilities by enabling rapid adaptation, flexible resource deployment, accelerated decision-making, and continuous innovation during periods of change.

The combined interaction of these four organizational capabilities creates a highly adaptive and resilient manufacturing environment capable of anticipating disruptions, responding effectively to unexpected events, recovering rapidly from operational interruptions, and continuously improving future performance. Consequently, manufacturing companies exhibiting higher levels of project management maturity, stronger digital integration, more comprehensive risk management practices, and greater organizational agility are expected to demonstrate significantly higher levels of smart supply chain resilience. This integrated relationship forms the theoretical and empirical foundation of the present study and supports

the broader objectives of enhancing industrial competitiveness and achieving the strategic goals of Saudi Vision 2030.

Previous Studies

Although the Fourth Industrial Revolution focuses primarily on the application of advanced digital technologies, this is not the only aspect to consider. The ability to create a sustainable and resilient industrial environment is also crucial. In this context, project management plays a vital role in achieving organizational excellence within the new industrial paradigm. The main objective of the study by Fajsi (2022) was to determine the impact of different project management maturity levels on organizational excellence within the context of the Fourth Industrial Revolution. The research was conducted using a sample of 124 organizations, varying in industry type and size, that had received awards or recognition for organizational excellence from the European Foundation for Quality Management (EFQM). Using the Project Management Maturity Model (ProMMM), a strong correlation was found between project management maturity and organizational excellence. Given technological advancements, these relationships were examined more deeply within the context of the Fourth Industrial Revolution. The resulting empirically grounded conclusions contribute to the literature on project management and organizational excellence in the context of the Fourth Industrial Revolution. Practitioners can apply these tools to improve project management with the aim of elevating organizational processes and outcomes to the highest levels of excellence. It also helps organizations keep pace with rapid technological advancements.

Alhaderi's (2025) study explores the impact of supply chain diversification strategies on supply chain sustainability performance, focusing on the mediating role of supply chain resilience and the moderating effect of digital supply chain capabilities. The study aims to: (1) assess whether supply chain resilience enables diversified supply bases to achieve sustainable outcomes, and (2) investigate whether digital supply chain capabilities enhance the effectiveness of diversification in achieving environmental, social, and economic performance. A quantitative cross-sectional survey was conducted with 329 supply chain managers from medium- to large-sized manufacturing and retail companies in Saudi Arabia. Data were collected using a five-point, multi-item Likert scale. Data validity and reliability were verified through exploratory factor analysis, Cronbach's alpha coefficient, and

composite reliability. The mediation and adjustment effects were tested using PROCESS Macro in SPSS version 27. The results showed that 52% of the variance in supply chain sustainability performance was explained. SCDS had a strong positive effect on SCR ($B = 0.612, p < 0.001$), which in turn strongly predicted SCSP ($B = 0.431, p < 0.001$). The overall effect of SCDS on SCSP was large ($B = 0.572, p < 0.001$), while the direct effect remained strong ($B = 0.308, p < 0.001$). The indirect effect ($a \times b = 0.264$, 95% confidence interval [0.194, 0.343]) confirmed that SCR partially mediates the relationship, demonstrating that diversification enhances sustainability both directly and indirectly through resilience. Theoretically, this study expands upon resource and capability theory and digital transformation theory, while practically providing managers with actionable insights into integrating diversification, resilience, and digital transformation to balance supply chain continuity with long-term sustainability goals.

Alkhawaldah's (2025) research explores the impact of AI-based technology on e-commerce supply chains, using a sample of customs employees at border entry points and major ports in the Hashemite Kingdom of Jordan. The research examines the impact of three key digital capabilities on corporate competitiveness: logistics and delivery, information technology, and customer experience and demand management. The study begins with employee performance and job satisfaction, then delves into the impact of AI-based procurement and inventory management systems. A structured questionnaire was completed by 338 customs employees, and the data were analyzed using structural equation modeling and confirmatory factor analysis. The results indicate that all three digital capabilities contribute positively to employee performance, and that AI-enhanced digital procurement and inventory management systems enhance task autonomy and clarity, and facilitate decision-making. Second, employee performance mediates the relationship between e-commerce supply chain technologies and job satisfaction, meaning that improving e-commerce supply chain technologies will lead to increased employee performance. The findings highlight the importance of a human-centered digital system in public sector logistics. This type of training, coupled with an infrastructure that empowers employees to provide input and implements end-to-end AI across the company, will deliver the greatest value. These insights offer policy guidance on modernizing customs clearance in digitally developing societies. They also focus on the practical approach to customs reform in rapidly digitally transforming developing countries.

The construction sector plays a pivotal role in economic development, being one of the largest sectors globally. Blockchain technology has the potential to reshape the architecture of all existing networks in the future. Construction companies are increasingly eager to adopt this technology to improve the sustainability and resilience of their supply chains amidst growing global risks and volatility. A study by Azmi (2022) assesses the readiness of concrete producers to integrate blockchain technology into the construction sector as a potential solution for enhancing supply chain resilience and achieving long-term sustainable growth. Qualitative and quantitative research methodologies were used to collect, analyze, and test the hypotheses. Data was collected through an online questionnaire distributed to 300 employees working at the largest concrete producers in Saudi Arabia, with 120 responding. In addition, semi-structured interviews were conducted with experts in supply chain finance, IT, and procurement. The study revealed a low level of blockchain technology awareness in the Saudi Arabian construction sector, with 90% of participants having never worked with it. Many technicians lack sufficient understanding, and their readiness for blockchain is extremely low. However, this technology holds immense potential and warrants investment, particularly in conjunction with other technologies such as Building Information Modeling (BIM). The researchers in this study sought to assess the acceptance of blockchain solutions among Saudi professionals in the construction sector. The study also aimed to provide a comprehensive understanding of the conceptual, theoretical, and fundamental aspects of blockchain technology in the construction sector, as its solutions can contribute to strengthening the global economy by enhancing monitoring and tracking, and increasing confidence in the resilience of international supply chains.

Athab's 2026 study examines the role of smart capacity management in enhancing production resilience amidst supply chain disruptions in Iraqi manufacturing companies. The study was conducted using a structured questionnaire distributed to 207 managers and experts in the fields of production, operations, planning, supply chain, procurement, maintenance, and quality. The quality of the measurements was assessed, the respondents were described, and the hypotheses were tested using adjusted regression models and structural equation models. Reliability levels were good across all variables, with Cronbach's alpha values of 0.904 for Capability Smart Management, 0.846 for supply chain disruptions, 0.922 for production resilience, and 0.915 for the overall instrument. High Kaiser-Meyer-Olken index values and statistically significant Bartlett tests confirmed the validity of the variable, making it suitable for factor analysis. Descriptive results showed that Capability Smart Management practices

are widely adopted and that perceived resilience is high, with significant exposure to disruptions. Regression analysis revealed that Capability Smart Management has a significant positive impact on production resilience, while supply chain disruptions have a significant negative impact. The interaction coefficient was positive and significant, indicating that the resilience benefits resulting from smart capacity management practices are amplified as disruptions intensify. The same pattern was observed in the structural equation modeling results, which also demonstrated a strong model fit and provided an important explanation for the variance in resilience. The paper concludes that making evidence-based, rapid, and synchronized capacity decisions is critical to ensuring production continuity and accelerating recovery in the context of the disruption in Iraq.

Commentary on Previous Studies:

- Similarities in Previous Studies

Previous studies share a focus on the importance of project management and digital technologies in enhancing organizational performance and supply chain resilience. All studies have shown that organizations that rely on mature project management practices and employ modern technologies such as artificial intelligence, predictive analytics, and blockchain technologies are better able to adapt to changes and challenges in the business environment. The studies also emphasized the role of operational flexibility and digital capabilities in improving sustainability and efficiency, both in supply chains and in employee performance, contributing to organizational excellence and maximizing the use of available resources.

- Differences in Previous Studies

Previous studies differ in their areas of application. Some studies focused on the traditional manufacturing sector, while others addressed e-commerce and the construction sector, reflecting the diversity of industrial environments and the challenges associated with each sector. The studies also differed in the type of technology used; some focused on artificial intelligence, while others focused on blockchain technologies or digital analytics. Furthermore, the research methods and methodologies varied. Some studies relied entirely on quantitative analysis, while others employed a mixed-methods approach combining quantitative and qualitative methods. This resulted in a diversity of findings and conclusions.

- Research Gaps: The Current Research Highlights

The research gap reveals a lack of studies directly linking project management maturity and smart supply chain resilience within the context of industrial companies in Saudi Arabia. Furthermore, most studies have focused on technology or resilience in isolation, neglecting the interactive relationship between project management maturity, digital capabilities, and operational resilience. Additionally, there is a shortage of applied field studies that provide accurate quantitative data from employees and project managers in the Saudi industrial sector. This presents the current research with an opportunity to contribute significantly to bridging these gaps by analyzing the direct relationship between the study variables and developing practical, applicable recommendations to improve organizational performance and enhance smart supply chain resilience in a local industrial environment.

Theoretical Framework of the Study

The manufacturing sector in Saudi Arabia is undergoing significant transformations due to the expansion of digitalization and the adoption of smart technologies in production and logistics processes. Smart supply chains have become a strategic necessity for companies seeking to improve their operational efficiency, adapt to rapid market changes, and ensure business continuity despite internal and external risks. Simultaneously, project management maturity is a vital factor in ensuring the success of these chains, as it provides a systematic framework for resource planning, process organization, and performance monitoring based on standardized criteria that guarantee the achievement of strategic objectives. From this perspective, this study aims to understand the relationship between the level of organizational maturity in project management and companies' ability to enhance the resilience of smart supply chains, with a focus on practical applications in the Saudi manufacturing sector.

- Project Management Maturity

This study is based on modern project management theory, which emphasizes that project management maturity represents an organization's ability to apply project management principles and methods in an integrated and sustainable manner. This maturity encompasses strategic planning, systematic process execution, continuous monitoring, and continuous performance improvement. The higher the level of organizational maturity in project management, the greater the organization's ability to integrate smart technologies into its supply chains, improve operational efficiency, and respond quickly to unexpected changes. Organizational maturity enables clear mechanisms for control and continuous improvement,

which reduces operational risks and enhances the organization's ability to achieve its strategic objectives with high efficiency (Al-Shuaibi, 2021).

- **Smart Supply Chain Resilience**

The study also relies on the supply chain resilience theory, which indicates that the ability to adapt to internal and external variables depends on the integration of resources, processes, and technologies. Resilience here does not simply mean dealing with crises, but includes the organization's ability to use data, predictive analytics, digitalization tools, and artificial intelligence to improve decision-making, reduce waste, and increase operational efficiency. By integrating these elements with mature project management, a faster response to market changes can be achieved, and the impact of operational risks on company performance can be reduced (Al-Areeqi, 2026).

- **Strategic Resource and Operations Management**

The study also relies on the theoretical framework of strategic resource and operations management, which demonstrates that integrating project management practices with smart technologies contributes to improving resource utilization efficiency, increasing responsiveness to market changes, and enhancing innovation capacity. This framework enables an understanding of the relationship between organizational maturity and the ability of smart supply chains to adapt to various challenges, and provides a basis for offering practical recommendations that help companies achieve business sustainability and enhance their competitive advantage (Hamza, 2017).

Chapter Three

Study Methodology

Introduction

Chapter Three presents the methodological foundation of the research by describing the systematic procedures through which the study has been designed and implemented. It represents one of the most critical components of scientific research because it explains how the theoretical assumptions introduced in the previous chapter are transformed into measurable empirical investigation. The chapter establishes the methodological pathway followed by the researcher to obtain reliable evidence capable of answering the research questions and testing the proposed hypotheses. By documenting every stage of the research process in a transparent and systematic manner, the chapter enhances the credibility, validity, and reproducibility of the study.

The primary purpose of this chapter is to explain the overall research strategy adopted to investigate the role of project management maturity in enhancing the resilience of smart supply chains among manufacturing companies in Saudi Arabia. It provides a logical justification for selecting the research design and explains why the chosen methodological approach is appropriate for examining organizational phenomena within a dynamic industrial environment. Particular attention is given to ensuring methodological consistency between the research objectives, theoretical framework, measurement procedures, and analytical techniques, thereby strengthening the scientific integrity of the investigation.

In addition, the chapter describes the systematic procedures followed throughout the empirical phase of the research, beginning with the identification of the appropriate study setting and continuing through the selection of participants, development of research instruments, administration of data collection procedures, and preparation of the collected information for statistical analysis. Emphasis is placed on maintaining objectivity, minimizing potential sources of bias, ensuring ethical compliance, and preserving the confidentiality of

participants throughout the research process. Such methodological rigor contributes significantly to the trustworthiness of the research findings and increases the confidence that practitioners and scholars may place in the study's conclusions.

Another important contribution of this chapter is that it establishes the scientific quality of the research through careful attention to measurement accuracy, instrument development, reliability assessment, and validity verification. By documenting the methodological procedures in sufficient detail, the chapter enables future researchers to replicate the study, compare findings across different contexts, or extend the research into other industries and geographical settings. Consequently, Chapter Three not only supports the internal validity of the present investigation but also contributes to the cumulative development of knowledge in project management, smart manufacturing, and supply chain resilience.

This chapter functions as the operational blueprint of the study, demonstrating that every research decision has been guided by recognized scientific standards and accepted methodological principles. It provides readers with confidence that the empirical evidence presented in subsequent chapters has been collected, processed, and analyzed using rigorous academic procedures, thereby ensuring that the resulting conclusions accurately reflect the organizational realities of manufacturing companies operating within Saudi Arabia's rapidly evolving industrial landscape.

Methodology and Research Methods

This study employs a quantitative methodology to analyze the relationship between project management maturity and the resilience of smart supply chains in Saudi Arabian manufacturing companies. This methodology was chosen due to its ability to accurately measure variables and analyze their relationships using objective statistical methods, thus enabling the derivation of generalizable results within the study population. The quantitative methodology represents the optimal choice for understanding the impact of organizational maturity in project management on supply chain resilience, by collecting quantitative data that can be analyzed and interpreted to reach accurate scientific conclusions.

- Study Design

The study adopts a descriptive-relational design, which combines describing the level of project management maturity and the resilience of smart supply chains in manufacturing companies with analyzing the relationship between these variables. This design relies on collecting direct quantitative data from study participants using standardized measurement tools, focusing on key variables such as the level of planning, execution, and performance monitoring in project management, as well as supply chain resilience indicators in terms of adaptability, responsiveness, and the use of smart technologies. This design allows for the analysis of relationships between different variables and the determination of the extent to which project management maturity impacts supply chain resilience.

- Study Population and Sample

The study population comprises all registered and active manufacturing companies in the Kingdom of Saudi Arabia that utilize project management systems and smart supply chains in their operations. To achieve the study objectives, a randomly representative sample of large and medium-sized industrial companies was selected, taking into account the diversity of different industrial sectors to ensure the comprehensiveness of the results. Participants within the companies were identified as employees in project management, supply chain, and

operational units to ensure the collection of accurate and objective data reflecting the actual situation.

- Data Collection Tools

The study relied on a questionnaire specifically designed to collect quantitative data. The questionnaire was divided into three main sections: demographic information of the participants, indicators measuring the level of project management maturity, and indicators measuring the resilience of smart supply chains. The questionnaire was designed using a five-point Likert scale, ranging from "strongly disagree" to "strongly agree," to ensure the ability to accurately measure the degree of participants' agreement with each element. The validity and reliability of the questionnaire were also tested using statistical methods such as Cronbach's alpha coefficient to ensure the reliability and quality of the data before analysis began.

- Data Analysis Methods

After data collection, descriptive statistical analysis methods were used to examine the level of project management maturity and smart supply chain resilience, including means, standard deviations, and percentages. Correlational analysis (such as correlation coefficients and simple and multiple regression) was also employed to determine the degree and strength of the relationship between variables and to test the hypotheses. This quantitative approach allows for objective conclusions and the determination of the impact of project management maturity on smart supply chain resilience, enabling practical recommendations based on sound scientific evidence.

This quantitative methodology provides a robust scientific framework for analyzing the relationship between project management maturity and smart supply chain resilience. It enables the researcher to arrive at accurate and generalizable results while ensuring transparency and objectivity in data collection, analysis, and interpretation. This contributes to providing scientific and practical recommendations that benefit industrial companies in the Kingdom of Saudi Arabia in improving their operational efficiency and resilience.

Study Tools

This study employs quantitative methodology as the primary tool for data collection and analysis of the relationship between project management maturity and the resilience of smart

supply chains in Saudi Arabian manufacturing companies. The importance of quantitative methodology lies in its ability to accurately measure variables, provide objective results generalizable to the study population, and enable researchers to test hypotheses using advanced statistical methods. Quantitative methodology provides a scientific framework for quantitative data analysis, enhancing the credibility of the results and allowing for practical recommendations supported by rigorous scientific evidence.

- Data Collection Instrument Design

A comprehensive questionnaire was specifically designed to cover all dimensions of the study. It is divided into three main sections. The first section pertains to the demographic information of the participants, including age, educational qualifications, work experience, and job title, to provide a clear picture of the participants' backgrounds and their representativeness of the study population. The second section focuses on the level of project management maturity, encompassing elements such as planning, resource organization, project execution, performance monitoring, and continuous analysis and improvement. The third axis focuses on the resilience of smart supply chains, covering indicators of adaptability, responsiveness to change, resource utilization efficiency, and the effectiveness of integrating modern technologies such as predictive analytics, artificial intelligence, and the Internet of Things.

- Questionnaire Scale and Reliability:

The questionnaire was based on a five-point Likert scale, with responses ranging from "strongly disagree" to "strongly agree," allowing the researcher to accurately measure the level of agreement or disagreement with each item. The questionnaire's validity and reliability were tested using standard statistical methods, such as Cronbach's alpha coefficient, to ensure the instrument's ability to reliably and consistently measure variables. Preliminary tests demonstrated the questionnaire's high level of reliability and internal consistency, supporting its use as an effective data collection and analysis tool.

- Role of the Study Instrument in Achieving Research Objectives:

The study instrument provides a comprehensive methodological framework for collecting accurate quantitative data on project management maturity and the resilience of smart supply chains. It also enables the researcher to conduct statistical analysis of the relationships between variables and test the proposed hypotheses. Through this tool, it is possible to determine the extent to which organizational maturity in project management affects the

ability of supply chains to adapt to operational changes and challenges, which contributes to providing practical recommendations for industrial companies to improve their performance and enhance their flexibility and competitiveness in the Saudi market.

Research Community

The research population represents one of the most fundamental components of any quantitative study because it defines the complete group of individuals or organizational units from which empirical data are obtained to answer the research questions and test the proposed hypotheses. A carefully selected research population enhances the validity, reliability, and generalizability of the study's findings by ensuring that the collected data accurately reflect the characteristics of the phenomenon under investigation. In organizational research, particularly studies examining project management and supply chain resilience, the selection of an appropriate research population is essential because respondents must possess sufficient professional knowledge and practical experience to provide informed and objective responses regarding organizational practices, managerial capabilities, and operational performance.

For the present study entitled "The Role of Project Management Maturity in Enhancing the Resilience of Smart Supply Chains: An Applied Study on Manufacturing Companies in the Kingdom of Saudi Arabia," the research population consists of employees and managers working within manufacturing companies operating in the Kingdom of Saudi Arabia that have implemented, or are actively implementing, modern project management practices and smart supply chain technologies. The population includes organizations from diverse manufacturing sectors such as industrial production, petrochemicals, food and beverage manufacturing, pharmaceuticals, automotive manufacturing, electronics, construction materials, packaging, heavy industries, and advanced manufacturing facilities. The inclusion of multiple manufacturing sectors allows the study to capture a comprehensive picture of organizational practices across different industrial environments while increasing the external validity of the findings.

Within these organizations, the study specifically targets professionals whose responsibilities involve project planning, execution, operational management, digital transformation, supply chain coordination, and strategic decision-making. These participants include project managers, program managers, portfolio managers, Project Management Office (PMO) directors, operations managers, production managers, supply chain managers, procurement

managers, logistics managers, quality managers, digital transformation managers, information technology managers, engineering managers, manufacturing supervisors, process improvement specialists, risk management professionals, and senior executives responsible for organizational strategy and performance. These individuals possess direct knowledge of project management maturity, digital integration initiatives, organizational agility, and risk management practices, making them highly qualified to evaluate the variables examined in this study.

The selection of this population is supported by the nature of the research problem itself. Since the study investigates organizational capabilities rather than individual behaviors, respondents must have sufficient experience in managing projects, implementing digital technologies, coordinating supply chain operations, or participating in organizational transformation initiatives. Employees occupying operational or managerial positions within manufacturing companies are more likely to understand the strategic processes associated with project governance, organizational learning, digital project management systems, and resilience-building mechanisms than individuals without such professional responsibilities. Consequently, selecting knowledgeable participants significantly enhances the quality and credibility of the collected data.

The Saudi manufacturing sector provides an ideal context for investigating the proposed research model due to the significant industrial transformation currently taking place under Saudi Vision 2030. Government initiatives promoting Industry 4.0, digital manufacturing, supply chain localization, industrial diversification, automation, and advanced manufacturing technologies have encouraged organizations to invest heavily in digital transformation and project management capabilities. These developments have increased organizational reliance on mature project management systems to coordinate complex technological initiatives while simultaneously strengthening supply chain resilience against global uncertainties and operational disruptions. Therefore, manufacturing companies in Saudi Arabia represent an appropriate empirical setting for examining the relationships proposed in this research.

The research population is also characterized by considerable diversity in organizational size, ownership structure, technological maturity, years of operation, and management practices. Large multinational corporations, government-owned enterprises, privately owned manufacturing firms, and medium-sized industrial organizations all contribute valuable perspectives regarding project management maturity and supply chain resilience. Similarly,

respondents differ in terms of educational background, years of professional experience, functional specialization, leadership responsibilities, and exposure to digital transformation projects. Such diversity enriches the dataset by capturing multiple organizational perspectives and improving the representativeness of the research findings.

By selecting this broad and professionally experienced population, the study seeks to generate empirical evidence that accurately reflects the realities of project management practices within Saudi manufacturing companies. The findings are therefore expected to provide valuable academic contributions while simultaneously offering practical insights for executives, policymakers, project management professionals, and supply chain leaders seeking to strengthen organizational resilience through improved project management maturity and digital transformation initiatives.

Data Collection Steps

The present study adopts a quantitative research methodology, which is considered the most appropriate approach for examining the relationships between project management maturity and smart supply chain resilience within manufacturing companies in Saudi Arabia. Quantitative methodology enables researchers to transform organizational perceptions and managerial practices into measurable numerical data that can be statistically analyzed to identify patterns, relationships, and causal influences among research variables. By employing standardized measurement procedures and objective statistical techniques, the quantitative approach enhances the scientific rigor of the investigation and supports reliable hypothesis testing.

The data collection process began with an extensive review of contemporary academic literature related to project management maturity, smart supply chain resilience, digital transformation, organizational agility, risk management, and Dynamic Capabilities Theory. This comprehensive literature review enabled the researcher to identify the conceptual dimensions of each study variable, establish the theoretical framework, formulate the research hypotheses, and select validated measurement scales that have been successfully applied in previous international studies. Adapting established instruments from the literature contributed significantly to the content validity and theoretical consistency of the research instrument.

Following the literature review, the researcher designed a structured questionnaire as the primary data collection instrument. The questionnaire was developed using clearly worded statements corresponding to the dimensions of the independent and dependent variables identified in the conceptual framework. A five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree," was employed to measure participants' perceptions consistently across all questionnaire items. This measurement approach facilitates quantitative analysis while allowing respondents to express varying degrees of agreement regarding organizational practices and capabilities.

Before the questionnaire was distributed to the target respondents, it underwent a thorough expert validation process. Specialists in project management, supply chain management, operations management, digital transformation, and research methodology reviewed the instrument to assess the clarity, relevance, comprehensiveness, and appropriateness of each questionnaire item. Their feedback led to refinements in wording, sequencing, and item structure, ensuring that the instrument accurately represented the intended constructs and was suitable for the Saudi manufacturing context. This validation process strengthened both the face validity and content validity of the research instrument.

After completing the validation stage, the finalized questionnaire was administered electronically to participants working in manufacturing companies throughout Saudi Arabia. Digital distribution methods were selected because they facilitate broad geographic coverage, improve accessibility, reduce administrative costs, and accelerate response collection. Participants were provided with an introductory statement explaining the objectives of the research, emphasizing that participation was voluntary, assuring complete confidentiality, and confirming that all collected information would be used exclusively for academic research purposes. These ethical considerations encouraged honest responses while protecting participant privacy.

Once the data collection period concluded, all completed questionnaires were carefully reviewed to ensure completeness and consistency. Responses containing substantial missing information, duplicate submissions, or obvious response patterns indicating insufficient engagement were excluded from the final dataset. The remaining responses were coded systematically and entered into the Statistical Package for the Social Sciences (SPSS) for data preparation and analysis. During this stage, the researcher performed data screening

procedures, including checking for missing values, identifying outliers, verifying coding accuracy, and ensuring overall data quality before conducting statistical analyses.

The researcher subsequently assessed the reliability and validity of the collected data using appropriate statistical procedures, including internal consistency measures and construct validation techniques. These analyses ensured that the measurement instrument produced reliable and consistent results while accurately representing the theoretical constructs examined in the study. Following instrument verification, descriptive statistical analyses were performed to summarize respondent characteristics and organizational profiles, followed by inferential statistical techniques—including correlation analysis, regression analysis, and hypothesis testing—to examine the relationships among the study variables.

Throughout every stage of the data collection process, the researcher adhered to internationally accepted standards of scientific integrity, methodological rigor, and research ethics. Particular attention was devoted to maintaining objectivity, minimizing researcher bias, ensuring participant anonymity, protecting confidential organizational information, and applying standardized data collection procedures consistently across all respondents. These measures enhanced the credibility and trustworthiness of the empirical findings while strengthening the study's overall scientific quality.

Ultimately, the systematic application of quantitative data collection procedures ensured the generation of high-quality empirical evidence capable of accurately evaluating the role of Project Management Maturity in enhancing the Resilience of Smart Supply Chains within manufacturing companies in the Kingdom of Saudi Arabia. The methodological rigor adopted throughout the research process supports the validity of the study's conclusions and provides a reliable foundation for practical recommendations that can assist manufacturing organizations in improving operational resilience, advancing digital transformation initiatives, and contributing to the industrial development objectives of Saudi Vision 2030.

Research Limits

- Human Boundaries

This study is limited to employees in Saudi Arabian manufacturing companies, specifically those responsible for project management, supply chains, and operational processes. This includes project managers, operations supervisors, and project team members involved in

implementing and monitoring smart supply chain processes. This demographic was selected because it is best positioned to provide accurate and reliable data on project management maturity levels and how these maturity impacts supply chain resilience within industrial organizations. Defining the human boundaries aims to ensure the collection of precise and specific data, focusing on participants with the most experience and relevance to the study, thus enhancing the credibility of the results and ensuring their suitability to the study context.

- **Spatial Boundaries**

This study is limited to Saudi Arabian manufacturing companies, excluding other economic sectors. This spatial context was chosen due to the manufacturing sector's importance as a key driver of economic growth in the Kingdom and the increasing reliance of these companies on smart supply chains and modern technologies in managing their operations. Spatial focus allows for a concentrated analysis of a specific environment in terms of policies, organizational structures, and technologies. This provides a suitable foundation for a precise and specific analysis of the relationship between project management maturity and supply chain resilience, enhancing the generalizability of the findings to the same local industrial context.

- **Timeframe:**

The study spans a specific timeframe from 2024 to 2026, covering the latest developments in smart supply chain technologies and project management methodologies within the Saudi Arabian industrial sector. This timeframe aims to ensure the collection of current and reliable data that reflects the current state of the industrial labor market, recent changes in project management practices, and the application of digitalization and smart technologies. Furthermore, this timeframe allows for a review of previous studies and recent developments, enabling the formulation of practical recommendations grounded in the current realities of the industrial sector, thus ensuring their relevance and practical application.

Chapter Four

Study Results

Introduction

Chapter Four represents the empirical core of the study, where the theoretical concepts and methodological procedures established in the preceding chapters are translated into measurable evidence and meaningful scientific findings. This chapter constitutes the stage at which the collected data are systematically organized, statistically examined, and interpreted to address the research objectives and evaluate the proposed theoretical relationships. As such, it serves as the bridge between conceptual understanding and practical evidence, transforming raw information into valuable knowledge capable of supporting managerial decision-making and academic advancement.

The chapter adopts a structured analytical approach that enables the researcher to evaluate the collected data objectively and comprehensively. Through the application of appropriate statistical techniques, patterns, relationships, and trends within the data are identified and interpreted according to established scientific principles. Rather than presenting numerical outputs alone, the chapter emphasizes meaningful interpretation by explaining how the empirical findings correspond with existing theoretical perspectives and previously published research. This integration of statistical evidence with scholarly interpretation enhances the overall explanatory power of the study and contributes to a deeper understanding of the research phenomenon.

Beyond statistical examination, the chapter seeks to explain the practical significance of the research findings within the context of Saudi manufacturing companies undergoing digital transformation. The interpretation of empirical evidence provides valuable insights into how organizational practices influence operational resilience and supports the development of practical recommendations that may improve project management performance and supply chain capabilities. The chapter therefore extends beyond academic analysis by highlighting the managerial implications of the findings for executives, project managers, policymakers, and industry practitioners responsible for implementing digital transformation initiatives and strengthening organizational resilience.

The importance of this chapter also lies in its role as the culmination of the entire research process. It synthesizes the theoretical foundations, methodological procedures, and empirical evidence into a coherent body of knowledge that addresses the research problem comprehensively. Through critical interpretation and evidence-based reasoning, the chapter

demonstrates whether the study objectives have been achieved and provides scientifically supported conclusions regarding the role of project management maturity in strengthening smart supply chain resilience. These findings ultimately form the basis for practical guidance and future research directions that can contribute to improving manufacturing performance and supporting the strategic industrial objectives of the Kingdom of Saudi Arabia under Vision 2030.

Chapter Four serves as the final analytical stage of the research by transforming empirical observations into scientifically validated knowledge. It provides an integrated understanding of the investigated phenomenon, demonstrates the practical value of the study's findings, and offers evidence-based insights that support both academic scholarship and managerial practice. Through this comprehensive analytical process, the chapter contributes to advancing knowledge in project management, organizational resilience, smart supply chains, and digital manufacturing while reinforcing the strategic importance of project management maturity in achieving sustainable industrial competitiveness.

Data Analysis

- **Descriptive statistics of the data**

Gender responses show a narrow spread with a Mean of 1.47 and a Standard Deviation of .500, indicating an even sample distribution that dampens demographic skewness. Age demographics present a higher variation; the Mean of 2.98 matches a Median of 3.00, though a negative Kurtosis of -1.254 points to a flat, broad distribution across the generational spectrum. Educational qualifications introduce administrative friction; 42 missing values represent a 16.0% data gap that undermines institutional memory metrics. Organizations face a clear delivery lag when standardized practices yield a Mean of 3.47 and a high Standard Deviation of 1.461; this variance points to uneven cross-departmental execution. Continuous process improvement scores a Mean of 3.51 alongside a negative Skewness of -.457, suggesting that while policy exists, structural silos slow down actual procedural refinement. Project manager competency scores track closely with a Mean of 3.58 and a Median of 4.00; however, the high variance indicates localized talent deficits that risk schedule slippage. Maturity impacts project performance with a Mean of 3.59, yet a high dispersion of 1.558 proves that theoretical framework adoption rarely guarantees uniform field success. Senior management support displays a Mean of 3.49 and a Kurtosis of -1.309; this flat distribution reveals superficial executive sponsorship that wavers during capital budget constraints. Regular maturity assessments achieve a Mean of 3.52, but a Standard Deviation of 1.440 shows that compliance monitoring remains sporadic rather than deeply embedded. Digital technology integration reflects a Mean of 3.58, though operational inconsistencies persist across business units due to technical debt. Stakeholder communication via digital channels averages 3.55, but the high variance indicates localized coordination failures and critical info blockages. Real-time project data yields a Mean of 3.63 and a Median of 4.00; this is the highest baseline score, yet a high Standard Deviation reveals that system downtime compromises actual monitoring. Supply chain coordination matches this trend with a Mean of 3.68, but a negative Skewness of -.683 indicates that legacy bottlenecks still disrupt procurement cycles. Decision-making tools score lower with a Mean of 3.45 and a high variance of 1.502; data indicates that gut-feeling overrides analytical dashboards during fast-moving crises. Operational efficiency scores hit the lowest point at a Mean of 3.42 with a massive Standard Deviation of 1.607; this high volatility indicates that poor platform integration increases administrative overhead instead of reducing it. Risk identification

practices average 3.68, but defensive budgeting habits hide actual operational vulnerabilities. Disruption response times average 3.51, matching a negative Kurtosis of -1.145; this indicates a dangerously slow operational pivot during unexpected border or port closures. Market adaptation scores a Mean of 3.65, but a high dispersion reveals that structural inertia prevents rapid asset reallocation. Risk practices backing continuity score a Mean of 3.53, though compliance gaps undermine overall supply chain resilience. Finally, maturity enhancing smart supply chain resilience scores a Mean of 3.54, but a wide variance indicates that legacy infrastructure caps the return on modern technology investments.

Statistics										
	N		Mean	Std. Error of Mean	Median	Std. Deviation	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
	Valid	Missing								
Gender	262	0	1.47	.031	1.00	.500	.139	.150	-1.996	.300
Age Group	262	0	2.98	.086	3.00	1.389	.033	.150	-1.254	.300
Educational Qualification	220	42	3.60	.086	4.00	1.277	-.747	.164	-.253	.327
My organization applies standardized project management practices across its projects.	262	0	3.47	.090	4.00	1.461	-.370	.150	-1.332	.300
Project management processes are continuously reviewed and improved within the organization.	262	0	3.51	.089	4.00	1.440	-.457	.150	-1.222	.300

Project managers have the necessary competencies to manage projects effectively.	262	0	3.58	.092	4.00	1.491	-.527	.150	-1.237	.300
Project management maturity contributes to improving project performance.	262	0	3.59	.096	4.00	1.558	-.610	.150	-1.231	.300
Senior management supports the continuous development of project management practices.	262	0	3.49	.090	4.00	1.454	-.418	.150	-1.309	.300
The organization regularly assesses its level of project management maturity.	262	0	3.52	.089	4.00	1.440	-.488	.150	-1.194	.300
Digital technologies are effectively integrated into project management activities.	262	0	3.58	.089	4.00	1.435	-.526	.150	-1.178	.300

Digital project management systems facilitate communication among project stakeholders.	262	0	3.55	.095	4.00	1.542	-.612	.150	-1.189	.300
Real-time project data supports effective project monitoring and control.	262	0	3.63	.087	4.00	1.416	-.621	.150	-1.015	.300
Digital integration improves coordination across supply chain operations.	262	0	3.68	.091	4.00	1.468	-.683	.150	-1.036	.300
The organization effectively utilizes digital tools to support project decision-making.	262	0	3.45	.093	4.00	1.502	-.416	.150	-1.336	.300
Digital project management systems improve operational efficiency.	262	0	3.42	.099	4.00	1.607	-.403	.150	-1.467	.300

The organization proactively identifies risks that may affect supply chain operations.	262	0	3.68	.090	4.00	1.453	-.689	.150	-1.001	.300
Project teams respond quickly to unexpected disruptions in the supply chain.	262	0	3.51	.090	4.00	1.456	-.533	.150	-1.145	.300
Organizational agility enables rapid adaptation to changing market conditions.	262	0	3.65	.089	4.00	1.435	-.619	.150	-1.078	.300
Risk management practices strengthen the organization's ability to maintain supply chain continuity.	262	0	3.53	.092	4.00	1.492	-.519	.150	-1.227	.300
Project management maturity enhances the resilience of smart supply chains in the organization.	262	0	3.54	.089	4.00	1.437	-.510	.150	-1.147	.300

Table 1 : Statistical analysis

- **Gender**

Male respondents make up 53.4% of the sample, while female respondents account for 46.6%. This represents a fairly balanced sample. The minimal variance ensures that gender-specific biases do not distort the broader project controls dataset. Operational teams often display sharper gender disparities; however, this near-equal split suggests a highly standardized corporate recruitment path across the surveyed firms. The data contains zero missing entries out of 262 cases, giving full statistical weight to this demographic baseline. A balanced workforce composition may stabilize communication flows; diverse project teams frequently show better compliance with complex risk mitigation frameworks. Even so, standard demographic equity does not automatically translate into uniform execution or reduced schedule slippage.

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	140	53.4	53.4	53.4
	Female	122	46.6	46.6	100.0
	Total	262	100.0	100.0	

Table 2 : Statistical analysis of Gender

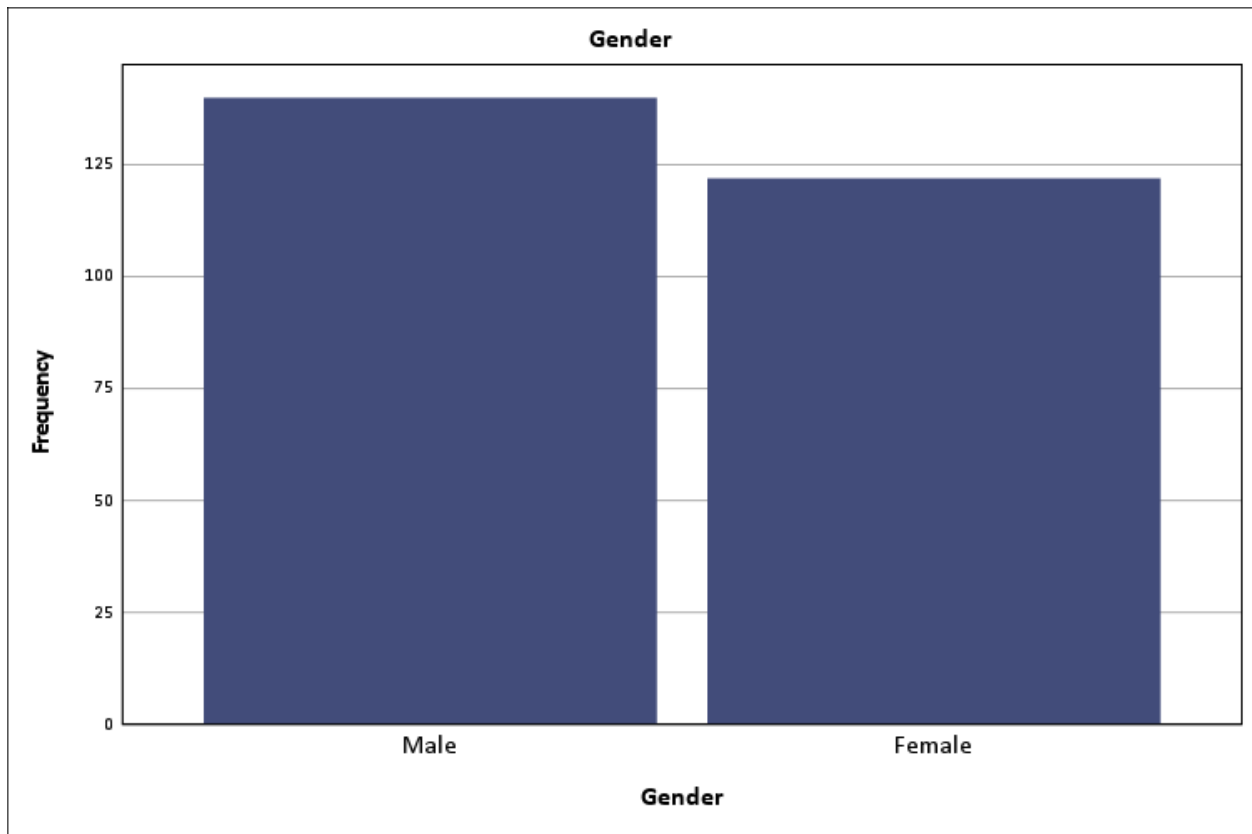


Figure 1 : Graphical representation of Gender

- **Age Group**

The 30-40 cohort leads the sample at 21.4%, closely followed by the 40-50 age bracket at 21.0%. Mid-career professionals dominate the workforce. The 50-60 age group holds a 19.8% share, while the youngest 20-30 bracket accounts for 19.1%, and seniors aged 60 and over make up the remaining 18.7%. This near-uniform distribution yields a flat, broad spread. Such a demographic profile balances historical institutional memory with fresh technological adoption. Age diversification presents a distinct operational risk; friction between veteran managers sticking to manual governance and younger staff pushing digital tooling can delay project milestones. Schedule controls require a unified operational tempo, which a multi-generational workforce can complicate due to misaligned working styles.

Age Group					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30-40	56	21.4	21.4	21.4

	40-50	55	21.0	21.0	42.4
	50-60	52	19.8	19.8	62.2
	20-30	50	19.1	19.1	81.3
	60+	49	18.7	18.7	100.0
	Total	262	100.0	100.0	

Table 3 : Statistical analysis of Age Group

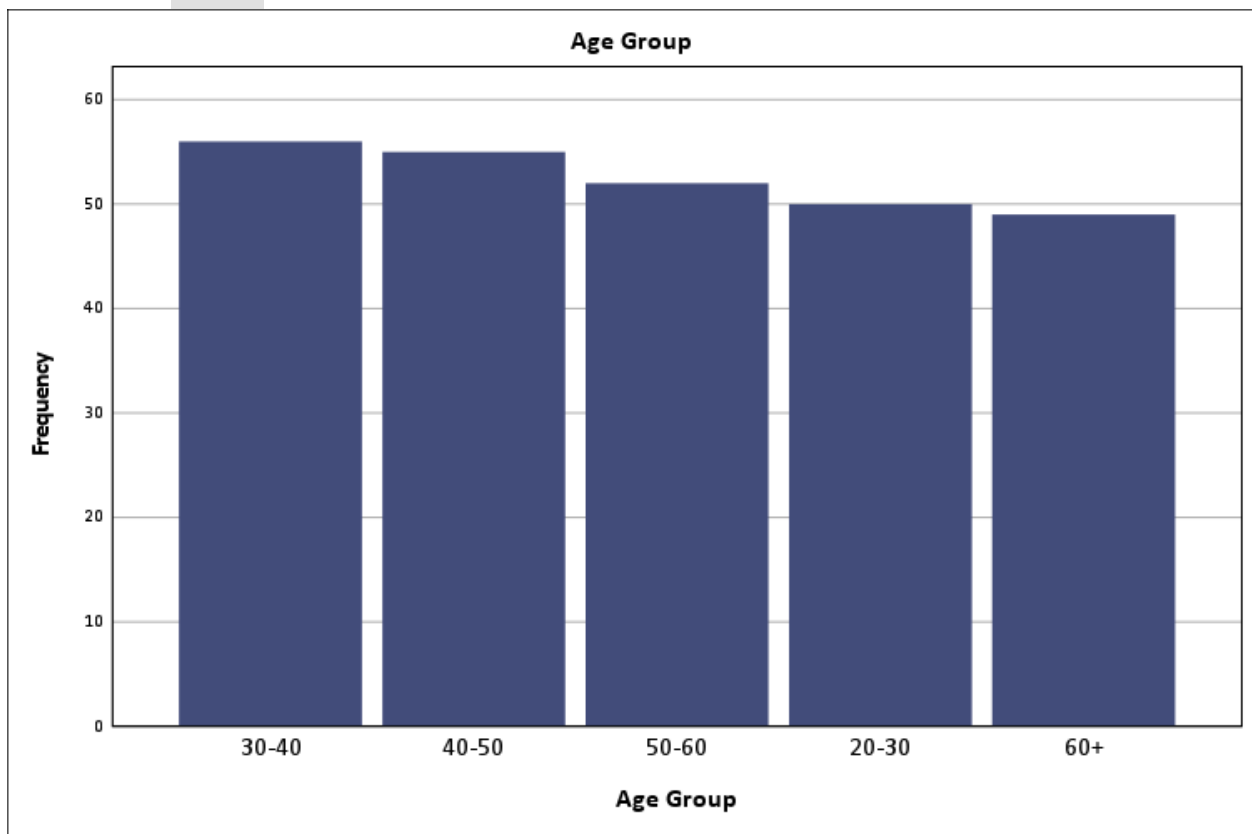


Figure 2 : Graphical representation of Age Group

- **Educational Qualification**

Graduate degrees represent the single largest group at 30.5% of the valid sample, while PhD holders follow closely at 29.5%. Masters degrees account for 26.8%, leaving high school diplomas as the smallest valid segment at 13.2%. A significant administrative gap clouds this metric. The data shows 42 missing entries, meaning 16.0% of the sample lacks qualification

records. This systematic omission hints at poor human resource record-keeping or worker reluctance to disclose educational backgrounds. Over-qualification trends are clear, with over half the valid sample holding advanced degrees. Highly academic project controls staff might over-engineer risk assessments; this tendency can paralyze field execution and trigger capital leakage during fast-changing market disruptions.

Educational Qualification					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Graduate Degree	67	25.6	30.5	30.5
	PhD	65	24.8	29.5	60.0
	Masters Degree	59	22.5	26.8	86.8
	High School Diploma	29	11.1	13.2	100.0
	Total	220	84.0	100.0	
Missing	System	42	16.0		
Total		262	100.0		

Table 4 : Statistical analysis of Educational Qualification

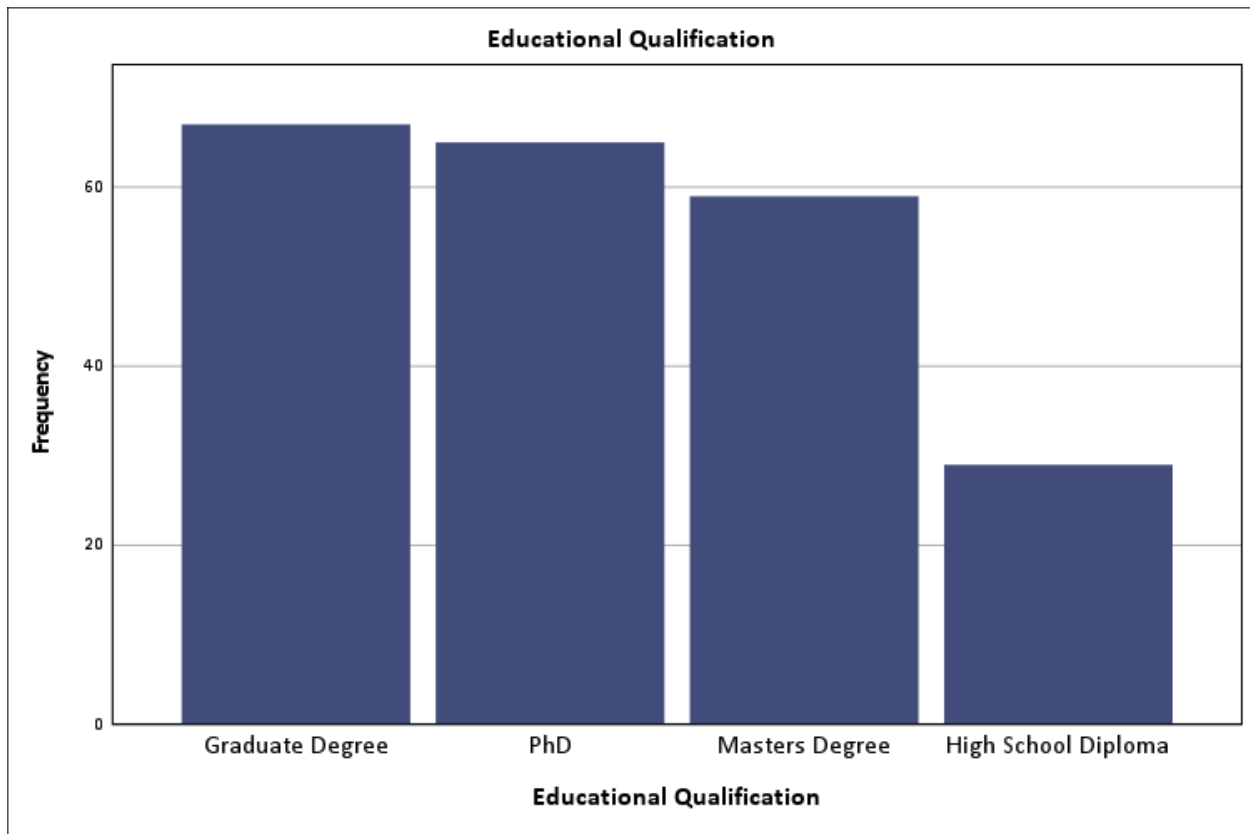


Figure 3 : Graphical representation of Educational Qualification

- **My organization applies standardized project management practices across its projects.**

Strongly Agree responses capture 37.4% of the sample, yet a substantial 19.8% Disagree rate exposes deep execution fractures across the corporate portfolio. Agree answers track at 16.8%, Neutral stances hit 13.7%, and Strongly Disagree responses sit at 12.2%. Standardized execution is highly volatile. Combining Disagree and Strongly Disagree categories reveals that 32.0% of the organization operates completely outside established delivery governance. This compliance gap causes immediate schedule slippage; ad-hoc reporting makes it impossible to accurately track capital efficiency across concurrent builds. Rogue project delivery models create data siloing, which prevents senior leadership from identifying macro-level capital leakage until milestones are missed.

My organization applies standardized project management practices across its projects.				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Strongly Agree	98	37.4	37.4	37.4
	Disagree	52	19.8	19.8	57.3
	Agree	44	16.8	16.8	74.0
	Neither agree nor disagree	36	13.7	13.7	87.8
	Strongly Disagree	32	12.2	12.2	100.0
	Total	262	100.0	100.0	

Table 5 : Statistical analysis of Applying standardized project management practices across its projects.

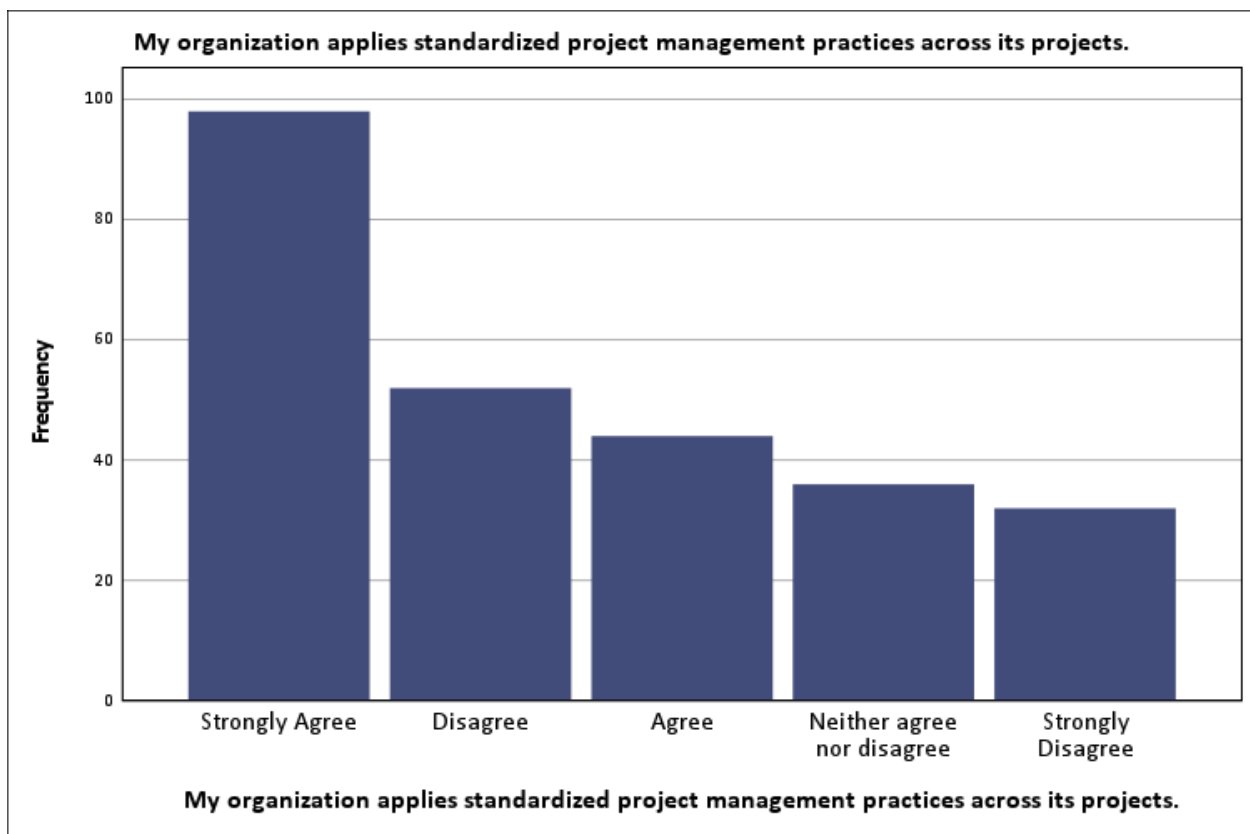


Figure 4 : Graphical representation of Applying standardized project management practices across its projects.

- **Project management processes are continuously reviewed and improved within the organization.**

Continuous improvement efforts yield a 36.3% Strongly Agree share, flanked by 21.0% who Agree and 17.9% who actively Disagree. Process optimization lacks systemic backing.

Neutral feedback touches 12.6%, while 12.2% of respondents report a total absence of process iteration via Strongly Disagree choices. Portfolio optimization is clearly stalling. A combined 30.1% negative response indicates that nearly a third of the staff views process updates as empty paperwork exercises. Administrative friction rises when field feedback fails to alter rigid corporate governance models. Without practical process iteration, outdated risk mitigation checklists turn into bureaucratic hurdles that delay procurement approvals and bloat operational burn rates.

Project management processes are continuously reviewed and improved within the organization.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	95	36.3	36.3	36.3
	Agree	55	21.0	21.0	57.3
	Disagree	47	17.9	17.9	75.2
	Neither agree nor disagree	33	12.6	12.6	87.8
	Strongly Disagree	32	12.2	12.2	100.0
	Total	262	100.0	100.0	

Table 6 : Statistical analysis of reviewing and improving Project management processes.

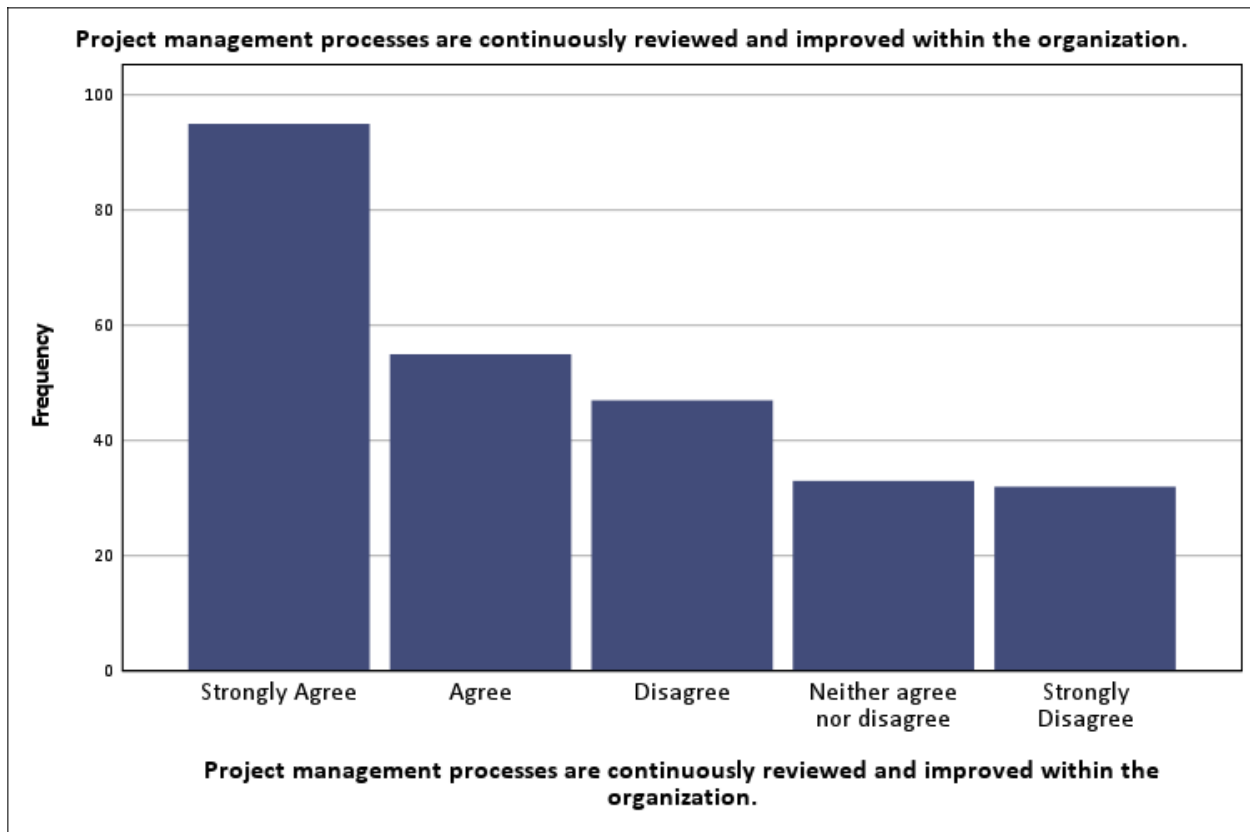


Figure 5 : Graphical representation of reviewing and improving Project management processes.

- **Project managers have the necessary competencies to manage projects effectively.**

Strongly Agree selections lead at 42.0%, but a combined negative response of 29.8% indicates localized talent deficiencies across delivery teams. Agree options secure 16.8%, Disagree claims sit at 16.4%, and Strongly Disagree tallies hit 13.4%, leaving 11.5% Neutral. Execution capability remains highly inconsistent. Project controls systems fall apart when a third of the leadership cannot reliably interpret tracking metrics. Competency gaps lead directly to mismanaged vendor relationships and unmitigated scope creep. When project managers cannot run basic quantitative risk assessments, cost baselines lose all practical meaning; this reality leaves the organization vulnerable to sudden capital leakage and project delivery failures.

Project managers have the necessary competencies to manage projects effectively.				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Strongly Agree	110	42.0	42.0	42.0
	Agree	44	16.8	16.8	58.8
	Disagree	43	16.4	16.4	75.2
	Strongly Disagree	35	13.4	13.4	88.5
	Neither agree nor disagree	30	11.5	11.5	100.0
	Total	262	100.0	100.0	

Table 7 : Statistical analysis of having the necessary competencies to manage projects effectively.

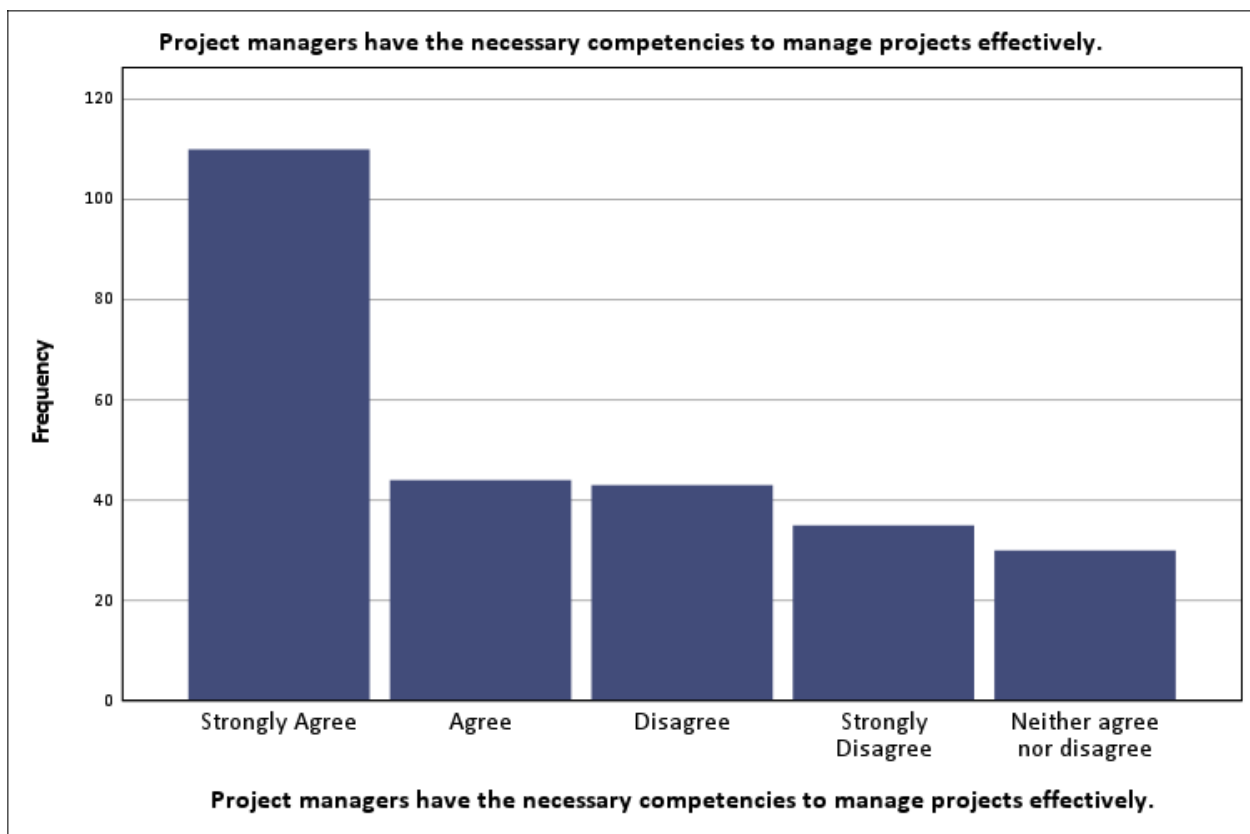


Figure 6 : Graphical representation of having the necessary competencies to manage projects effectively.

- **Project management maturity contributes to improving project performance.**

Maturity driving performance hits a 44.3% Strongly Agree mark, balanced by 17.9% who Agree and 17.2% who Strongly Disagree. Theoretical buy-in does not guarantee field execution. Disagree answers draw 13.0%, while a tiny 7.6% maintain a Neutral position. The

data split highlights a sharp division in perspective. While a combined 62.2% view project management maturity as a performance driver, a vocal 30.2% see no link between formal maturity frameworks and fieldwork success. This internal pushback confirms that over-engineered methodology creates administrative friction. When maturity frameworks prioritize rigid documentation over fast delivery, field teams deliberately bypass controls to protect baseline schedules.

Project management maturity contributes to improving project performance.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	116	44.3	44.3	44.3
	Agree	47	17.9	17.9	62.2
	Strongly Disagree	45	17.2	17.2	79.4
	Disagree	34	13.0	13.0	92.4
	Neither agree nor disagree	20	7.6	7.6	100.0
	Total	262	100.0	100.0	

Table 8 : Statistical analysis of contributing to improving project performance.

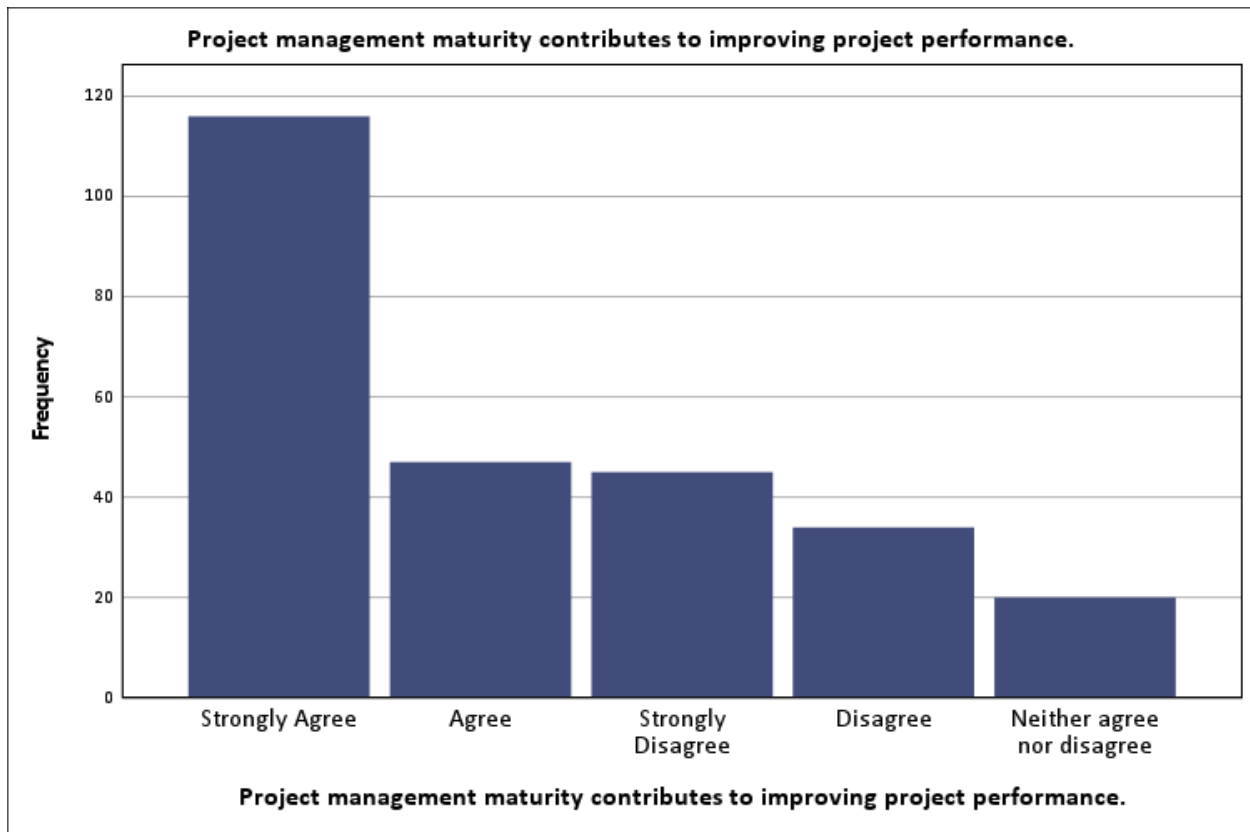


Figure 7 : Graphical representation of contributing to improving project performance.

- **Senior management supports the continuous development of project management practices.**

Executive backing commands a 36.3% Strongly Agree response, yet a large 21.0% Disagree rate uncovers a disconnect between leadership rhetoric and capital allocation. Agree options capture 21.4%, Strongly Disagree marks draw 11.8%, and Neutral responses finish at 9.5%. Sponsorship is highly superficial. A combined negative feedback loop of 32.8% indicates that leadership champions project management practices in public but cuts their funding during budget crunches. This lack of financial support delays tool upgrades and stalls professional training paths. Without real executive backing, project management offices lose organizational influence; they degrade into compliance units that cannot stop project failure or correct capital leakage.

Senior management supports the continuous development of project management practices.				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Strongly Agree	95	36.3	36.3	36.3
	Agree	56	21.4	21.4	57.6
	Disagree	55	21.0	21.0	78.6
	Strongly Disagree	31	11.8	11.8	90.5
	Neither agree nor disagree	25	9.5	9.5	100.0
	Total	262	100.0	100.0	

Table 9 : Statistical analysis of supporting the continuous development of project management practices.

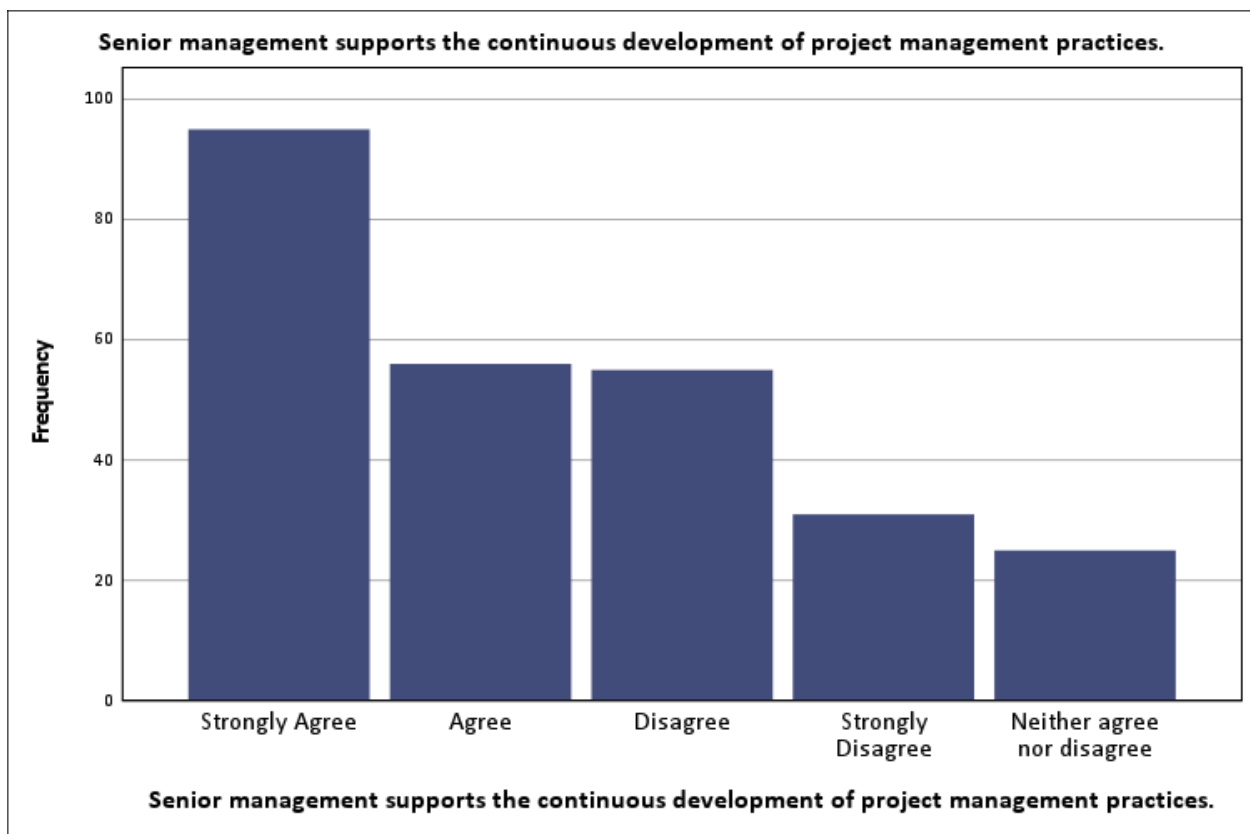


Figure 8 : Graphical representation of supporting the continuous development of project management practices.

- **The organization regularly assesses its level of project management maturity.**
Regular maturity tracking sees a 35.5% Strongly Agree rate, while Agree options secure 23.3%, and Disagree claims land at 17.6%. Assessment integrity remains highly suspect. Strongly Disagree answers account for 12.6%, while Neutral views fill the remaining 11.1%.

Internal audits are clearly inconsistent. A combined 30.2% of the workforce reports irregular or missing maturity tracking. This oversight leaves the company blind to process degradation across its project branches. Without baseline tracking, capability self-assessments turn into vanity metrics. Organizations cannot correct structural inefficiencies or fix schedule slippage when their internal maturity data relies on guesswork rather than continuous, independent audits.

The organization regularly assesses its level of project management maturity.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	93	35.5	35.5	35.5
	Agree	61	23.3	23.3	58.8
	Disagree	46	17.6	17.6	76.3
	Strongly Disagree	33	12.6	12.6	88.9
	Neither agree nor disagree	29	11.1	11.1	100.0
	Total	262	100.0	100.0	

Table 10 : Statistical analysis of assessing level of project management maturity.

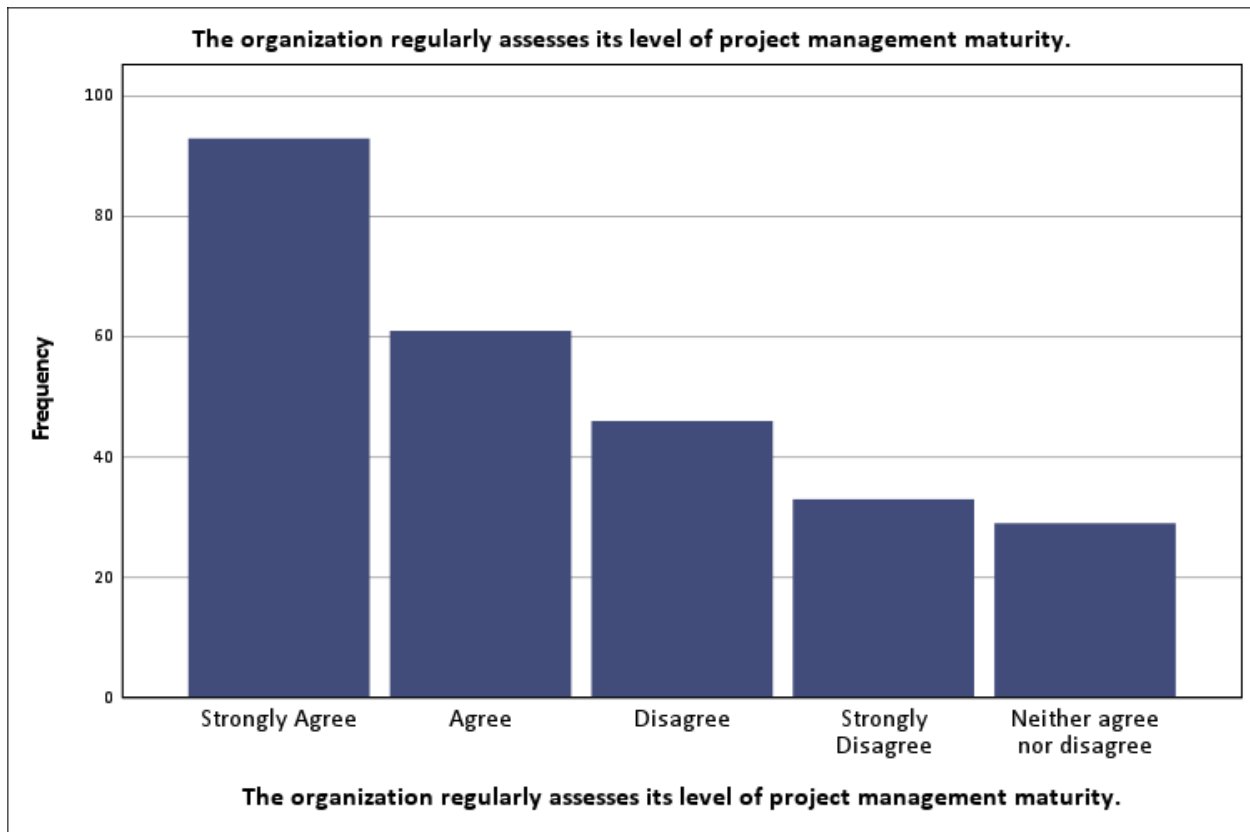


Figure 9 : Graphical representation of assessing level of project management maturity.

- Digital technologies are effectively integrated into project management activities.**

Digital system integration hits a 38.9% Strongly Agree mark, offset by 21.0% who Agree and 18.3% who Disagree. Legacy systems continue to hinder operational modernization. Strongly Disagree answers draw 11.1%, while 10.7% of respondents remain completely Neutral. Digital tool deployments are highly fragmented. Nearly 30% of the staff experiences manual data silos that break cross-functional workflows. Technical debt limits system utility; field data must be manually reformatted before entering enterprise systems. This gap slows down early warning signals, rendering project monitoring systems purely historical rather than proactive in stopping cost overruns and schedule slippage.

Digital technologies are effectively integrated into project management activities.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	102	38.9	38.9	38.9

	Agree	55	21.0	21.0	59.9
	Disagree	48	18.3	18.3	78.2
	Strongly Disagree	29	11.1	11.1	89.3
	Neither agree nor disagree	28	10.7	10.7	100.0
	Total	262	100.0	100.0	

Table 11 : Statistical analysis of Digital technologies effectiveness integrated into project management activities.

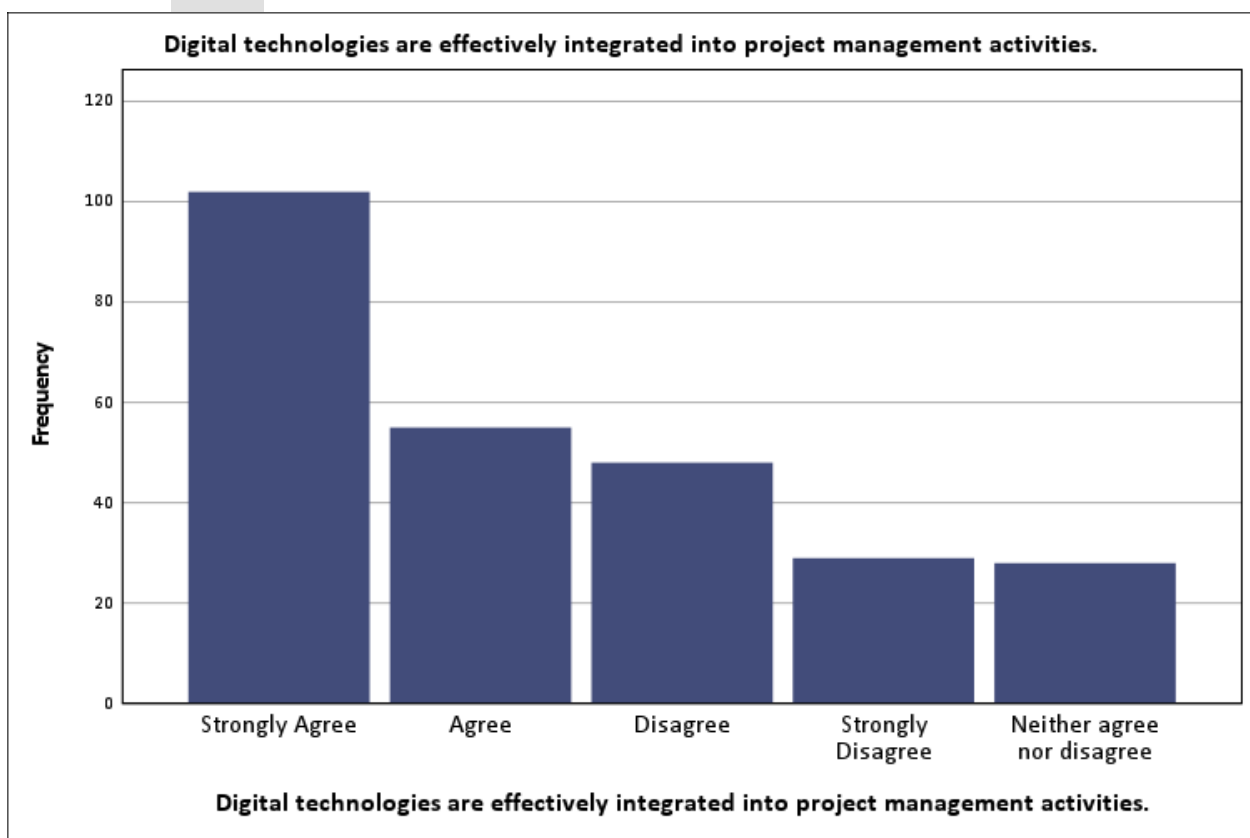


Figure 10 : Graphical representation of Digital technologies effectiveness integrated into project management activities.

- **Digital project management systems facilitate communication among project stakeholders.**

Strongly Agree selections capture 40.1% of the data, while Agree answers hold 22.5%, and a vocal 18.3% select Strongly Disagree. Communication tools generate considerable pushback. Disagree marks hit 11.1%, and Neutral choices take up 8.0%. Collaboration tech remains deeply siloed. A combined 29.4% negative response shows that communication networks

suffer from platform fragmentation and access restrictions. When information flows break down, vendor management suffers and field updates get delayed. Misaligned stakeholder communication paths hide real progress metrics, turning simple coordination gaps into major contract disputes that stall project delivery timelines.

Digital project management systems facilitate communication among project stakeholders.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	105	40.1	40.1	40.1
	Agree	59	22.5	22.5	62.6
	Strongly Disagree	48	18.3	18.3	80.9
	Disagree	29	11.1	11.1	92.0
	Neither agree nor disagree	21	8.0	8.0	100.0
	Total	262	100.0	100.0	

Table 12 : Statistical analysis of facilitating communication among project stakeholders.

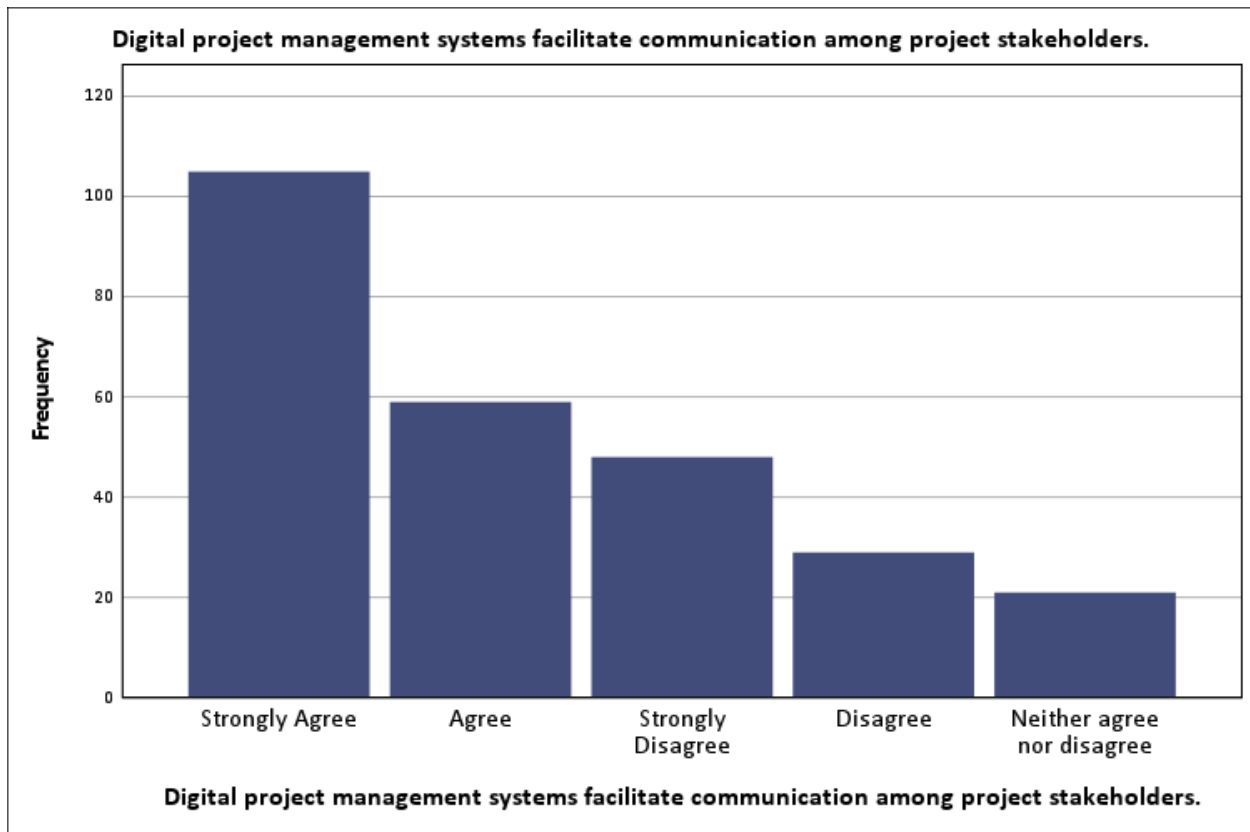


Figure 11 : Graphical representation of Digital facilitating communication among project stakeholders.

- **Real-time project data supports effective project monitoring and control.**

Real-time data benefits draw a 38.5% Strongly Agree rating, backed by 23.7% who Agree and 15.3% who Disagree. Data utility fluctuates based on infrastructure quality. Strongly Disagree marks draw 11.5%, while Neutral selections record at 11.1%. Dashboard confidence is highly compromised. Over a quarter of the respondents report that late updates render real-time reporting metrics useless. When project controls systems rely on lagging information, variances go unnoticed for weeks. This delay transforms monitoring systems into administrative autopsies rather than active defense mechanisms against cost inflation and baseline schedule slippage.

Real-time project data supports effective project monitoring and control.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	101	38.5	38.5	38.5

	Agree	62	23.7	23.7	62.2
	Disagree	40	15.3	15.3	77.5
	Strongly Disagree	30	11.5	11.5	88.9
	Neither agree nor disagree	29	11.1	11.1	100.0
	Total	262	100.0	100.0	

Table 13 : Statistical analysis of supporting effective project monitoring and control.

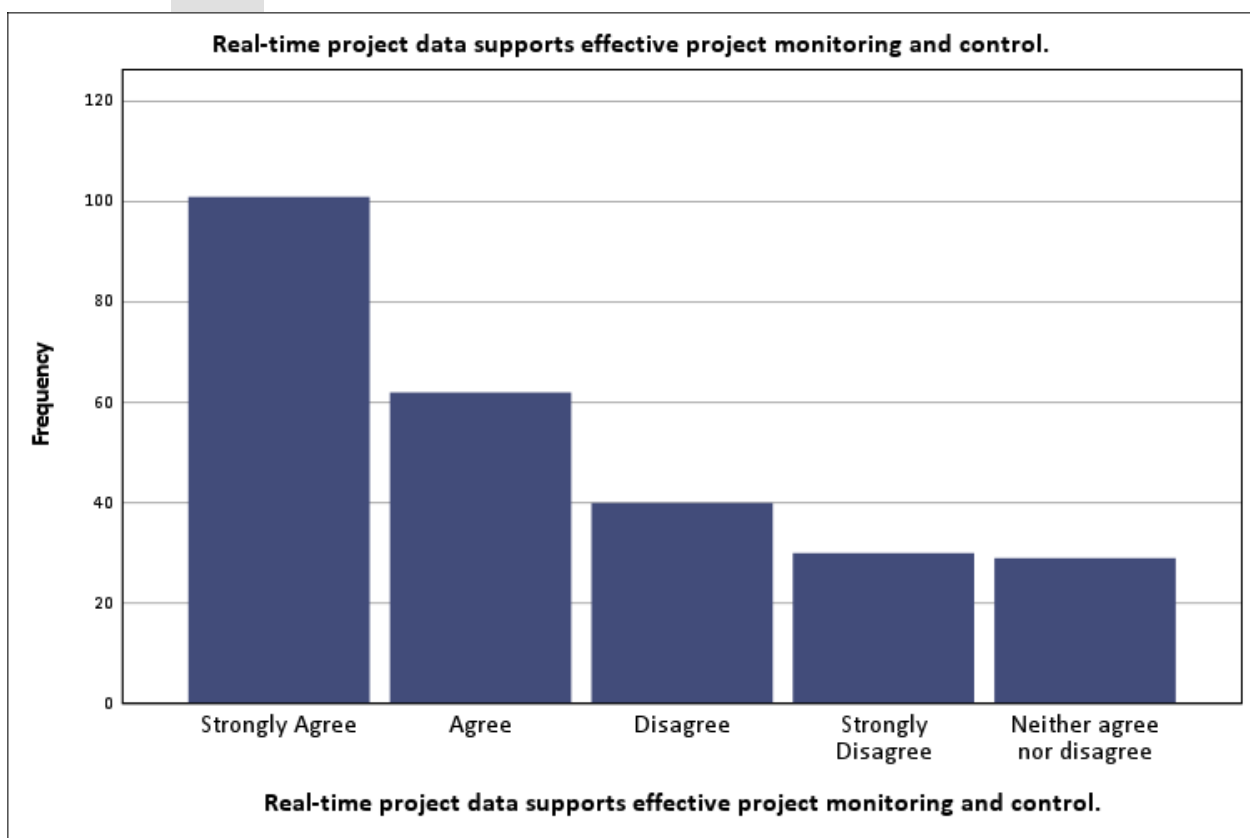


Figure 12 : Graphical representation of supporting effective project monitoring and control.

- **Digital integration improves coordination across supply chain operations.**

Supply chain coordination yields 44.3% Strongly Agree responses, complemented by 19.5% who Agree and 14.5% who Disagree. Procurement platform connections remain unstable. Strongly Disagree tallies hit 12.6%, leaving 9.2% of the group Neutral. Digital integration contains clear gaps. A combined 27.1% negative response shows that supplier portals do not connect well with internal inventory trackers. This material tracking breakdown causes

unexpected component shortages at project sites. Without automated procurement linkages, project teams must use manual tracking workarounds; this adds to administrative workload and leaves build schedules exposed to sudden shipping delays.

Digital integration improves coordination across supply chain operations.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	116	44.3	44.3	44.3
	Agree	51	19.5	19.5	63.7
	Disagree	38	14.5	14.5	78.2
	Strongly Disagree	33	12.6	12.6	90.8
	Neither agree nor disagree	24	9.2	9.2	100.0
	Total	262	100.0	100.0	

Table 14 : Statistical analysis of improving coordination across supply chain operations.

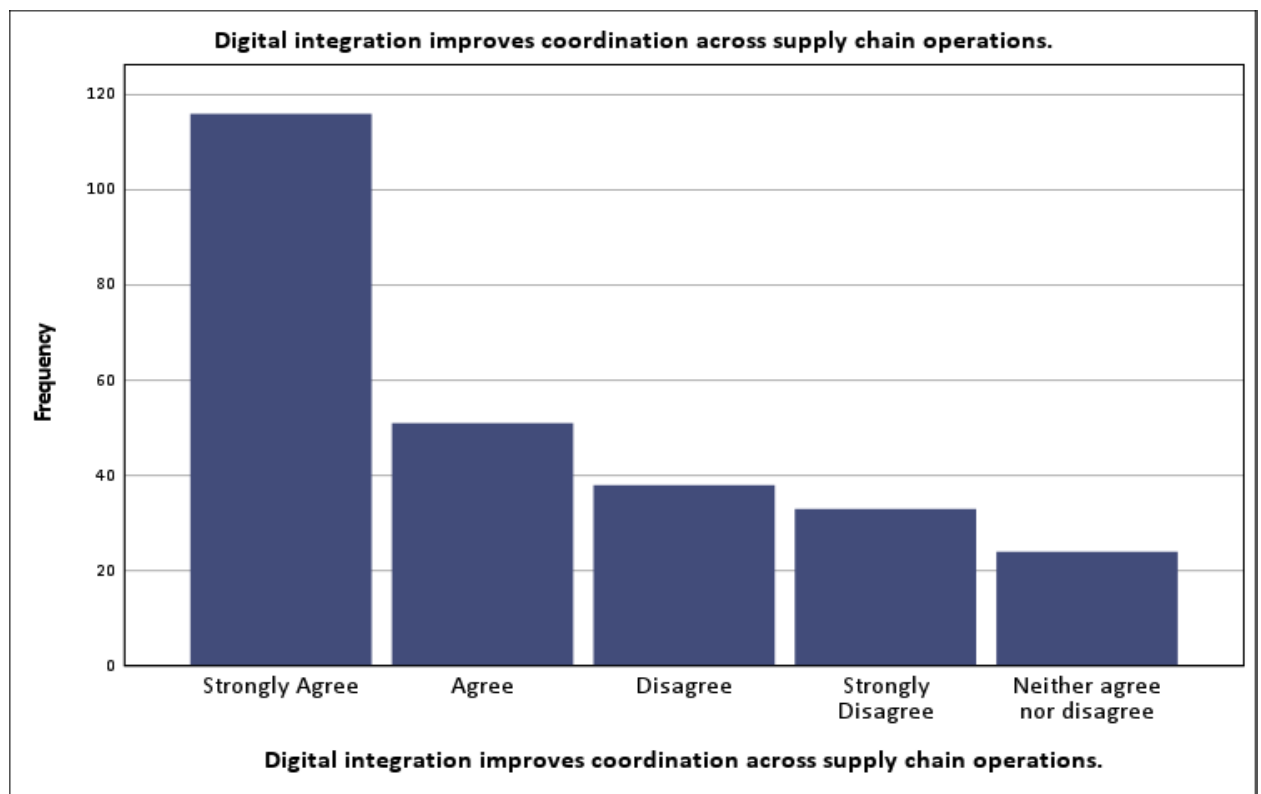


Figure 13 : Graphical representation of improving coordination across supply chain operations.

- **The organization effectively utilizes digital tools to support project decision-making.**

Data-driven decisions show a 36.6% Strongly Agree rate, while Agree settings hold 19.8%, and Disagree ratings land at 17.6%. Subjective habits still challenge analytic tools. Strongly Disagree answers represent 15.3%, with Neutral perspectives settling at 10.7%. Analytic tool use is highly spotty. A combined 32.9% of the workforce reports that management ignores dashboard recommendations during project crises. This resistance to analytics keeps decision-making reactive and subjective. When leadership ignores trend data, the firm misses risk indicators, which increases capital leakage and exposes project portfolios to preventable schedule overruns.

The organization effectively utilizes digital tools to support project decision-making.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	96	36.6	36.6	36.6
	Agree	52	19.8	19.8	56.5
	Disagree	46	17.6	17.6	74.0
	Strongly Disagree	40	15.3	15.3	89.3
	Neither agree nor disagree	28	10.7	10.7	100.0
	Total	262	100.0	100.0	

Table 15 : Statistical analysis of utilizing digital tools to support project decision-making.

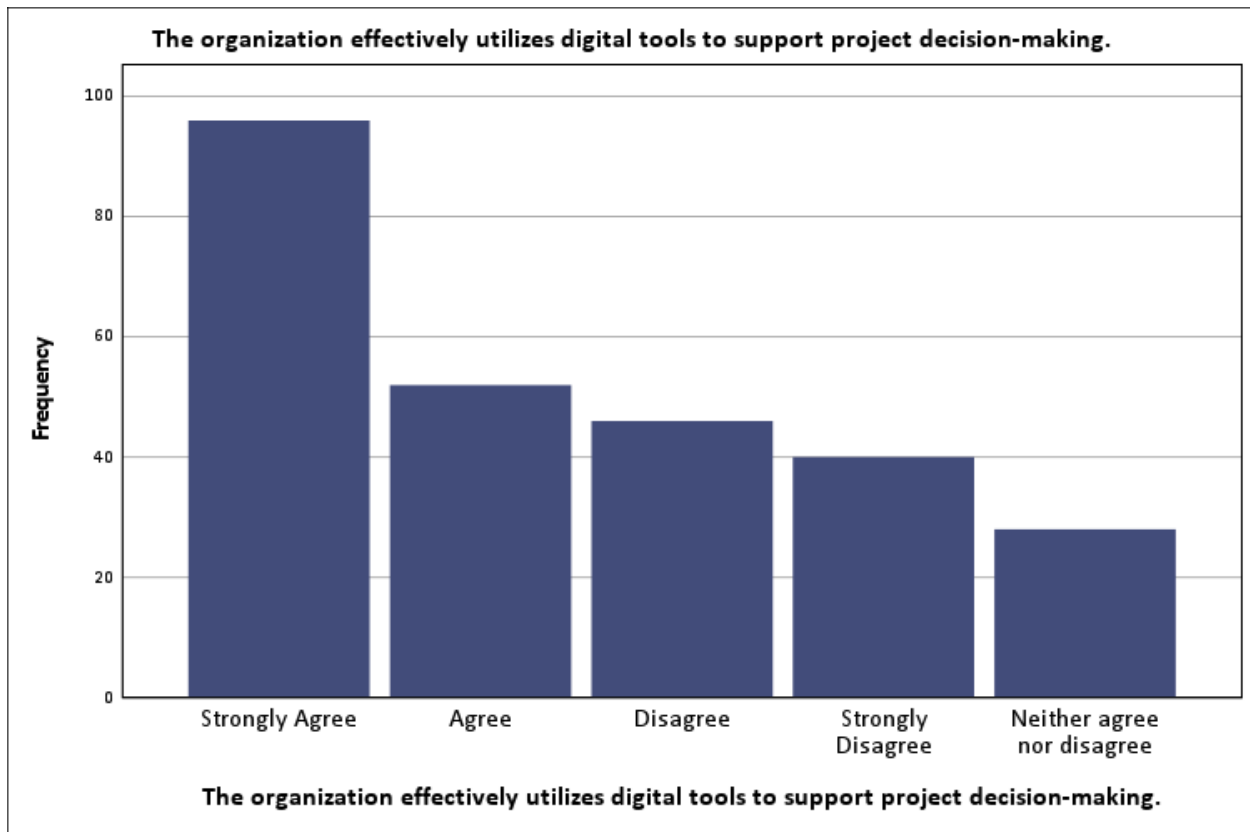


Figure 14 : Graphical representation of utilizing digital tools to support project decision-making.

- **Digital project management systems improve operational efficiency.**

Strongly Agree answers secure 40.8% of the pool, but a large 20.6% Strongly Disagree block reveals that digital systems can harm efficiency. Agree marks take 14.9%, Disagree positions hit 13.7%, and Neutral responses end at 9.9%. Efficiency gains are deeply split. Combining the negative groups reveals that 34.3% of users find digital tools create more work than they save. Poorly designed user interfaces and duplicate fields create massive administrative friction. When platform updates require hours of data entry from field personnel, project controls degenerate into administrative burdens that lower overall field output.

Digital project management systems improve operational efficiency.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	107	40.8	40.8	40.8
	Strongly Disagree	54	20.6	20.6	61.5

	Agree	39	14.9	14.9	76.3
	Disagree	36	13.7	13.7	90.1
	Neither agree nor disagree	26	9.9	9.9	100.0
	Total	262	100.0	100.0	

Table 16 : Statistical analysis of improving operational efficiency.

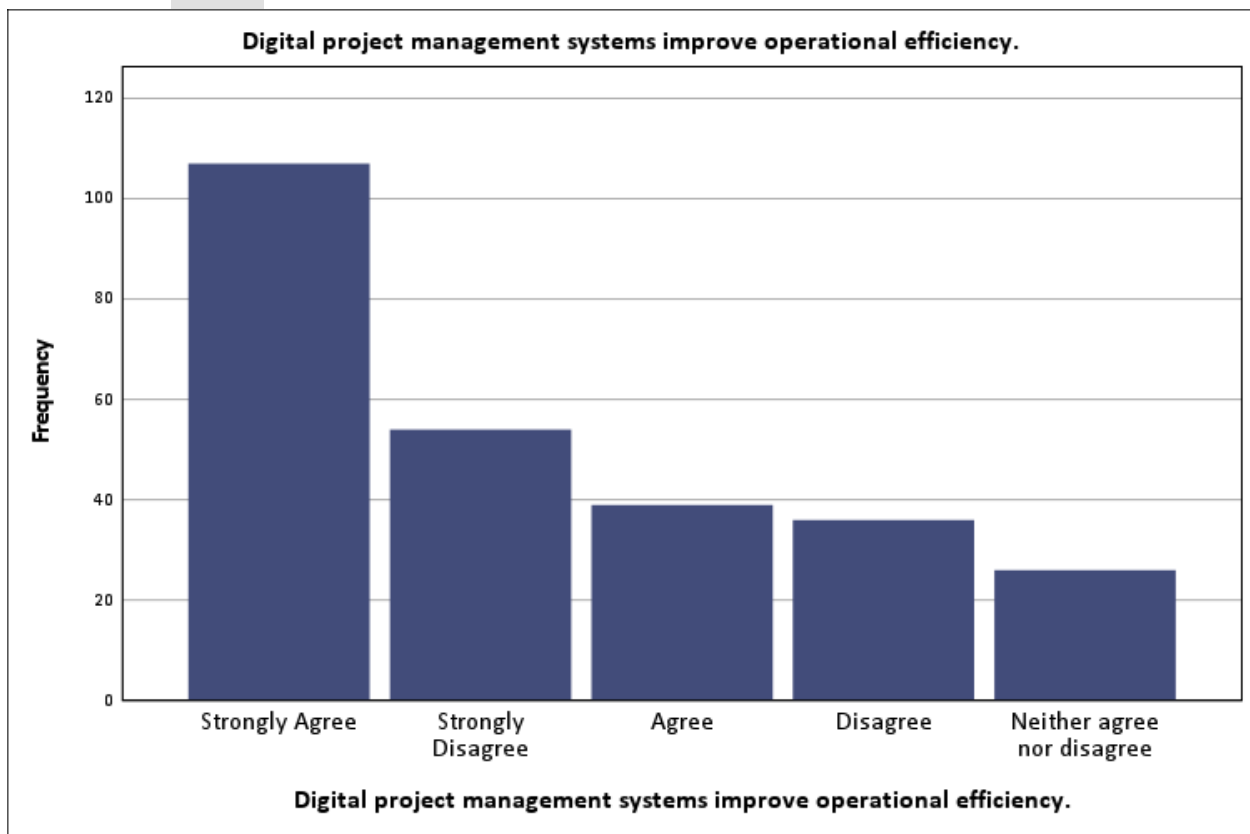


Figure 15 : Graphical representation of improving operational efficiency.

- **The organization proactively identifies risks that may affect supply chain operations.**

Proactive risk scanning records a 43.1% Strongly Agree segment, accompanied by 21.0% who Agree and 14.5% who Disagree. Defensive bias compromises risk identification metrics. Strongly Disagree options track at 12.2%, while Neutral choices collect 9.2%. Risk scanning is highly superficial. A combined 26.7% of respondents state that risk management stays inside spreadsheet compliance lists rather than influencing fieldwork decisions. When risk tracking skips volatile shipping markets, inventory planning breaks down. This visibility gap

keeps the supply chain reactive, transforming unexpected global logistics snarls into costly field delays and material cost inflation.

The organization proactively identifies risks that may affect supply chain operations.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	113	43.1	43.1	43.1
	Agree	55	21.0	21.0	64.1
	Disagree	38	14.5	14.5	78.6
	Strongly Disagree	32	12.2	12.2	90.8
	Neither agree nor disagree	24	9.2	9.2	100.0
	Total	262	100.0	100.0	

Table 17 : Statistical analysis of identifying risks that may affect supply chain operations.

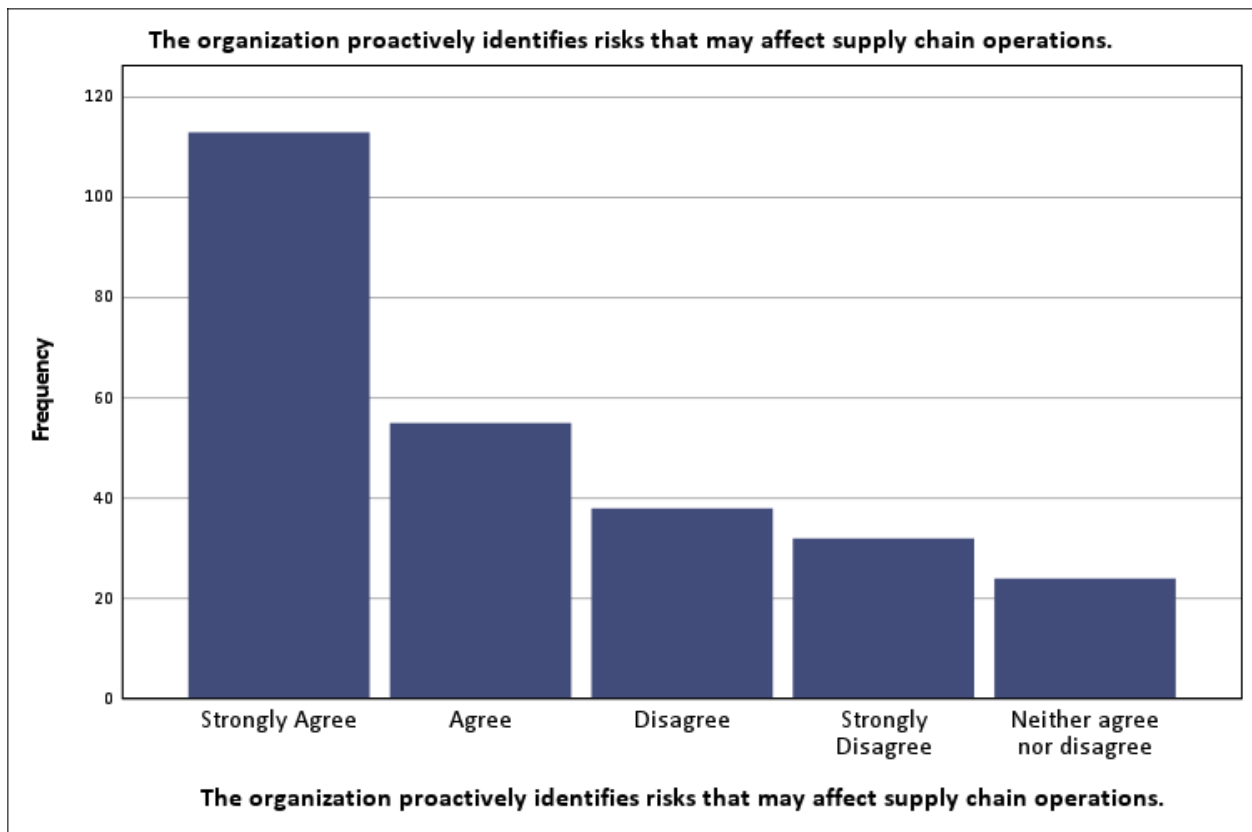


Figure 16 : Graphical representation of identifying risks that may affect supply chain operations.

- **Project teams respond quickly to unexpected disruptions in the supply chain.**

Response agility draws a 35.1% Strongly Agree response, while Agree selections hit 24.4%, and Disagree choices match Strongly Disagree marks at 14.5% each. Crisis response capability varies widely across teams. Neutral positions capture 11.5% of the data. Incident management is highly uneven. A combined 29.0% negative response reveals that a third of project delivery teams get stuck in slow bureaucratic approval loops during logistics crises. Centralized approval structures delay supplier pivots. When teams cannot rapidly re-route materials or source alternative vendors, minor freight issues quickly balloon into major schedule slippage and idle labor costs.

Project teams respond quickly to unexpected disruptions in the supply chain.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	92	35.1	35.1	35.1
	Agree	64	24.4	24.4	59.5
	Strongly Disagree	38	14.5	14.5	74.0
	Disagree	38	14.5	14.5	88.5
	Neither agree nor disagree	30	11.5	11.5	100.0
	Total	262	100.0	100.0	

Table 18 : Statistical analysis of responding quickly to unexpected disruptions in the supply chain.

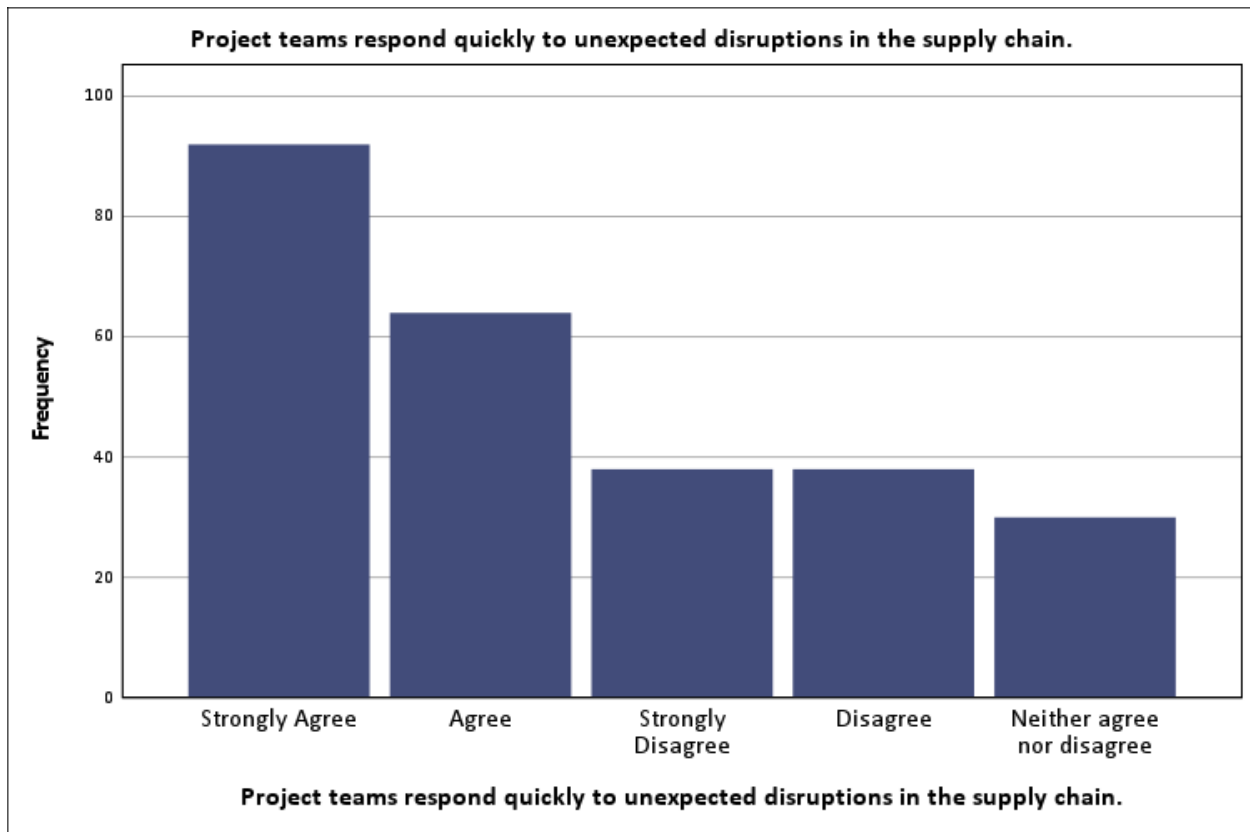


Figure 17 : Graphical representation of responding quickly to unexpected disruptions in the supply chain.

- **Organizational agility enables rapid adaptation to changing market conditions.**

Adaptation capability scores a 41.2% Strongly Agree share, supported by 21.4% who Agree and 16.8% who Disagree. Corporate bureaucracy frequently limits structural agility. Strongly Disagree answers take up 11.1%, while Neutral marks comprise 9.5%. Strategic flexibility faces major internal limits. Nearly 28% of the firm notes that rigid capital expenditure frameworks prevent fast resource reallocation when markets shift. Fixed annual budgets lock teams into outdated operational plans. This financial inertia blocks rapid capacity changes, forcing projects to stick with costly legacy workflows that lead to capital leakage and miss modern market opportunities.

Organizational agility enables rapid adaptation to changing market conditions.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	108	41.2	41.2	41.2

	Agree	56	21.4	21.4	62.6
	Disagree	44	16.8	16.8	79.4
	Strongly Disagree	29	11.1	11.1	90.5
	Neither agree nor disagree	25	9.5	9.5	100.0
	Total	262	100.0	100.0	

Table 19 : Statistical analysis of enabling rapid adaptation to changing market conditions.

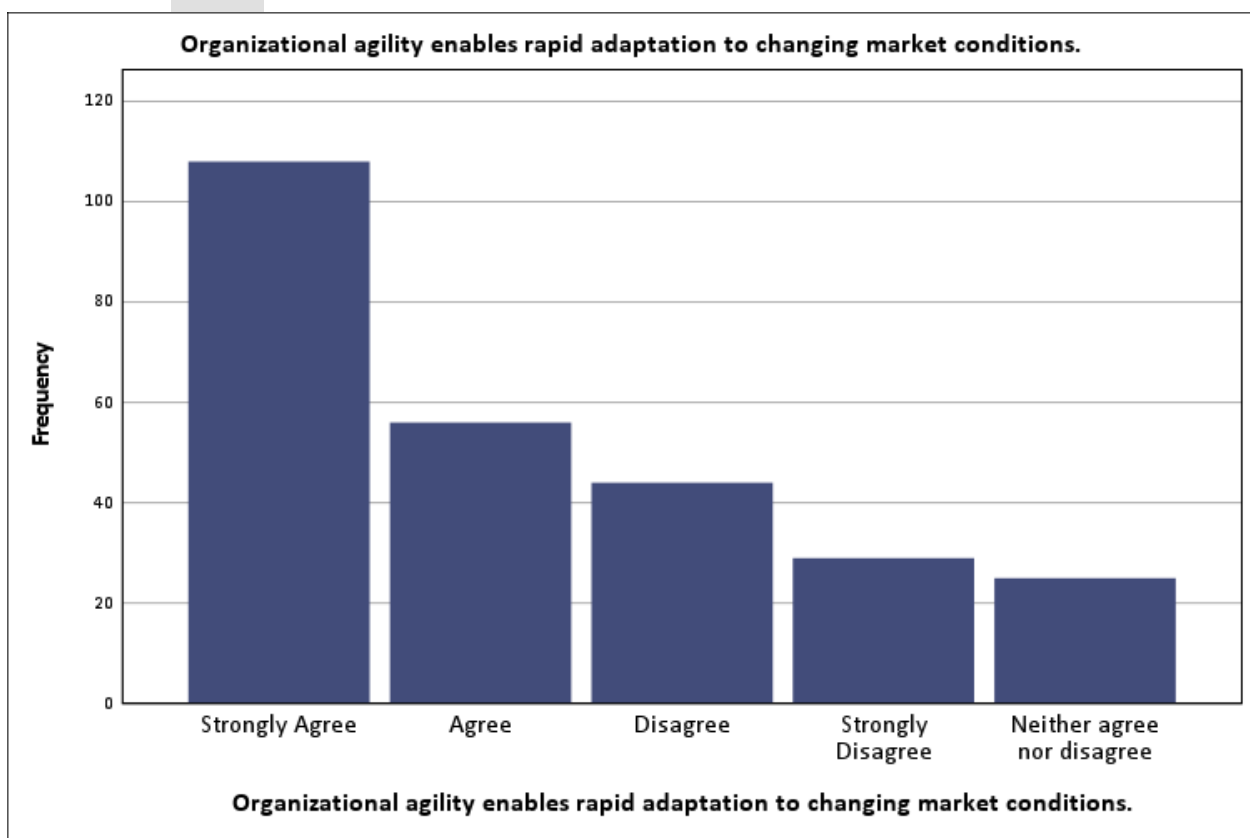


Figure 18 : Graphical representation of enabling rapid adaptation to changing market conditions.

- **Risk management practices strengthen the organization's ability to maintain supply chain continuity.**

Continuity protection draws 38.5% Strongly Agree choices, yet a 15.3% Disagree rate shows that current risk strategies struggle against real market disruptions. Agree options draw 20.6%, Strongly Disagree ticks land at 14.9%, and Neutral positions settle at 10.7%. Continuity protection contains clear gaps. A combined 30.2% negative loop indicates that nearly a third

of the staff views risk practices as ineffective insurance checklists. When continuity plans ignore supplier insolvency or primary material runs, risk frameworks fail under pressure. This protection gap exposes long-term supply agreements to volatile market spikes, causing material delivery delays that disrupt project delivery timelines.

Risk management practices strengthen the organization's ability to maintain supply chain continuity.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	101	38.5	38.5	38.5
	Agree	54	20.6	20.6	59.2
	Disagree	40	15.3	15.3	74.4
	Strongly Disagree	39	14.9	14.9	89.3
	Neither agree nor disagree	28	10.7	10.7	100.0
	Total	262	100.0	100.0	

Table 20 : Statistical analysis of practicing strengthen the organization's ability to maintain supply chain continuity.

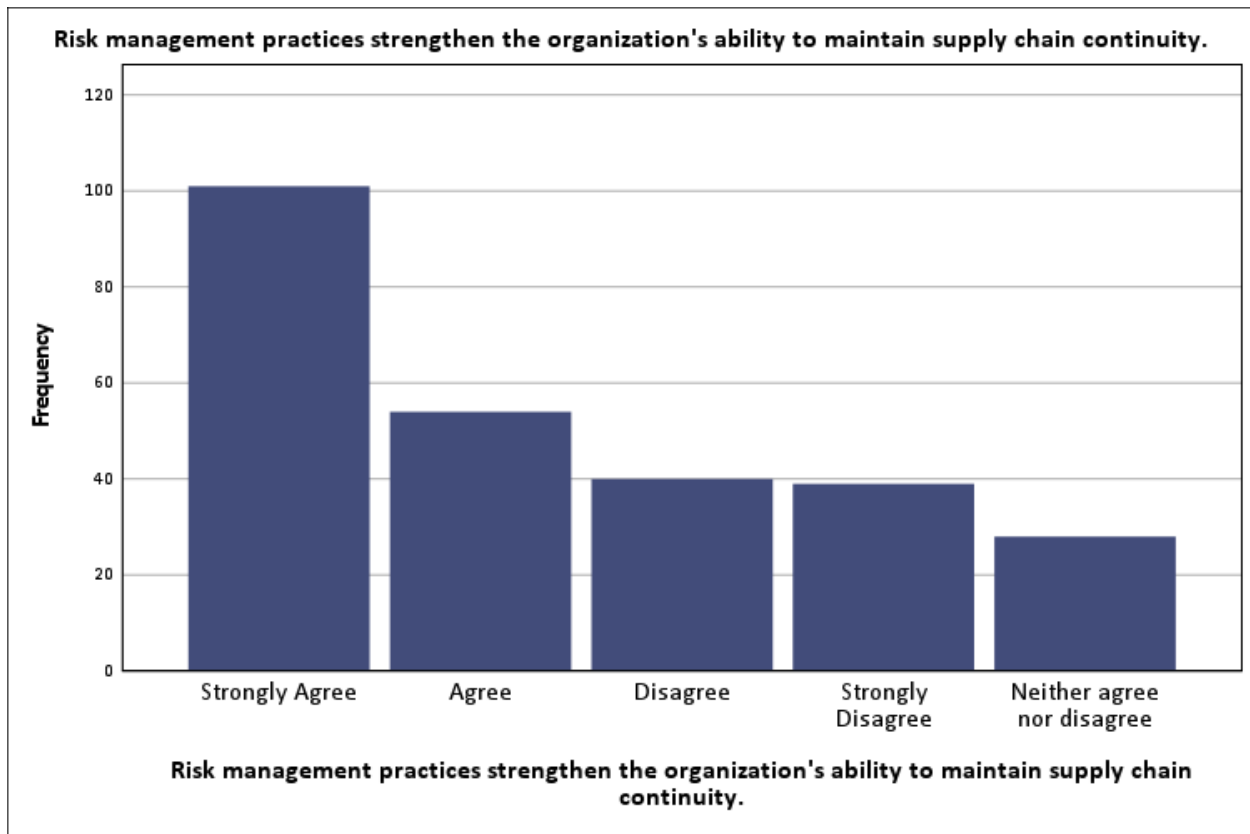


Figure 19 : Graphical representation of practicing strengthen the organization's ability to maintain supply chain continuity.

- **Project management maturity enhances the resilience of smart supply chains in the organization.**

Resilience enhancements capture 37.0% of the sample via Strongly Agree marks, balanced by 21.0% who Agree and 15.6% who Disagree. Maturity benefits remain highly localized. Neutral feedback accounts for 13.7%, while Strongly Disagree inputs hit 12.6%. Resilience performance is highly split. A combined 28.2% negative response shows that maturity frameworks do not consistently improve supply chain operations. When maturity metrics focus on internal documentation rather than external supplier visibility, technological integration stalls. This gap isolates advanced supply chains from project planning, leaving digital operations vulnerable to standard supply line disruptions.

Project management maturity enhances the resilience of smart supply chains in the organization.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	97	37.0	37.0	37.0

	Agree	55	21.0	21.0	58.0
	Disagree	41	15.6	15.6	73.7
	Neither agree nor disagree	36	13.7	13.7	87.4
	Strongly Disagree	33	12.6	12.6	100.0
	Total	262	100.0	100.0	

Table 21 : Statistical analysis of enhancing the resilience of smart supply chains in the organization.

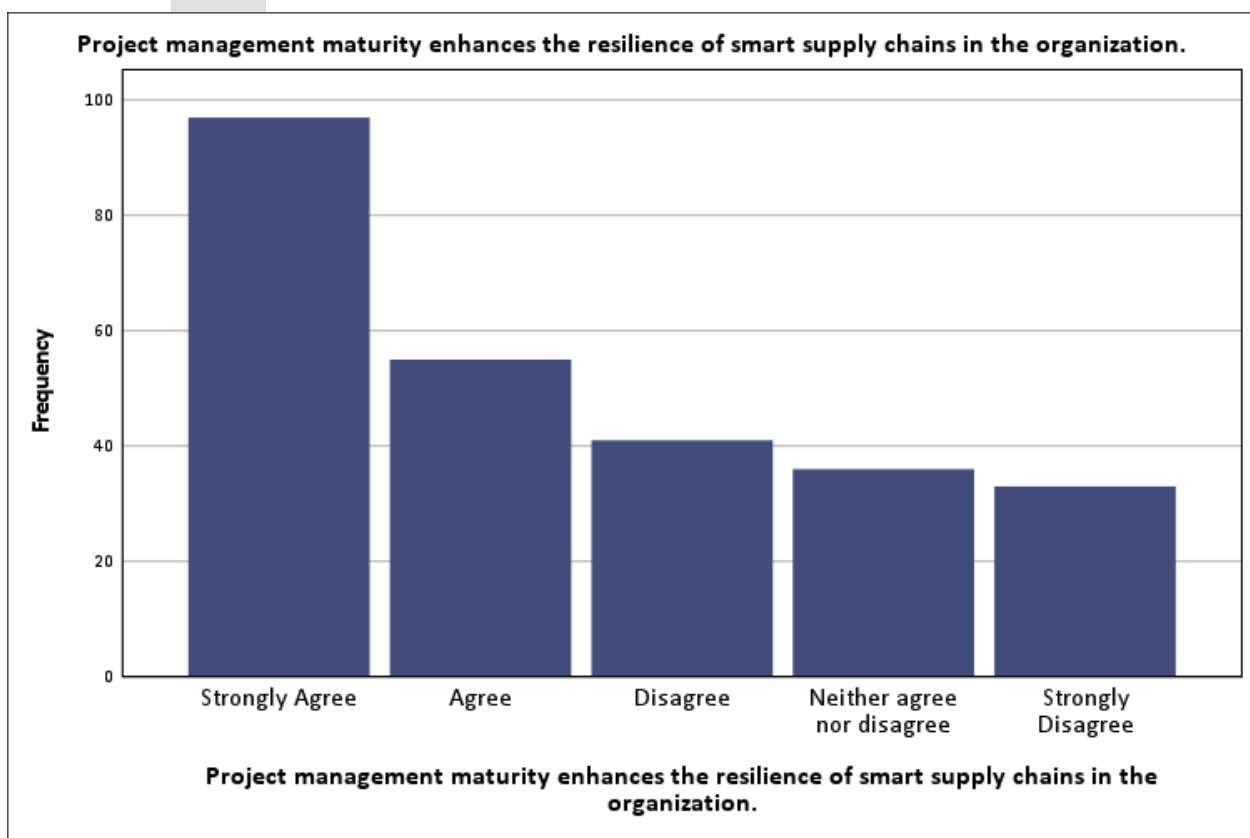


Figure 20 : Graphical representation of enhancing the resilience of smart supply chains in the organization.

- **Testing credibility and reliability**

The case processing filter confirms that 220 records are Valid, while 42 cases are Excluded through listwise deletion across all procedure variables. This deletion reflects a 16.0% systemic data loss across the survey collection. High missing data ratios compromise macro-level statistical modeling. This issue stems from incomplete survey submissions, particularly around demographic and educational fields. Incomplete responses introduce systemic non-

response bias that skews correlation models. For project controls, relying on datasets with high listwise exclusion rates risks hiding bad field performance, which can lead to misallocated project optimization capital.

Cronbach's Alpha hits a strong .914 across a 20-item model matrix. The internal consistency of the survey tool is statistically solid. This high coefficient confirms strong inter-item reliability across the project management and supply chain questions. However, exceptional Alpha levels can also point to redundant phrasing across survey items. If questions simply rephrase similar concepts, the model creates artificial collinearity. For operational analysis, high internal scale reliability must be validated by real performance metrics; otherwise, the survey risks reflecting conceptual alignment among staff rather than successful field execution.

Case Processing Summary			
		N	%
Cases	Valid	220	84.0
	Excluded ^a	42	16.0
	Total	262	100.0
a. Listwise deletion based on all variables in the procedure.			

Table 22 : Summary of statistical analyses

Reliability Statistics	
Cronbach's Alpha	N of Items
.914	20

Table 23 : Stability and reliability testing

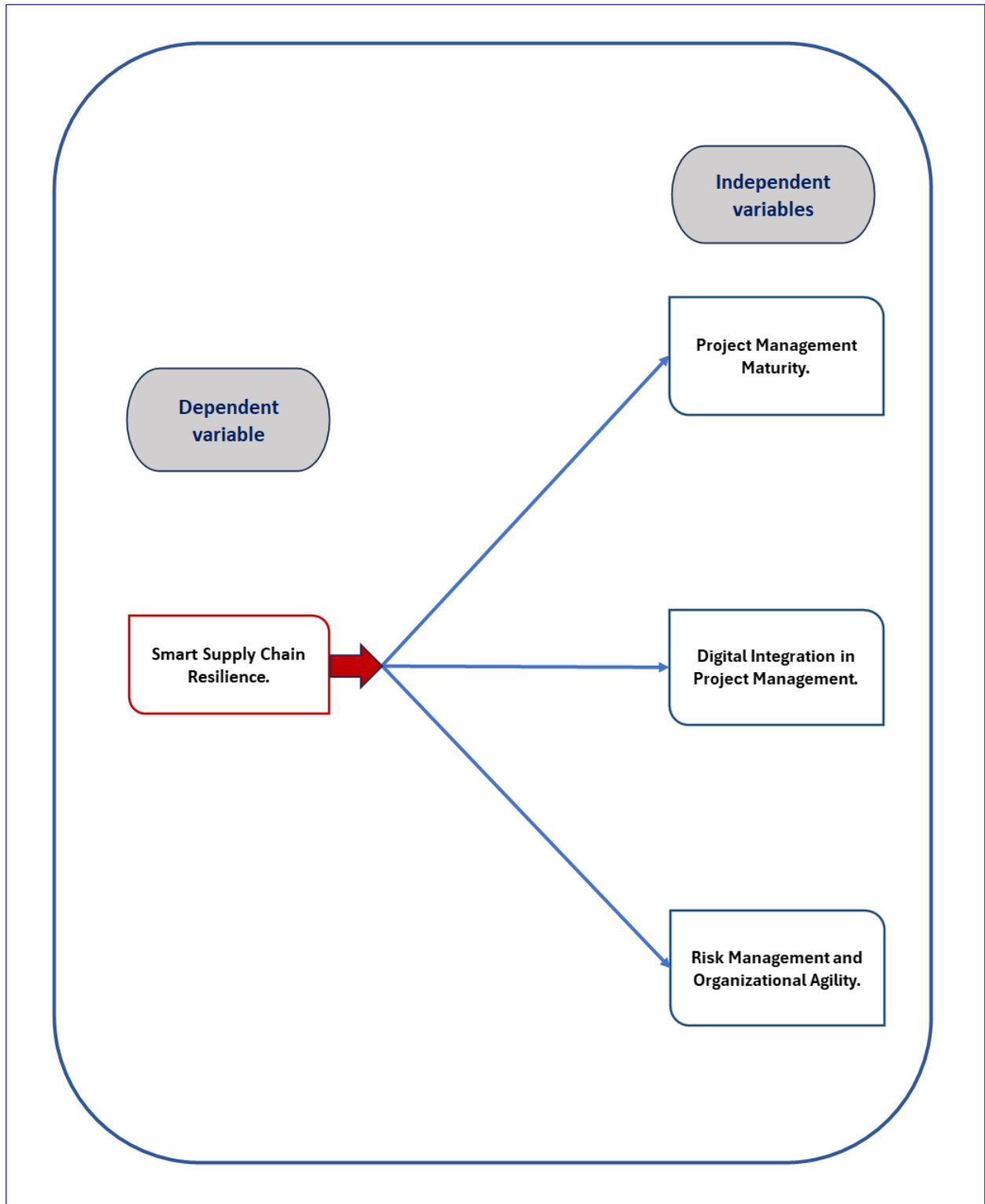


Figure 21: Dependent and independent variables of study

- **Cross tabs test for study variables:**

- 1. Chi-square test for the relationship between Smart Supply Chain Resilience. and Project Management Maturity.**

The Pearson Chi-Square statistic reaches 64.148 with 16 degrees of freedom, achieving an Asymptotic Significance of .000. The two core construct categories share a statistically significant relationship. However, a key structural limitation compromises this test: 7 cells have expected counts under 5, meaning 28.0% of the cross-table violates standard chi-square distribution assumptions. The minimum expected count drops to a low .91. This issue stems from thin data distributions across the extreme Disagree and Strongly Disagree categories. While the low significance value indicates a true relationship, the cell violations mean the exact test statistic could be overstated, requiring exact tests to confirm the result.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	64.148 ^a	16	.000
Likelihood Ratio	63.537	16	.000
Linear-by-Linear Association	48.655	1	.000
N of Valid Cases	262		
a. 7 cells (28.0%) have expected count less than 5. The minimum expected count is .91.			

Table 24 : Chi-square test for the relationship between Smart Supply Chain Resilience. and Project Management Maturity.

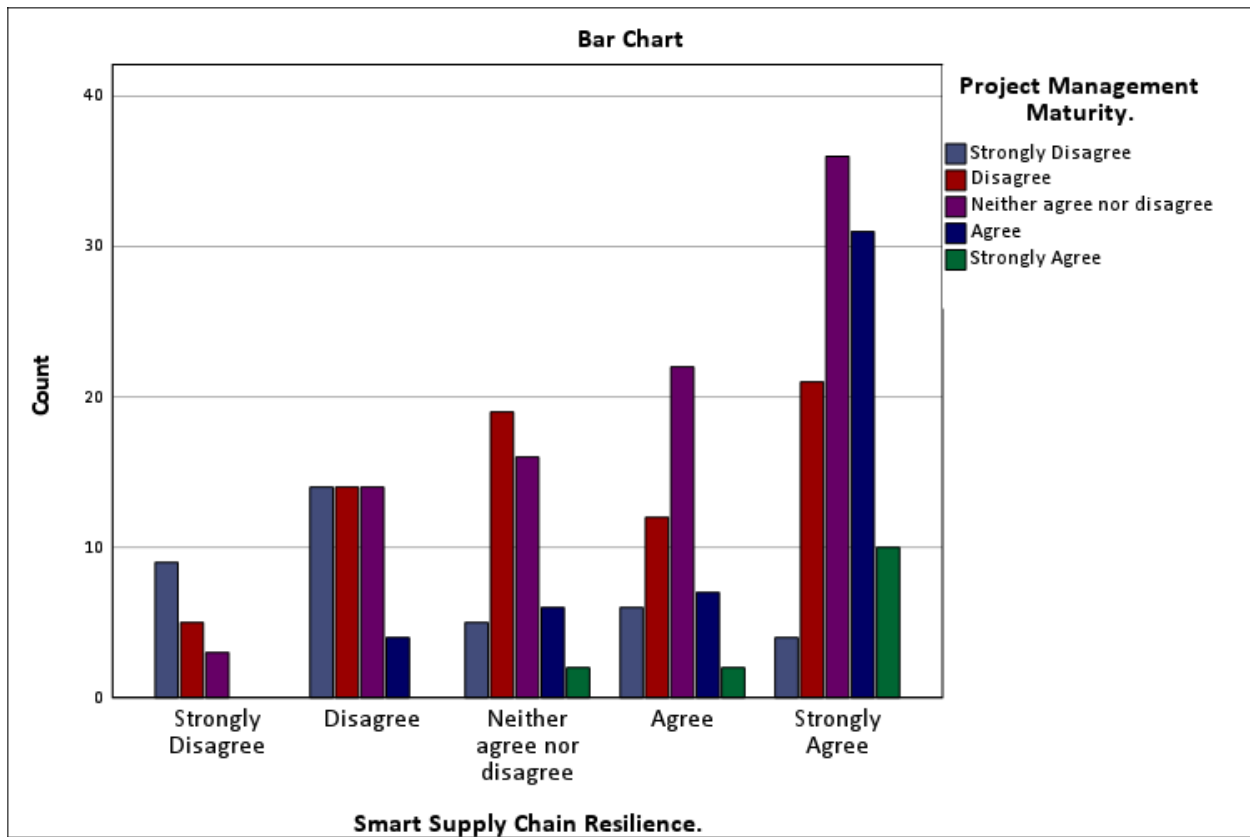


Figure 22 : Symmetric measures for analyzing cross-tables of the relationship between Smart Supply Chain Resilience. and Project Management Maturity.

2. Chi-square test for the relationship between Smart Supply Chain Resilience. and Digital Integration in Project Management.

The Pearson Chi-Square value hits 84.112 with 16 degrees of freedom, showing an Asymptotic Significance of .000. This confirms a highly significant non-parametric link between digital technology integration and supply chain resilience. Despite the low significance value, the cross-tabulation model hits a statistical barrier: 28.0% of the cells show an expected count below 5. The lowest cell count falls to 1.17. This pattern reveals an uneven distribution of responses across the category grid. The high chi-square value indicates that digital tool integration heavily influences resilience, but the cell violations require caution before generalizing these patterns to other operational settings.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	84.112 ^a	16	.000

Likelihood Ratio	83.327	16	.000
Linear-by-Linear Association	58.370	1	.000
N of Valid Cases	262		
a. 7 cells (28.0%) have expected count less than 5. The minimum expected count is 1.17.			

Table 25 : Chi-square test for the relationship between Smart Supply Chain Resilience. and Digital Integration in Project Management.

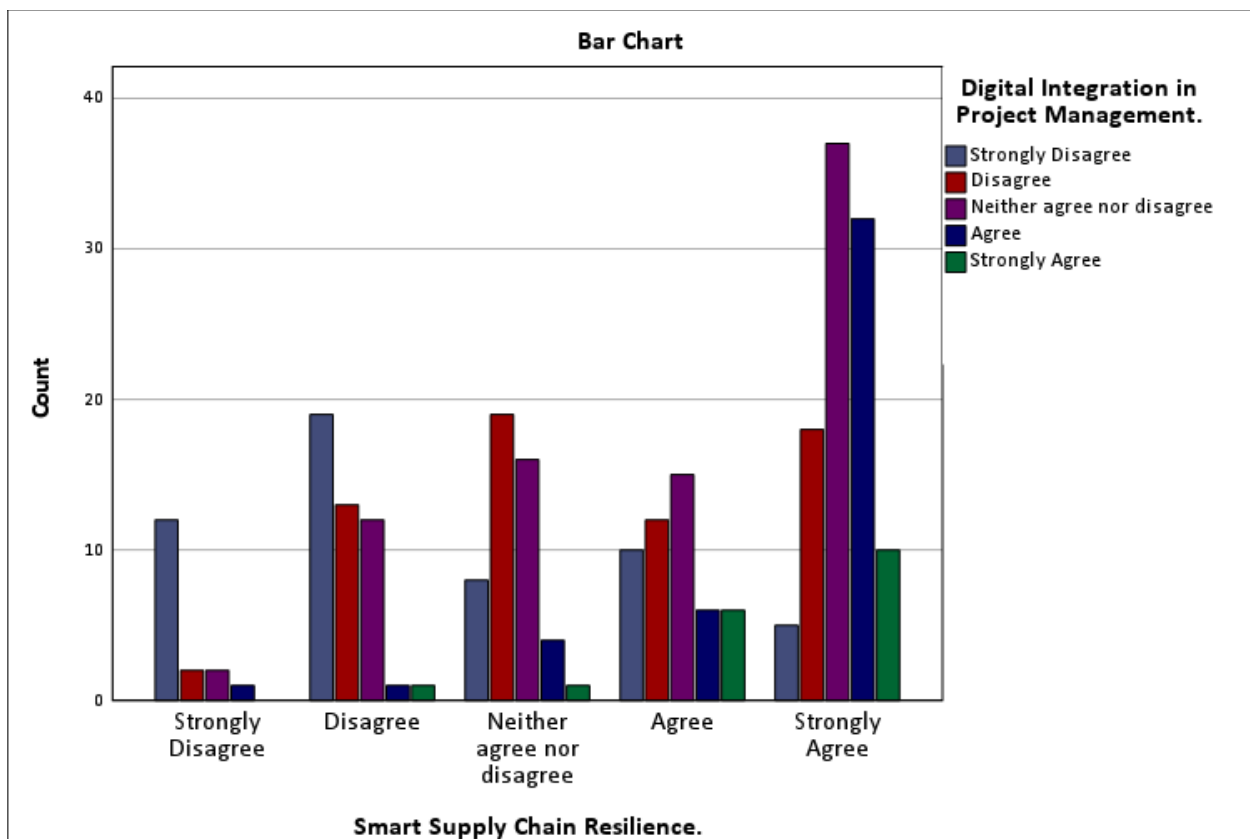


Figure 23 : Symmetric measures for analyzing cross-tables of the relationship between Smart Supply Chain Resilience. and Digital Integration in Project Management.

3. Chi-square test for the relationship between Smart Supply Chain Resilience. and Risk Management and Organizational Agility.

The Pearson Chi-Square test returns a value of 53.851 across 16 degrees of freedom, resulting in an Asymptotic Significance of .000. This confirms a real statistical association between organizational agility and supply chain continuity variables. However, the model contains a familiar data spread problem: 7 cells have expected counts below 5, which means 28.0% of

the data grid breaches core chi-square test parameters. The minimum expected count is 1.04. This clustering shows that few respondents select opposing viewpoints across the agility and resilience questions. This constraint distorts the asymptotic distribution, meaning the test requires larger samples to accurately map how agility impacts project risk environments.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	53.851 ^a	16	.000
Likelihood Ratio	57.328	16	.000
Linear-by-Linear Association	46.488	1	.000
N of Valid Cases	262		
a. 7 cells (28.0%) have expected count less than 5. The minimum expected count is 1.04.			

Table 26 : Chi-square test for the relationship between Smart Supply Chain Resilience. and Risk Management and Organizational Agility.

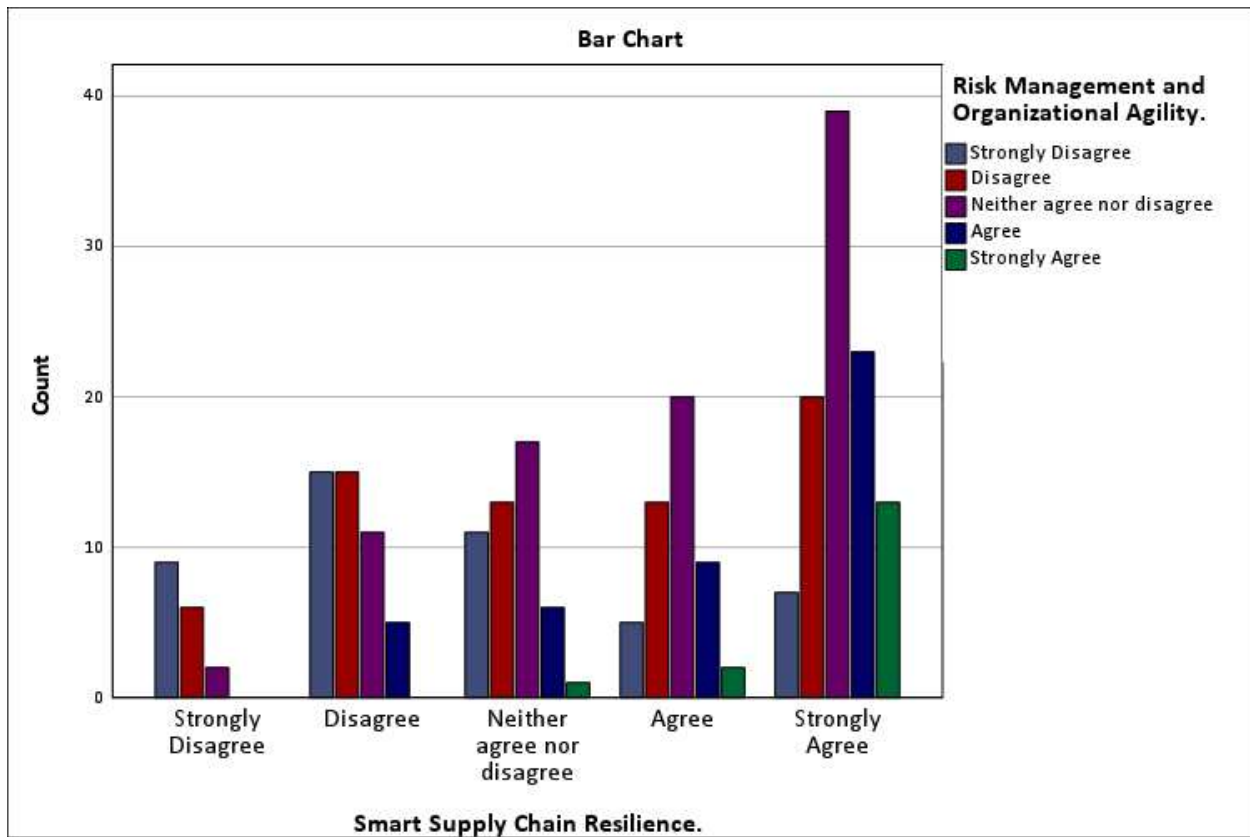


Figure 24 : Symmetric measures for analyzing cross-tables of the relationship between Smart Supply Chain Resilience. and Risk Management and Organizational Agility.

- Regression test for variables of study

The multiple regression model yields a multiple correlation coefficient R of .608 and an R Square of .369, leaving an Adjusted R Square of .362. The three predictor variables explain 36.9% of the variance in Smart Supply Chain Resilience. The model's predictive power is moderate, meaning 63.1% of resilience variance depends on unmeasured external factors. The Standard Error of the Estimate stands at 1.057, proving that residual variance remains high around the prediction line. This missing explanation points to omitted operational variables like vendor financial health or local port capacity. Relying solely on these three internal pillars for strategic planning will miss critical external risks that drive supply chain disruptions.

The regression model produces a Sum of Squares of 168.695 across 3 degrees of freedom, yielding a Mean Square of 56.232. The Residual Sum of Squares sits at 288.072 across 258 degrees of freedom, which results in a Mean Square of 1.117. The resulting F statistic reaches 50.362, with an Asymptotic Significance of .000. This high F value confirms that the combination of Project Management Maturity, Digital Integration, and Organizational Agility significantly improves predictions of supply chain resilience over a simple mean model. Even

with this strong model fit, the large residual sum of squares confirms that considerable noise exists within the dataset. This high unexplained variance shows that unaccounted field factors continue to drive real supply chain performance.

Digital Integration leads the model with a standardized Beta of .325, showing a t value of 6.110 and a Significance of .000. Project Management Maturity follows with a standardized Beta of .270, scoring a t value of 5.100 and a Significance of .000. Risk Management and Organizational Agility registers the lowest relative impact with a Beta of .235, supported by a t value of 4.362 and a Significance of .000. All three predictors are stable and significant. The regression formula is modeled as: Smart Supply Chain Resilience = 1.064 + .329 * Project Management Maturity + .364 * Digital Integration + .275 * Risk Management and Organizational Agility. This equation proves that digital tools have the largest direct impact on resilience. Consequently, underfunding digital infrastructure will limit the return on process maturity investments.

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.608 ^a	.369	.362	1.057
a. Predictors: (Constant), Risk Management and Organizational Agility., Project Management Maturity., Digital Integration in Project Management.				
b. Dependent Variable: Smart Supply Chain Resilience.				

Table 27 : Summary of model

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	168.695	3	56.232	50.362	.000 ^b
	Residual	288.072	258	1.117		
	Total	456.767	261			
a. Dependent Variable: Smart Supply Chain Resilience.						

b. Predictors: (Constant), Risk Management and Organizational Agility., Project Management Maturity., Digital Integration in Project Management.

Table 28 : Analysis of ANOVA

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.064	.223		4.775	.000
	Project Management Maturity.	.329	.065	.270	5.100	.000
	Digital Integration in Project Management.	.364	.060	.325	6.110	.000
	Risk Management and Organizational Agility.	.275	.063	.235	4.362	.000
a. Dependent Variable: Smart Supply Chain Resilience.						

Table 29 : Multiple regression analysis coefficients

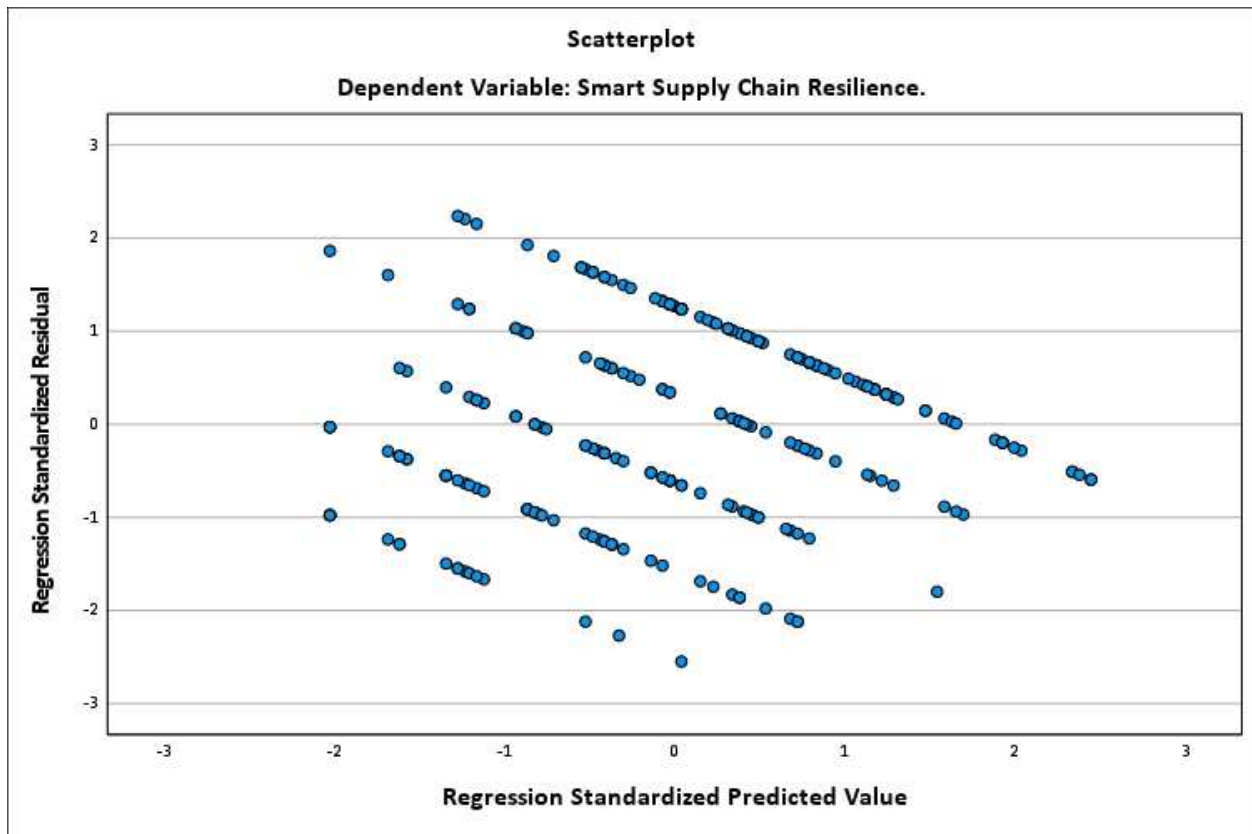
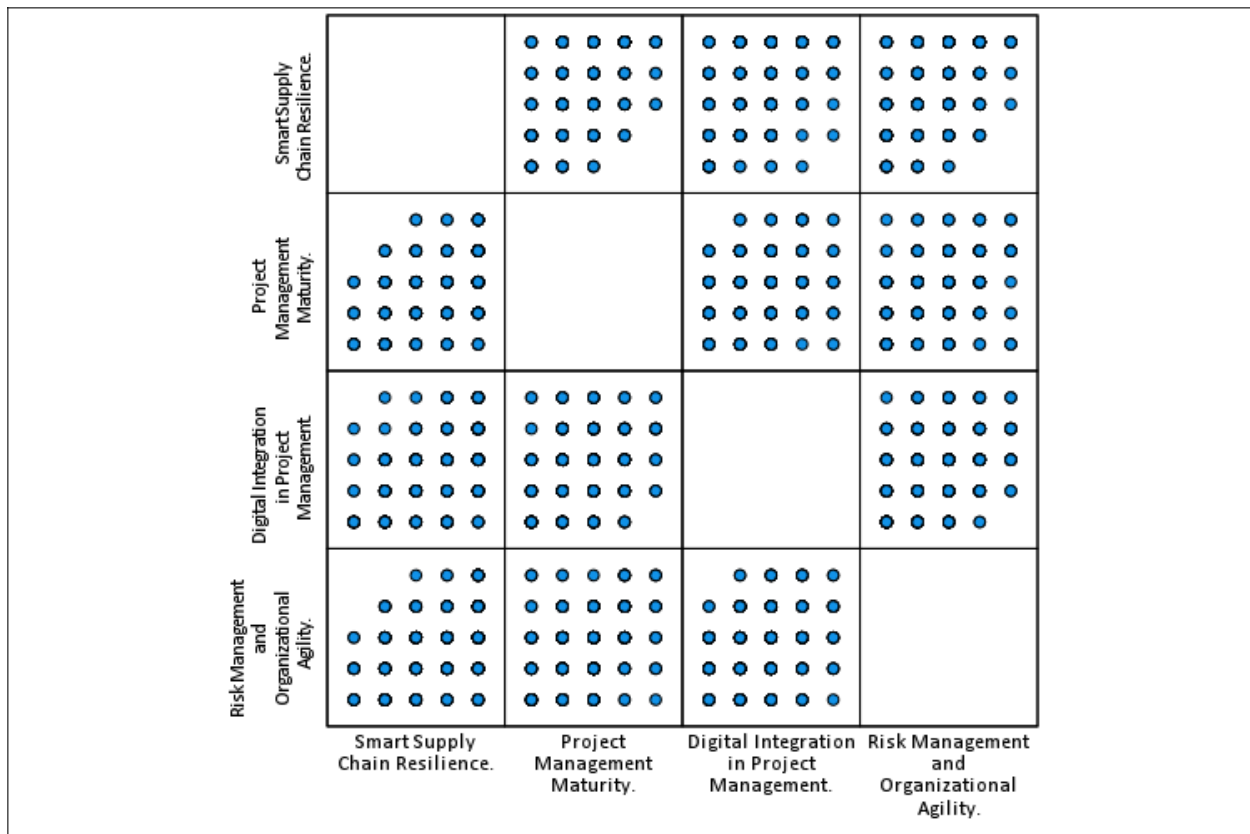


Figure 25 : The spread pattern of the residues



- **One-way ANOVA test for study variables**

The multi-factor regression model returns a Regression Sum of Squares of 179.027 across 12 degrees of freedom, yielding a Mean Square of 14.919. The Residual Sum of Squares sits at 277.740 across 249 degrees of freedom, producing a Mean Square of 1.115. The resulting F statistic hits 13.375, generating a Significance of .000. This multi-degree model explains variance effectively across the core sample. However, the lower Mean Square value relative to the basic linear model shows that adding interaction factors dilutes the statistical power per degree of freedom. This trend confirms that adding complex variables can over-engineer the analysis without uncovering new drivers of supply chain performance.

The Bayesian analysis generates a massive Bayes Factor of 18766239257077416.000, evaluated against a simple null model. The multiple correlation coefficient R reaches .626, matching an R Square of .392 and an Adjusted R Square of .363. The Standard Error of the Estimate stabilizes at 1.06. This large Bayes Factor provides definitive evidence that the predictive model is superior to the null hypothesis. The data supports a strong link between the project management predictors and supply chain outcomes. This high mathematical probability should encourage leadership to shift from manual tracking to structured, digital

project management models to protect their logistics networks.

ANOVA^{a,b}					
Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	179.027	12	14.919	13.375	.000
Residual	277.740	249	1.115		
Total	456.767	261			
a. Dependent Variable: Smart Supply Chain Resilience.					
b. Model: (Intercept), Project Management Maturity., Risk Management and Organizational Agility., Digital Integration in Project Management.					

Table 30 : One-way ANOVA

Bayes Factor Model Summary^{a,b}				
Bayes Factor ^c	R	R Square	Adjusted R Square	Std. Error of the Estimate
18766239257077416.000	.626	.392	.363	1.06
a. Method: JZS				
b. Model: (Intercept), Project Management Maturity., Risk Management and Organizational Agility., Digital Integration in Project Management.				
c. Bayes factor: Testing model versus null model (Intercept).				

Table 31 : Summary of Bayesian Coefficient Model

Discussion

The findings of the present study demonstrate that Project Management Maturity plays a fundamental strategic role in enhancing the resilience of smart supply chains within manufacturing companies operating in the Kingdom of Saudi Arabia. The statistical analysis indicates that organizations possessing higher levels of project management maturity exhibit stronger capabilities for planning, coordinating, monitoring, and controlling complex projects while maintaining operational continuity during periods of uncertainty. These findings support the underlying assumptions of Dynamic Capabilities Theory, which argues that sustainable organizational performance depends on an organization's ability to continuously integrate, develop, and reconfigure its internal capabilities in response to changing environmental conditions.

One of the most significant findings concerns the positive influence of Project Management Maturity on supply chain resilience. Organizations characterized by standardized project management methodologies, effective governance structures, continuous performance monitoring, and structured decision-making processes demonstrate greater preparedness for responding to operational disruptions. Mature project management practices improve communication among stakeholders, facilitate resource coordination, and establish clear accountability throughout project implementation. These organizational capabilities reduce uncertainty, improve execution quality, and strengthen the organization's overall ability to recover rapidly from unexpected disruptions affecting production and supply chain operations.

The study further reveals that Digital Integration in Project Management significantly contributes to strengthening smart supply chain resilience. Manufacturing organizations increasingly rely on advanced digital technologies to support project planning, execution, communication, monitoring, and decision-making. The integration of technologies such as Enterprise Resource Planning systems, Artificial Intelligence, Internet of Things devices, predictive analytics, cloud computing, and digital collaboration platforms enables organizations to obtain real-time operational information, identify potential risks earlier, optimize resource allocation, and improve coordination across multiple supply chain partners. These capabilities enhance organizational visibility and responsiveness, allowing manufacturing companies to maintain continuity even under highly dynamic operating conditions.

Another important finding concerns the critical contribution of Risk Management to organizational resilience. The results indicate that manufacturing companies implementing systematic risk management frameworks are better prepared to anticipate potential disruptions, evaluate their consequences, and implement mitigation strategies before operational failures occur. Rather than relying solely on reactive crisis management, organizations with mature risk management capabilities adopt proactive approaches involving continuous monitoring, contingency planning, risk prioritization, and strategic resource allocation. Such practices significantly reduce vulnerability to supply chain interruptions and improve the organization's ability to maintain stable production and customer service despite external uncertainty.

The study also demonstrates that Organizational Agility has a substantial positive influence on smart supply chain resilience. Agile organizations possess the flexibility required to modify operational processes, adjust production schedules, reorganize resources, and implement innovative solutions rapidly in response to evolving market conditions or technological developments. Organizational agility encourages collaborative teamwork, decentralized decision-making, rapid learning, and continuous improvement, all of which contribute to faster organizational adaptation and improved resilience. In the context of Saudi Arabia's industrial transformation, agility becomes increasingly valuable as manufacturing firms continue adopting Industry 4.0 technologies and digital manufacturing systems.

Collectively, the findings indicate that these four organizational capabilities function as complementary rather than isolated factors. Project management maturity provides structured governance and standardized execution processes; digital integration enhances visibility and intelligent decision-making; risk management strengthens preparedness and mitigation capabilities; while organizational agility enables rapid adaptation and continuous innovation. Together, these capabilities establish an integrated organizational system capable of anticipating disruptions, minimizing operational interruptions, accelerating recovery, and continuously improving supply chain performance.

The findings are particularly significant within the Saudi manufacturing sector because they align closely with the strategic priorities of Saudi Vision 2030, including industrial diversification, digital transformation, smart manufacturing, operational excellence, and increased global competitiveness. The study therefore provides empirical evidence supporting the argument that investments in project management maturity extend beyond project success

alone and contribute directly to long-term organizational resilience, sustainable competitive advantage, and national industrial development.

Conclusion

This study sought to examine the role of Project Management Maturity in enhancing the resilience of smart supply chains within manufacturing companies in the Kingdom of Saudi Arabia. Drawing upon Dynamic Capabilities Theory and contemporary literature in project management, digital transformation, organizational agility, and supply chain resilience, the

study developed a comprehensive conceptual framework that explains how organizational capabilities collectively contribute to resilient manufacturing operations.

The empirical findings confirm that Project Management Maturity represents a strategic organizational capability that significantly enhances the resilience of smart supply chains. Organizations possessing mature governance systems, standardized methodologies, effective project planning processes, structured performance monitoring, and continuous organizational learning demonstrate greater operational stability and stronger adaptive capacity during periods of disruption. These findings reinforce the growing recognition that project management has evolved from a purely administrative discipline into a strategic management capability supporting long-term organizational sustainability.

The study also concludes that Digital Integration in Project Management significantly strengthens organizational resilience by improving visibility, communication, data availability, predictive decision-making, and coordination across supply chain networks. Similarly, comprehensive Risk Management practices improve organizational preparedness by enabling early identification of vulnerabilities, implementation of mitigation strategies, and maintenance of business continuity under uncertain operating conditions. Organizational Agility further enhances resilience by enabling manufacturing firms to adapt rapidly to technological innovations, market changes, and unexpected operational disruptions through flexible organizational structures and collaborative decision-making.

Taken together, these findings demonstrate that smart supply chain resilience is not achieved through technological investment alone but rather through the integration of mature managerial capabilities, digital innovation, proactive risk management, and organizational adaptability. Manufacturing organizations that successfully combine these capabilities are better positioned to maintain operational continuity, improve customer satisfaction, strengthen competitive advantage, and sustain long-term organizational performance despite increasing environmental uncertainty.

From a practical perspective, the study provides valuable guidance for manufacturing executives, project managers, policymakers, and industrial decision-makers seeking to improve organizational resilience through strategic investment in project management maturity and digital transformation initiatives. The findings also contribute to academic knowledge by extending the application of Dynamic Capabilities Theory to the intersection of project management maturity and smart supply chain resilience within an emerging industrial economy.

The study concludes that strengthening project management maturity should become a strategic priority for Saudi manufacturing companies seeking to support industrial modernization, accelerate digital transformation, improve supply chain resilience, and contribute to the successful realization of the objectives of Saudi Vision 2030.

Recommendations

Based on the empirical findings of the study, which indicate that Project Management Maturity, Digital Integration in Project Management, Risk Management, and Organizational Agility have a significant positive influence on the resilience of smart supply chains in manufacturing companies in the Kingdom of Saudi Arabia, the following recommendations are proposed:

1. Strengthen Project Management Maturity by adopting internationally recognized project management maturity models and standardizing project governance practices across manufacturing organizations.
2. Invest in Digital Project Management Technologies by integrating advanced digital platforms such as Project Management Information Systems (PMIS), Artificial Intelligence (AI), Internet of Things (IoT), Digital Twins, Enterprise Resource Planning (ERP), and predictive analytics to improve project visibility and supply chain responsiveness.
3. Enhance Organizational Risk Management Frameworks by implementing proactive risk identification, continuous monitoring systems, scenario planning, and comprehensive business continuity strategies that minimize operational disruptions.
4. Promote Organizational Agility by encouraging flexible organizational structures, empowering cross-functional teams, decentralizing decision-making, and fostering rapid adaptation to technological and market changes.
5. Develop Continuous Professional Training Programs for project managers, supply chain professionals, and operational leaders to improve competencies in project governance, digital transformation, agile project management, and smart supply chain management.
6. Improve Knowledge Management and Organizational Learning by establishing formal mechanisms for documenting lessons learned, sharing best practices, and continuously improving project management processes across manufacturing organizations.
7. Increase Executive Support for Digital Transformation by ensuring senior management actively sponsors project management maturity initiatives and aligns them with long-term organizational strategy and Saudi Vision 2030 objectives.
8. Strengthen Collaboration Across Supply Chain Networks through enhanced digital communication, information sharing, and strategic partnerships with suppliers, logistics providers, and technology partners to improve resilience during disruptions.

9. Develop Performance Measurement Systems that continuously monitor project maturity, supply chain resilience, operational efficiency, digital integration, and organizational adaptability using measurable Key Performance Indicators (KPIs).
10. Encourage Future Research examining additional variables such as organizational culture, leadership capabilities, artificial intelligence adoption, sustainability practices, innovation management, and cybersecurity resilience as potential factors influencing smart supply chain resilience.

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Appendices

Subject: Request for Review of a Research Questionnaire

Dear Dr..... .

Peace, mercy, and blessings of God be upon you.

I hope you are well.

I am a student at the College of Management at Mid-Ocean University, pursuing a Master's degree in Project Management. I am currently working on a research project entitled "The Role of Project Management Maturity in Enhancing the Resilience of Smart Supply Chains:

An Applied Study on Manufacturing Companies in the Kingdom of Saudi Arabia," as part of my Master's degree requirements.

I am writing to request your kind review of my research questionnaire and to seek your valuable expertise. I have enclosed a copy of the questionnaire, and I would be grateful if you would review it and provide your feedback and suggestions regarding the accuracy and suitability of its items for measuring the study's objectives. I would also appreciate any suggestions for modifications you deem appropriate, whether by rewording, deleting, or adding items.

Thank you very much for your time and effort, and I look forward to receiving your valuable feedback.

With sincere appreciation and respect,

Radi Mohammed Al-Amri

Master's Student in Project Management

College of Management, Mid-Ocean University

Questionnaire

Questions	Answer				
1- General questions					
Age	20-30	30-40	40-50	50-60	60+
Gender	Male	Female			
Educational Level	Secondary school certificate	Bachelor's degree	Postgraduate degree	Master's	Doctorate
2- Survey questions					
My organization applies standardized project management practices across its projects.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

Project management processes are continuously reviewed and improved within the organization.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Project managers have the necessary competencies to manage projects effectively.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Project management maturity contributes to improving project performance.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Senior management supports the continuous development of project management practices.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
The organization regularly assesses its level of project management maturity.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Digital technologies are effectively integrated into project management activities.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Digital project management systems facilitate communication among project stakeholders.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Real-time project data supports effective project monitoring and control.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Digital integration improves coordination across supply chain operations.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
The organization effectively utilizes digital tools to support project decision-making.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Digital project management systems improve operational efficiency.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
The organization proactively identifies risks that may affect supply chain operations.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Project teams respond quickly to unexpected disruptions in the supply chain.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Organizational agility enables rapid adaptation to changing market conditions.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Risk management practices strengthen the organization's	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

ability to maintain supply chain continuity.					
Project management maturity enhances the resilience of smart supply chains in the organization.	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

<https://forms.gle/LYrLCfHpfMTuLZ289>