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Unveiling the impact of supply chain network data practices on performance: A study of Pakistan's automotive manufacturing sector

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ABSTRACT

The investigation aims to clarify the connection between SC network data, the executives, the supply chain network data framework foundation, supply chain network incorporation, and the inventory network execution of firms in the assembly industry in Pakistan (Karachi). Consequently, the examination shows a gap in research concerning the impact of inventory network data rehearses on supply chain network execution. The exploration plan for this investigation utilized the quantitative technique of reviewing surveys that were created, which were dependent on an intensive and point-by-point examination of the applicable writing. For an example comprised of 144 usable pieces of information, PLS-SEM was utilized to inspect the examination model. The discoveries show that inward mix and client reconciliation completely incorporate the connection between the Supply chain network data of the executives and the Supply chain network data framework foundation toward inventory network execution. This examination is restricted to a specific example: auto firms in Pakistan, because of which the generalizability of discoveries is additionally restricted. Companies are keen to get everyone on their SC network to communicate using data organization to help administrators be more dynamic while getting updated data based on the board and framework. As at least one, it assists with planning different inside and outside proportions of the worth chain between assembling organizations in the affiliation's stock organization association. This would enable manufacturing companies to improve their presentation in the extended term.

Keywords: Supply chain performance, Supply chain integration, Information sharing, Supply chain information management, Information system infrastructure, Internal integration, Customer integration

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1. Introduction

1.1 Background

As of today, the high level of competition in the global environment and rapid market fluctuations compel organizations to focus on supply chain coordination as a key indicator of effectiveness and efficiency (Rasheed et al., 2024a). The shared use of data enables coordination within supply chains and their organizations. Research has found that the competent execution of the supply chain overall relies on how the information production network functions as a proper and helpful force (Rasheed et al., 22024b). Data sharing significantly contributes to gaining a competitive edge, improving channel coordination, reducing supply chain costs, expanding material flow, strengthening partnerships, enhancing order fulfilment rates, and enabling faster deliveries, which increases customer loyalty. This demonstrates how data has played a critical role in assembly businesses across all cycles, including supply chain activities and production.

Toward the end of the 21st century, significant developments occurred in organizations' data system (IS) infrastructure and information technology (IT) management. Without IT, achieving an effective and efficient supply chain network is difficult. Additionally, the Fourth Industrial Revolution has emphasized the importance of staying updated with the newest trends in IS and IT to maintain competitiveness and effectiveness. Visibility within the supply chain and organizations can be enhanced through IS, allowing firms to implement practical advancements in IT and develop their supply chain networks and processes accordingly (Rashid & Rasheed, 2024). Further studies have clarified how intra- and inter-organizational relationships and performance are influenced by IT practices. Previous research highlighted that investments in IT are typically associated with greater productivity growth, increased performance, and enhanced innovation. However, earlier studies showed that without a significant level of Information System Infrastructure (ISI), achieving success in supply chain integration may remain unfulfilled. Additional studies indicated that Information Technology could not consistently enhance performance gains or address poor financial performance (Rashid et al., 2023). Moreover, some organizations failed to perform better after implementing inter-organizational data sharing through IT. Effective utilization of technology is often limited due to the lack of systematic, hands-on practices that help firms recognize its potential benefits (Rashid et al., 2024a). According to past studies, there is inconsistency in outcomes related to the linkage between supply chain data practices and SC network performance, highlighting the possibility of overlooked variables. Limited studies also explore the supporting role of downstream supply chain coordination between firm performance and supply chain data practices. This research illustrates how downstream supply chain integration supports the connection between SC network data practices and performance. Accordingly, this study addresses the gap in previous research and presents significant empirical evidence.

Data sharing is essential for fostering collaboration within supply chains and their organizations. Previous studies have demonstrated how IT implementation affects relationships and performance among intra- and inter-organizational entities. The latest technological revolution has also emphasized the importance of manufacturing supply chain networks and staying updated with advancements in information systems (IS) and information technology (IT) to maintain competitiveness. However, some studies have shown that IT has not consistently enhanced performance gains or improved financial outcomes. Additionally, specific organizations have failed to perform better after implementing inter-organizational data sharing through IT. In the manufacturing and supply chain network, its enhanced role introduces a new dimension of functional synchronization that has not been adequately explored. Past research has further indicated that significant investments in IT are generally linked with better development, greater efficiency, and improved performance. Accordingly, these findings suggest that further research is needed to understand the relationship between IT and performance, primarily to determine the return on substantial IT investments. In Pakistan, there is a pressing need to explore the impact of supply chain information management and IS infrastructure on supply chain performance. This research will address how IT implementation and data management influence the daily operations and performance of the manufacturing industry in Pakistan. This study aims to extend this area of research. This study aims to uncover the connection between executive supply chain information management, the foundation of the Supply Chain Network Data Framework (IS), supply chain network coordination, and companies' performance in the Pakistan assembly industry. This investigation seeks to address the research gap regarding the influence of SC network data practices on the execution of supply chain networks.

1.2 Significance of the Study

Several significant factors were observed during this study. Among them, time constraints and resource limitations restricted the scope of the research to some extent. The investigation primarily focused on certain manufacturing businesses, mainly in the automotive sector, which reduces the generalizability of the results. Furthermore, due to the limited availability of supply chain experts in the manufacturing industry, the relatively small sample size also limits the replication of these findings to a larger population. The sample was restricted to Karachi-based manufacturing industries due to the availability and accessibility of respondents, which further limited the study's broader applicability across the country. The collected data pertains to a few manufacturing firms and their suppliers, primarily from 2 to 3 industries focused on the automotive sector. Additionally, participant responses were sometimes hindered by concerns about how their feedback might reflect on their companies. The research highlights how organizations are eager to involve every member of their supply chain network in leveraging data organization to aid decision-makers. This enables directors to become more dynamic by utilizing updated data and robust system infrastructures. Such efforts help coordinate various internal and external value chain measures across manufacturing firms within supply chain networks. This coordination allows manufacturing organizations to improve their performance over the long term. Administrators stand to benefit significantly from this research, as it offers guidance on updating the supply chain network execution in the assembly industry. Researchers can utilize the findings to inform future studies, while senior executives can gain comprehensive insights into supply chain integration and data practices that positively influence supply chain performance.

1.3 Definition of the Terms

1.3.1 Supply Chain Information Management (SCIM)

Supply chain information management involves key business processes from the end customer to primary suppliers who provide goods, services, and information. It aims to create value for customers and other stakeholders.

1.3.2 Supply Chain Information System Infrastructure (SCISI)

This infrastructure simplifies processes, communication, and supply chain data management. It enhances interactions within and between partners in a supply chain network and improves the ability to reduce lead times in coordination efforts.

1.3.3 Internal integration (II)

Internal integration refers to collaborating various departments and functional areas within a firm to operate as a cohesive process. To meet client demands, all activities and functions must work together rather than in isolated departmental silos.

1.3.4 Customer integration (CI)

Customer integration describes the level of coordination between a manufacturing firm and its downstream customers. It enables companies to understand customer requirements and specific needs, allowing them to serve customers more effectively.

1.3.5 Supply chain performance (SCP)

Supply chain performance refers to the systematic evaluation of the efficiency and effectiveness of supply chain operations. It encourages collaboration among supply chain participants within an industry. Robust performance testing ensures financial stability and sustainability (Rashid et al., 2024b). As Johnson (2001) emphasizes, effective performance measurement is crucial for ensuring continuous improvement of supply chain processes.

2. Literature Review

2.1 Supporting Theories

This study's theoretical foundation is based on System and Resource-Based Theory (RBT). System Theory posits that all components in a system work together as interconnected and interdependent parts to achieve a common goal. It is essential to emphasize comprehensive system partnerships and integration to build on System Theory with a suitable framework for RBT. Additionally, RBT focuses on utilizing internal resources to gain a competitive advantage. Supply chain network companies aim to enhance process improvement and data systems to deliver unique value and management. This theory highlights the relationship between internal competencies and supply chain networks, enabling organizations to achieve their goals effectively. This theoretical approach strengthens the overall database network model by integrating internal resources and skilled information exchange across the supply chain. Such integration enhances collaboration and operational efficiency. Furthermore, the information system aids organizations in improving business performance, maintaining competitiveness, and responding effectively to environmental changes, competitors, and market demands. This study proposes an association between supply chain network ISI, supply chain network integration (including supplier, customer, and internal coordination), supply chain information management, and supply chain performance. The theoretical framework emphasizes the role of information systems in designing and managing supply chain networks. StudyStudy surveys and literature reviews are employed as methodologies to gather relevant and exploratory data to gather relevant and exploratory data. The theoretical framework provides a foundation for understanding and focusing on the relationship between supply chain integration and performance. Addressing these issues, particularly for the manufacturing sector, involves analyzing client and internal coordination, supply chain information management, and SC network ISI (Titus & Bröchner, 2005).

2.2 Relevant Studies

This section depicts the relationship between the Supply Chain (SC) network data framework (IS) foundation, supply chain network coordination, supply chain network data management, and the manufacturing performance of industry-related firms in Malaysia. The analysis explores a gap in research concerning the impact of supply chain network data practices on manufacturing performance. This study employed a quantitative research method using survey questionnaires for its research design. Based on a sample of 248 usable responses, multiple regression analysis was conducted to evaluate the research model. The results indicate that the supply chain infrastructure significantly influences the relationship between the Supply Chain Network Data Framework (IS) Foundation and supply chain network data management when evaluating manufacturing performance.

The scope of this research is limited to electronic and electrical manufacturing organizations in Peninsular Malaysia. Therefore, the findings are not generalizable to broader contexts and require further study with larger and more diverse samples. The primary aim of companies is to connect all members of their supply chain network through a unified data framework. This interconnection would enable managers to make better decisions by implementing improved infrastructure and data management systems. Consequently, manufacturing firms may enhance their overall performance in the long run. Kumar et al. (2017) developed a theoretical framework based on literature that outlines three dimensions of supply chain network integration: customer, internal, and information integration. The study examines how these dimensions contribute to improved supply chain network performance, such as inventory turnover, production flexibility, total logistics costs, order fulfilment rates, and operational performance.

This investigation employs a mixed-methods approach. The survey questionnaire was first evaluated for gathering practical data, and an inductive approach was subsequently applied to validate findings through two semi-structured interviews. Primary data from UK manufacturers in the food industry were collected through the survey. The survey targeted respondents who were managers or supervisors in their company's coordination and supply chain network or individuals with adequate knowledge of how effectively their supply chain network had improved and how their organizations managed their inventory network capabilities. Sixty respondents fully completed the survey and were included in the study. Semi-structured interviews were conducted with two supply chain managers from UK food manufacturing firms. The survey data was analyzed using SPSS software. The correlation analysis demonstrated that supply chain integration (SCI) constructs significantly correlate with supply chain performance (SCP). This research identified the relationship between supply chain integration and SCP within the UK food industry. Integrating the supply chain offers several benefits, such as reducing coordination costs, increasing business productivity, and improving the company's adaptability in responding to external demand fluctuations.

Internal process integration enhances organizational collaboration and customer engagement through the efficient exchange of information. This study also explored the link between supply chain networks, strategic supply chain integration methods (SCIM), and information systems (IS) to facilitate operational performance improvements. The research further highlighted how different types of IS support supply chain operations to achieve enhanced performance. Specifically, the study recognized three types of IS: strategic, operational, and infrastructural. Three aspects of supply chain network structures were identified at the plant level: data exchange and quality, purchasing management, and warehouse management. The researcher targeted 365 respondents via email and in-person visits, focusing on pharmaceutical firms' operations managers, manufacturing heads, and plant-level supply chain managers for data collection. Of 365 respondents, 270 agreed to participate, and data from 262 firms were used for analysis.

A structured survey questionnaire was employed as the research instrument, comprising eight constructs with 41 items. Responses were collected using a seven-point Likert scale. The relationship between supply chain network performance IS and operational performance (OP) was examined. The results showed that IS infrastructure significantly influences operational performance through supply chain network samples, resulting in improved operational execution. Operational performance was evaluated based on several factors, including the number of defects in processes, improvements in product quality, and the delivery of items or raw materials at the right time, place, and quantity. Different levels of IS operational, strategic, and infrastructural must be interconnected to support the entire supply chain network. To thoroughly assess the impact on operational performance, it was noted that focusing solely on IS and the existing network may be insufficient. The role of quality management should also be considered as a crucial factor influencing operational performance. However, the alignment of IS and supply chain networks at the plant level has not been extensively studied. A review of supply chain network management (SCM) suggests that information sharing (IS) has become a critical factor in achieving supply chain advantages. This research emphasizes the impact of SCI frameworks on information exchange and supply chain network performance.

A key motivation of this investigation is to explore the impact of integrating supply chain management (SCM) with data exchange on supply chain performance (SCP). Product and service quality, improved coordination within the supply chain, competitive advantage, and cost reduction are directly linked to effective data exchange. The conceptual model comprises three hypotheses with three key constructs: data exchange, supply chain integration (SCI), and SCP. Customer integration and internal integration are downstream elements of the SCI construct. Types of data exchange include customer data sharing, inter-functional data exchange, and intra-organizational data exchange. SCP is further categorized into four constructs: cost efficiency, supply chain reliability, resource utilization, and the adaptability and responsiveness of the network. An empirical study tested these hypotheses by collecting data from 158 manufacturing companies in Turkey, with responses measured using a seven-point Likert scale. The findings suggest that the SCI network foundation plays a crucial role in the information exchange by emphasizing organization, collaboration, and coordination among supply chain participants. Additionally, the results provide valuable insights into how organizations can leverage data sharing to improve supply chain performance.

The study further examines the effects of three types of SCI on organizational performance from the perspective of enterprise capabilities. Using Structural Equation Modeling (SEM) and data collected from 617 firms in China, the relationships between internal integration, customer integration, customer-oriented performance, and financial performance were analyzed. The results indicate that internal integration enhances external integration and organizational performance, both directly and indirectly. Partial or complete mediating effects were observed in SCI and organizational performance, addressing inconsistencies in prior research regarding the impact of SCI on performance. This research extends existing literature on organizational capabilities, SCI, and SCI constructs. The investigation also explores the relationship between supply chain network integration and business operations. A quantitative methodology was employed, with convenience sampling and survey questionnaires administered to 98 participants in Malaysia. Multivariate analysis was used to examine the study's context. Results reveal that all three components of supply chain integration significantly impact business operations. However, financial and physical integration's influence is less pronounced than information flow integration's. The research focused on the manufacturing sector, with participants holding managerial positions. The findings provide strategic insights for policymakers and supply chain specialists on the importance of IT frameworks and SCI in enhancing the effectiveness of the manufacturing sector in terms of revenue growth, operational scale, and customer relationships.

Rashid et al. (2024c) explored the integration of cloud adoption and artificial intelligence (AI) in enhancing the resilience and sustainability of manufacturing supply chains in the United States. Published in the Journal of Manufacturing Technology Management, the research highlights how emerging technologies, such as AI and cloud computing, optimize supply chain operations and contribute to sustainable practices. The findings provide actionable insights for manufacturers aiming to navigate disruptions while maintaining long-term environmental and operational goals. Rashid et al. (2024d), in the Journal of Global Operations and Strategic Sourcing, this paper examines the role of information processing and digital supply chain tools in bolstering supply chain resilience through effective risk management practices. The study underscores the importance of digital transformation in mitigating risks and fostering robust supply chain structures. The authors prove how digital technologies facilitate better decision-making and adaptive strategies to address potential disruptions.

Similarly, Rashid et al. (2024e), in the Journal of Science and Technology Policy Management, investigate the mediating role of integration in the relationship between supply chain information management practices and supply chain performance. Focusing on a developing economy, the authors provide empirical evidence on how internal and external integration improve operational performance, offering valuable lessons for firms in emerging markets aiming to enhance their supply chain efficiencies. Rashid et al. (2024f), in their paper published in the Journal of Global Operations and Strategic Sourcing, the authors delve into how multifaceted green functions contribute to sustainability in manufacturing supply chains. The study discusses adopting green practices, such as eco-friendly sourcing, waste reduction, and energy efficiency, emphasizing their role in achieving long-term sustainability goals while maintaining operational effectiveness. It offers a comprehensive view of the strategic alignment between environmental responsibility and supply chain performance.

2.3 Conceptual Framework

2.3.1 SCIM

Managing a supply chain (SC) network involves integrating critical organizational activities across all stakeholders, from end customers to key suppliers, to deliver products, services, and information that create value for customers and other partners. From this perspective, transforming raw materials from their initial state to finished goods for the end customer requires collaboration across multiple organizations rather than a single entity. Some studies collectively explore critical aspects of supply chain management, sustainability, and performance across various industries and contexts. Rashid et al. (2024g) identify disruptive factors affecting manufacturing vendor-managed inventory (VMI), emphasizing improved collaboration and technological integration to overcome challenges. Similarly, Rashid et al. (2024h) highlight how big data analytics and artificial intelligence, combined with green supply chain practices, drive sustainable performance in manufacturing firms in developing countries. Extending this focus on sustainability, Rashid et al. (2024i) apply the conservation of resources (COR) theory to demonstrate how resource conservation strategies enhance sustainable performance in the tourism sector. Rashid and Rasheed (2023) emphasize the mediating role of inventory management in leveraging knowledge resources for improved firm performance, while Rashid et al. (2022a) explore blockchain's transformative impact on supply chain performance, highlighting its ability to improve transparency, trust, and efficiency. Lastly, Rashid et al. (2022b) investigate customer satisfaction in Karachi's retail chain stores, identifying supply chain inefficiencies and service quality as key disruptive factors, with practical recommendations for enhancing customer experiences. Together, these studies comprehensively understand the interplay between technology, sustainability, and performance in diverse supply chain contexts.

Effective supply chain management heavily relies on integrating and interacting processes and information flows within and between organizations. Optimal performance and seamless integration depend on efficient data exchange, further supported by advancements in supply chain information management (SCIM). Furthermore, when information is uniformly managed across the supply chain network, there is a significant boost in business activities. These enhanced capabilities are achieved when data is shared effectively, promoting collaboration among individuals and systems. Supply chain managers aim to provide data that facilitates the optimal performance of all participants in the supply chain. Properly organized and shared information is crucial for supporting decision-making processes, enabling organizations within the supply chain network to make informed and effective decisions. Poorly managed information can lead to beneficial and detrimental outcomes, depending on the quality and timeliness of the shared data.

Some other studies examine the interplay of inventory control, supply chain practices, and organizational performance across various sectors. Hashmi et al. (2020b) explore disruptive factors in inventory control using exploratory factor analysis, identifying key dimensions that influence operational efficiency. Similarly, Rashid et al. (2020) analyze the impact of demographic factors on inventory managers' perceptions of healthcare performance, shedding light on the role of human elements in inventory practices. Hashmi et al. (2021a) and (2021b) delve deeper into the healthcare context, highlighting the mediating role of inventory control practices in enhancing organizational performance, with a particular focus on public hospitals in Punjab, Pakistan. These studies underscore the criticality of integrated systems and supply chain practices, as Hashmi et al. (2020a) illustrated, who demonstrate their mediating effect on public healthcare performance through structural equation modelling. Beyond healthcare, Albhirat et al. (2024) leverage the PRISMA Statement to conduct a systematic review of enviropreneurship studies, presenting a research agenda for sustainability-focused entrepreneurship. Collectively, these studies provide valuable insights into inventory management, supply chain optimization, and sustainable practices across industries.

Current supply chain frameworks emphasize various methods for leveraging network information, such as maintaining extensive inventories, fostering information sharing among supply chain participants, and ensuring strong commitment at every level. While these strategies may appear distinct, they all underscore the importance of collaboration and communication. Consequently, exchanging information is a foundational element that drives communication and collaboration within the supply chain. In the warehousing industry, tools are frequently employed to facilitate information sharing among warehouse managers, manufacturers, and retailers, helping them maintain competitive advantages within the supply chain. However, the addition of new systems and processes often makes integration more complex and time-consuming. This underscores the need for continuous improvement in information management to streamline operations and enhance supply chain efficiency.

2.3.2 Supply Chain Information System Infrastructure (SCISI)

SCISI is primarily designed to enhance task-specific performance, optimize functionality, and improve the overall efficiency of processes spanning different areas of an organization. Researchers have reported that the lack of coordinated planning often results in inefficiencies, highlighting the need for an integrated approach to streamline processes and reduce cycle times. This need has been addressed by introducing the Information System Infrastructure (ISI), a framework that integrates software and hardware components to eliminate inefficiencies within a supply chain network. The Supply Chain Information System Infrastructure enables smoother processes, communication, and interactions, making it easier to manage supply chain relationships. It enhances the capability to mitigate coordination delays by eliminating bottlenecks and inefficiencies. This is achieved through features like customized data retrieval, automated material handling, and electronic data exchange, which optimize the performance of IS systems and improve the overall supply chain network. By providing critical support to the supply chain network, SCISI facilitates the effective exchange of information, improving coordination and operational outcomes. It expands the scope and effectiveness of supply chain operations by enabling organizations to share vital information about administrative and operational components efficiently. The system’s intrinsic attributes allow businesses to forecast customer demands more accurately and meet their current needs effectively, thereby supporting informed decision-making and enhancing supply chain performance.

2.3.3 Supply Chain Network Integration (SCNI)

Supply Chain Network Integration is a critical process that involves treating the entire supply chain as a unified system. This integration requires the seamless collaboration of all stakeholders, suppliers, customers, and partners within the supply chain management network to maximize the benefits of the entire chain. A key aspect of SCNI is recognizing employees' roles and contributions to achieving supply chain objectives. Integration consolidates all activities necessary to meet customer needs, fostering collaboration among internal organizational functions, suppliers, clients, and external partners. Efficient supply chain network integration ensures that all operational activities within a company and those across its supply chain partners are interconnected and synchronized. This level of coordination facilitates smoother workflows, enhances resource utilization, and ensures the alignment of supply chain processes with organizational goals, ultimately driving better performance and customer satisfaction.

2.3.4 Supply Chain Performance

Supplier performance is delivering raw materials, components, or goods to an organization on time and under optimal conditions. Increasingly, many companies emphasize the importance of working with a select number of qualified suppliers. This marks a significant shift from the traditional adversarial buyer-supplier relationship to a more collaborative approach. To foster effective supplier involvement, it is essential to understand and address buyers' expectations regarding quality, delivery, service, and cost. Suppliers can help organizations improve overall performance, reduce costs, and minimize competitive risks by aligning with these expectations. When these expectations are met, the relationship between suppliers and buyers evolves into a valuable partnership that aids the organization in achieving its strategic goals. This study explores the integration of supply chain processes both within organizations and across partnerships with external stakeholders in the supply chain network. Effective supply chain integration, whether internal or external, is crucial for ensuring synchronized and seamless data flow across the supply chain in the manufacturing sector. Moreover, recognizing the importance of alliances with vendors and customers is critical. This involves fostering collaborative relationships and measuring key indicators that reflect strengthened partnerships between suppliers and buyers. Such enhanced relationships can improve supply chain performance by ensuring mutual alignment, efficiency, and resilience.

2.4 Hypothesis Development

The job of executives' supply chain network data is to distribute the data among accomplices or individuals in the supply chain network. In addition, data sharing plays a fundamental role in making businesses a reality. IS among the network accomplices in the supply chain help the associations to react to economic situations. As expressed by the information stream in the SC network system, assistance can be planned for the store network organization network mix with a stable data basis and information exchange. Numerous analysts have presented the basics of data exchange practices in a supply chain network. Exact and accelerated dynamics through the supply chain network through the competent and successful exchange and trading of data are also conceivable. It is seen as the reason for the upper hand. Customer response and company presentation improve by sharing data between network accomplices in the supply chain. We suspect along this line that:

H1: SCIM has a critical impact on SCI.

H2: SCIM has a critical impact on SCP.

Additionally, the combination can promote regular contact between individuals or accomplices on SC through accurate and convenient board data. I will set up exhibition that the assembling companies put together. The data participation in the supply chain network ensures a uniform data flow and, thus, better supply chain performance. Conceptualize the relationship between information sharing about the essential understanding of events and supply chain performance. The most significant monetary benefit from IS comes from eased dynamics, which announce that IS achieves cost savings by reducing SKUs and defects. The IS license made planning and developing common items more effortless, which prompted further developed SCP network execution. Then, at that point, on a suspect:

H3: SCISI has a critical impact on SCI.

According to the MIDA (2017) report, there is a growing trend in global information and communication technology within the manufacturing industry. The literature highlights numerous scenarios where companies establish and maintain new connections to develop robust information systems infrastructure. An effective network information system (IS) extends the scope and efficiency of an organization's supply chain by facilitating the productive exchange of information across various value chain segments. Integrating a supply chain network, including communication, sharing inventory-related data and production schedules, and collaborating with customers, can significantly reduce the complexity of downstream processes. Manufacturers with well-coordinated information system capabilities are better positioned to provide consistent and reliable access to critical client, production, demand, and transaction data. This capability improves supplier performance within the supply chain by streamlining processes. Moreover, automation and system integration minimize errors and inefficiencies associated with manual workflows. Coordinated information systems in manufacturing also enhance decision-making processes and foster better collaboration with supply chain partners, ultimately improving overall supply chain performance. We therefore theorize:

H4: SCISI has a critical impact on SCP.

These hypothetical arguments support the premise that supply chain network data facilitates supply chain network integration, thereby influencing performance outcomes. The discussion suggests that both supply chain network data management and the supply chain network data framework impact supply chain performance through their roles in enabling supply chain integration. A primary goal is to achieve a prominent position in business operations, enhancing overall corporate performance. Information technology (IT) is primarily used to optimize specific tasks, streamline operations, and minimize inefficiencies to improve execution. Thus, establishing an effective information system (IS) significantly influences the performance of the supply chain network, providing essential functional support for better outcomes. The influence of client and internal linkages on supply chain performance has been examined in manufacturing and service companies, making it a relevant focus for this study. The prevailing perspective in the literature is that higher levels of integration lead to improved business performance. This insight underpins the foundational research on supply chain network integration. We therefore hypothesize:

H5: SCI significantly mediates the relationship between SCIM and SCP.

H6: SCI significantly mediates the relationship between SCISI and SCP.

2.5 Conceptual Framework

Figure 1 below represents the conceptual framework.

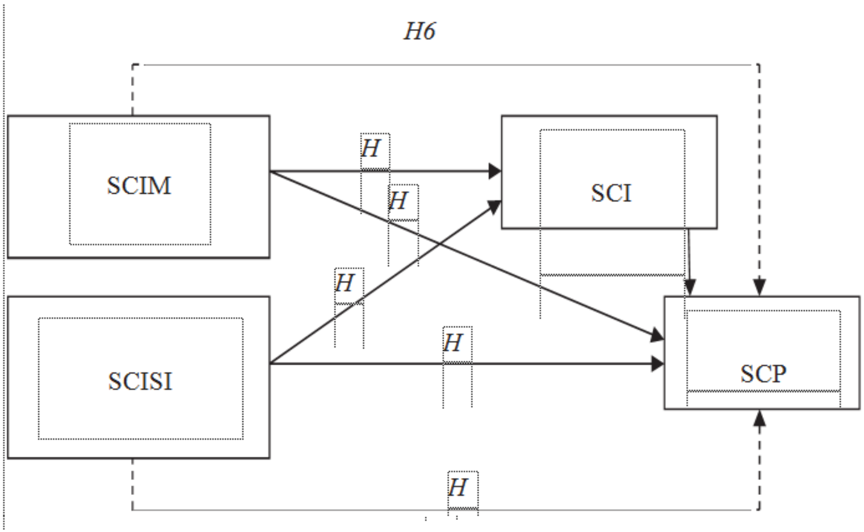

Figure 1: Conceptual Framework

3. Research Methodology

3.1 Study Approach

The researcher adopts three types of research criteria: qualitative, quantitative, and mixed approach (Rashid et al., 2021; Khan et al., 2023a). This research paper has used a quantitative approach with the help of a questionnaire survey, which mainly permits to develop and apply a mathematical model and will obtain the statistical result by analyzing and evaluating the quantifiable and the approximations of information gathered through surveys, polls and reviews (Khan et al., 2023b). The quantitative approach reveals the linking between the factors and logical results in extremely cautious conditions (Rasheed et al., 2025a; b). Researchers typically highlight three main types of research purposes: exploratory, explanatory, and descriptive. Research generally involves a careful investigation of a phenomenon or the objectives of an inquiry (Amirah et al., 2024). The objective of a study should be to identify or define an idea, describe a situation, or forecast a solution, which subsequently determines the type of research to be conducted. Researchers begin by observing the conditions and situations and then collect data relevant to the context, conditions, and experimental logic. They analyze the results and subsequently integrate the findings into existing theories (Jais et al., 2024). In this study, we employed explanatory research to examine the effect of one variable on another. The study is explanatory, and the research design is based on a quantitative method (Yadav & Rai, 2017; Nazri et al., 2024). The research design refers to the comprehensive process of logically integrating the various components of the research. It establishes the strategy for collecting, evaluating, and analyzing information, identifying the relationships, whether positive or negative, strong or weak, between variables. This approach also highlights the influence of independent variables (IV) on dependent variables (DV). This study collected data from 144 participants to analyze how (SCIM) and ISI (Institute for Scientific Information) rankings influence decision-making in companies.

The target population refers to the individuals from whom data is collected to compute and analyze precise information. In this research, the target population comprises supply chain professionals working in Pakistan-based organizations within the manufacturing sector. According to Tabachnick and Fidell (2014), the recommended sample size can be determined using the formula 50 + 8m, where m represents the number of independent variables in the study. Based on this formula, the sample size for the current research is 144. Alternatively, some researchers suggest calculating the sample size using the formula N × 10, where N is the number of latent variables in the structural model (e.g., six latent constructs in this study). Using this method, this study's minimum required sample size is 100. However, the sample size collected for the current research is 144, exceeding the minimum requirements. Sampling is one of the most critical elements affecting the accuracy and reliability of survey or study results. For the current research, data were collected using a non-probability sampling method. Specifically, a targeted sampling technique was employed to gather data and explain the findings. Targeted sampling is used when researchers need to reach a specific subset of individuals. In this approach, participants are deliberately selected because they meet predefined criteria, ensuring that the sample aligns with the study's objectives. The survey instrument used in this research was adapted from various studies supporting this investigation's measurement requirement. The instrument includes items designed to measure different aspects of management perceptions within the manufacturing sector, utilizing a 5-point Likert scale. It is organized systematically, categorizing the constructs to make them clear and understandable for respondents. Each item is phrased based on respondents' perspectives, making it easier for them to provide responses aligned with their level of agreement for each statement. A 5-point Likert scale accompanies each statement to capture responses effectively (Joshi et al., 2015; Ngah et al., 2024a; b).

The first step in data collection involves gathering information to analyze and measure variables of interest in a well-structured manner. This ensures the ability to answer research questions, test hypotheses, and derive meaningful results. Data were collected through multiple methods, including online surveys, face-to-face interactions, and other approaches such as interviews, questionnaires, survey observations, document reviews, records analysis, and focus group discussions. The research targeted specific geographical areas to identify relevant populations for data collection. Data collection methods included interviews, questionnaires, and group discussions conducted within these locations. The number of items for each variable and their respective sources is summarized in Table 1.

Table 1: Sources of Data Collection

S. No.	Variables Name	Source
1.	Supply Chain Information Management	Sundram et al. (2018)
2.	Supply Chain Information System Infrastructure	Sundram et al. (2018)
3.	Supply Chain Internal Integration	Kumar et al. (2017)
4.	Supply Chain Customer Integration	Kumar et al. (2017)
5.	Supply Chain Performance	Kumar et al. (2017).

Source: Literature

A rigorous validation process was conducted to ensure the validity of the survey questionnaire. Validity is one of the most challenging aspects of research to achieve. For the current study, supply chain professionals and academic experts evaluated the questionnaire's face validity and content relevance before being finalized and distributed to supply chain experts from manufacturing companies (Rahi et al., 2024; Tunio et al., 2024).

The researcher utilized the Structural Equation Modeling (SEM) technique through SMART-PLS 3.2.8 to test the model and hypotheses. The primary objective of Partial Least Squares Structural Equation Modeling (PLS-SEM) is to maximize the explained variance of variables. PLS-SEM was employed to facilitate the effective interpretation of cause-effect relationships between variables. In research, ethical considerations play a vital role in ensuring the integrity and fairness of the study. Participants in this research were asked to provide informed consent and voluntarily participate. Protecting participants' data was strictly maintained, and their information was exclusively used for research purposes (Haq et al., 2023; Rashid & Rasheed, 2022). Before completing the questionnaire, participants were fully informed about the study's purpose and asked to respond according to their perceptions. They were also allowed to withdraw from the study at any time. Additionally, strict measures were taken to ensure that no participants were subjected to mental or physical harm during the research process. These ethical considerations aligned with established guidelines and recommendations for quantitative research (Hashmi & Mohd, 2020).

4. Data Analysis

The purpose of this research is to evaluate an expected version and also to test the proposed hypothesis through data analysis. In this section, we used SPSS for data screening to determine a linkage between volatile variables and whether any of the proposed hypotheses have a significant effect. The pilot study plays a crucial role in conducting effective research. The questionnaire (research instrument) is pre-tested in this phase to ensure reliability and consistency. Respondents randomly filled out 25 questionnaires, and reliability was assessed to measure consistency, as Drost (2011) suggested—the pilot study aimed to validate the research instrument and ensure its effectiveness. Cronbach's alpha, introduced by Cronbach (1951), was used as the primary method to measure data reliability. To collect data, 155 questionnaires were distributed in offices and circulated via email to relevant respondents. Of these, 144 respondents completed the questionnaire, resulting in a 95% response rate. According to Mellahi and Harris (2016), a 50% response rate is considered "good" in management and business research. Before commencing statistical analysis, the 144 responses underwent a thorough data screening process, which is a critical step. Data screening was performed using SPSS to identify and address any issues with the dataset. This process included checking for missing values, identifying univariate and multivariate outliers, and removing impurities. After completing these steps, the final sample size 144 was retained for further analysis.

4.1 Descriptive analysis and interpretations:

A descriptive analysis was carried out on a sample of 144 respondents to obtain their demographic profiles. The demographic profile includes company type, size, work position, position experience and qualifications as shown in table 2.

Table 2: Profile of Respondents

Demographic items	Frequency	Percent
Firm Type		
Automotive	89	61.81
Textile	18	12.50
Pharmaceutical	22	15.28
Food & Beverages	12	8.33
Other…..	3	2.08
Firm Size		
< 250	0	0.00
250 – 1000	18	12.50
1000 – 3000	62	43.06
3000 – 5000	52	36.11
More than 5000	12	8.33

Work Position		
Top Management	25	17.36
Middle Management	91	63.19
Lower Management	28	19.44
Experience		
one - three years	23	15.97
four - to seven years	40	27.78
eight – eleven years	56	38.89
More than eleven years.	25	17.36
Qualification		
Bachelor	88	61.11
Master	56	38.89
Others…..	0	0.00

Source: SPSS output

After completing the data screening process, further analysis was conducted using Smart PLS 3.2.8. Initially, the data was evaluated using the external measurement model to assess the reliability and validity of the constructs. Then, hypothesis testing was performed to analyze the relationships between variables based on the proposed model.

The outer model evaluates the solidity and effectiveness of the study. Internal consistency of variables is measured by solidity. Combination (AVE) and univariate (FLC) effectiveness are measured based on data validity. Reliability is commonly referred to as the consistency and stability of a measurement tool. This study assessed reliability using Cronbach's alpha, with a threshold value greater than 0.7, which is considered acceptable to ensure dependability. Convergent validity assesses the correlation between constructs and is measured using the Average Variance Extracted (AVE). The threshold for factor loadings to establish convergent validity is typically greater than 0.7, while the threshold for AVE is at least 0.5. Factor loadings between 0.5 and 0.6 are also acceptable under certain conditions (Rashid et al., 2024a; 2025). Table 3 provides the AVE values for all latent variables, along with the factor loading values for each element of the latent variables.

Table 3: Results of validities

Constructs	Items	Loadings	CR	AVE
SCIM	SCIM2	0.702	0.834	0.627
	SCIM3	0.809		
	SCIM5	0.857		
SCISI	SCISI1	0.830	0.859	0.672
	SCISI2	0.905		
	SCISI4	0.713		
II	II2	0.765	0.885	0.564
	II3	0.661		
	II4	0.746		
	II5	0.744		
	II6	0.735		
	II7	0.844		
CI	CI1	0.705	0.834	0.627
	CI5	0.845		
	CI6	0.819		
FL	FL2	0.797	0.838	0.633
	FL3	0.799		
	FL6	0.792		
IC	IC1	0.723	0.806	0.516
	IC2	0.831		
	IC3	0.767		
	IC4	0.513		

INV	INV2	0.747	0.849	0.589
	INV3	0.601		
	INV4	0.847		
	INV5	0.848		
OP	OP1	0.835	0.902	0.699
	OP2	0.880		
	OP3	0.847		
	OP5	0.777		

Source: SmartPLS output

Below Figure 2 is a graphical presentation of the structural model.

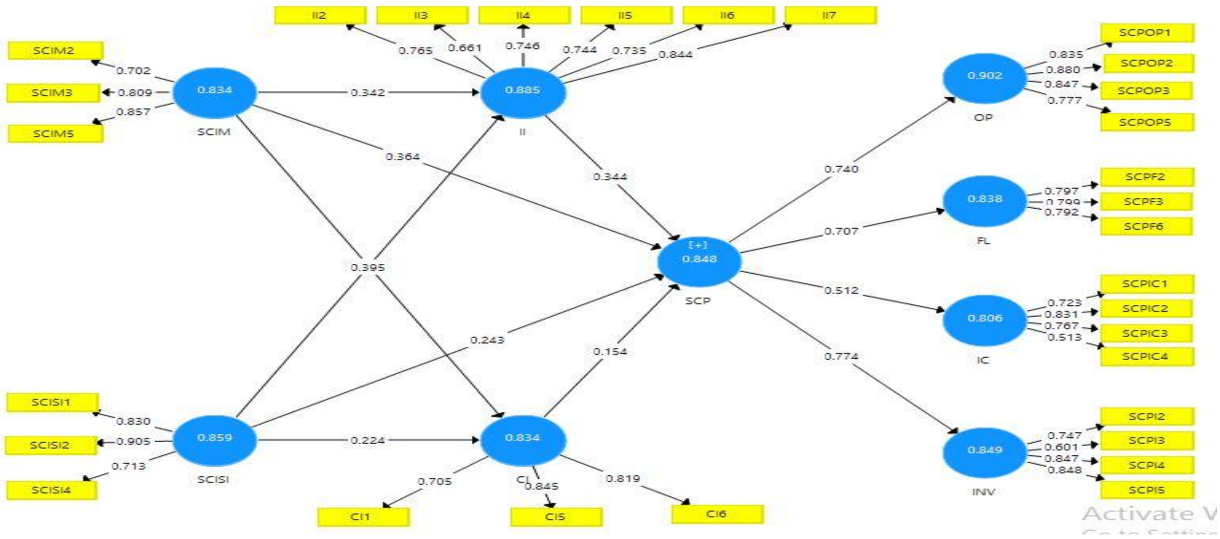

Figure 2: Algorithm (Source: SmartPLS output)

The discriminate validity analyzed the uniqueness of the construct measure. Discriminate validity usually measures the difference between constructs. Discriminate validity is constructed to confirm the result and check that there are no statistical discrepancies. It is necessary to create discriminate validity to confirm that the results are safe and that no more statistical differences are found. The Fornell and Lacker criteria define the discriminate validity, the crossing loading and the Heterotrait-Monotrait ratio between the items (Rasheed & Rashid, 2023). For the Fornell-Lacker criterion, it is recommended that a specific latent variable show relatively more variance with its items than with other variables. For this, the diagonal values now confirm the existence of discriminate validity. The discriminate validity results are presented in Table 4.

Table 04: Correlations of Discriminate Validity

	CI	FL	IC	II	INV	OP	SCIM	SCISI
CI	0.792							
FL	0.234	0.796						
IC	0.369	0.312	0.718					
II	0.274	0.430	0.377	0.751				
INV	0.126	0.373	0.259	0.475	0.767			
OP	0.255	0.347	0.107	0.210	0.406	0.836		
SCIM	0.314	0.264	0.269	0.494	0.381	0.321	0.792	
SCISI	0.312	0.330	0.245	0.527	0.441	0.068	0.386	0.820

Source: SmartPLS output

Some researchers have suggested that the Fornell-Larcker criterion is not highly effective for assessing univariate effectiveness. To address this, Henseler et al. (2015) recommended using the Heterotrait-Monotrait Ratio (HTMT) as a more robust method for confirming discriminate validity. A threshold of less than 0.9 is used to establish discriminate validity. Table 5 presents the HTMT values (Rasheed et al., 2023), all below 0.9, confirming that discriminate validity has been achieved.

Table 05: Heterotrait-Monotrait Ratio(HTMT) Results

	CI	FL	IC	II	INV	OP	SCIM	SCISI
CI								
FL	0.379							
IC	0.572	0.439						
II	0.371	0.537	0.494					
INV	0.215	0.471	0.285	0.553				
OP	0.345	0.423	0.219	0.297	0.430			
SCIM	0.457	0.371	0.444	0.626	0.446	0.416		
SCISI	0.412	0.443	0.330	0.649	0.538	0.163	0.526	

Source: SmartPLS output

Checking the loading of items is another approach. The results are presented in Table 6.

Table 6: Cross Loadings

	CI	FL	IC	II	INV	OP	SCIM	SCISI
CI1	0.705	0.265	0.315	0.222	0.026	0.328	0.113	0.166
CI5	0.845	0.069	0.268	0.271	0.088	0.195	0.279	0.315
CI6	0.819	0.236	0.300	0.166	0.169	0.114	0.327	0.249
FL2	0.297	0.797	0.276	0.356	0.273	0.304	0.125	0.282
FL3	0.148	0.799	0.211	0.375	0.355	0.318	0.275	0.319
FL6	0.108	0.792	0.260	0.288	0.255	0.196	0.232	0.176
IC1	0.204	0.319	0.723	0.275	0.190	-0.065	0.347	0.258
IC2	0.201	0.310	0.831	0.295	0.328	0.147	0.103	0.216
IC3	0.450	0.151	0.767	0.284	0.086	0.154	0.165	0.079
IC4	0.317	-0.056	0.513	0.275	-0.017	0.010	0.328	0.157
II2	0.344	0.410	0.265	0.765	0.322	0.069	0.314	0.500
II3	0.124	0.292	0.147	0.661	0.471	0.255	0.257	0.381
II4	0.007	0.334	0.417	0.746	0.350	0.158	0.319	0.316
II5	0.149	0.103	0.225	0.744	0.319	0.270	0.453	0.193
II6	0.180	0.320	0.204	0.735	0.368	0.135	0.470	0.415
II7	0.380	0.427	0.422	0.844	0.319	0.095	0.413	0.515
INV2	0.169	0.277	0.112	0.173	0.747	0.076	0.150	0.228
INV3	0.243	0.109	0.151	0.292	0.601	0.034	0.069	0.240
INV4	0.036	0.330	0.237	0.458	0.847	0.488	0.408	0.489
INV5	0.053	0.356	0.255	0.459	0.848	0.443	0.399	0.333
OP1	0.283	0.338	-0.016	0.279	0.387	0.835	0.419	0.093
OP2	0.135	0.315	-0.021	0.251	0.351	0.880	0.320	0.024
OP3	0.239	0.373	0.254	0.202	0.329	0.847	0.152	0.128
OP5	0.188	0.092	0.134	-0.079	0.286	0.777	0.177	-0.044
SCIM2	0.099	0.292	0.070	0.369	0.232	0.264	0.702	0.178
SCIM3	0.379	0.086	0.184	0.294	0.179	0.257	0.809	0.450
SCIM5	0.261	0.247	0.337	0.486	0.444	0.250	0.857	0.296
SCISI1	0.138	0.288	0.166	0.454	0.288	-0.077	0.142	0.830
SCISI2	0.319	0.324	0.232	0.465	0.407	0.105	0.317	0.905
SCISI4	0.287	0.192	0.196	0.376	0.375	0.115	0.474	0.713

Source: SmartPLS output

4.2 Hypothesis Testing and Inner Model Measurement

After evaluating the external measurement model, the next step is to analyze the data for the internal measurement model. Hypothesis testing was conducted using Smart PLS, employing the bootstrapping technique; figure 3 represents the bootstrapping. Researchers commonly use Smart PLS because it provides robust results and effectively handles complex and challenging models compared to other approaches. This study applied the bootstrapping method with a re-sampling technique of 5,000 subsamples to evaluate the inner model.

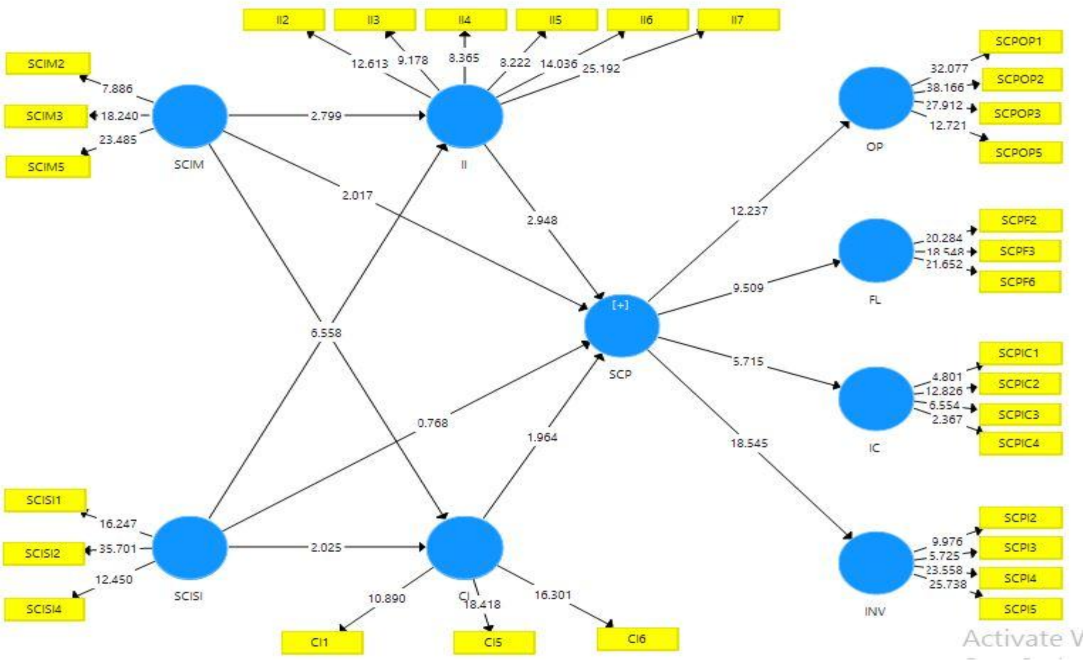

Figure 3: Bootstrapping (Source: SmartPLS output)

4.2.1 Predictive significance

The quality and capability of the internal model predict the endogenous construct. The primary measures for assessing predictive accuracy are the cross-validated redundancy (Q^2) and the coefficient of determination (R^2). The R^2 value estimates the model's predictive accuracy and represents the relationship between independent variables (IV) and dependent variables (DV).

As cited by Rashid et al. (2024a), R^2 is categorized into three levels:

High: $R^2 > 0.6$

Moderate: R^2 between 0.3 and 0.6

Low: $R^2 < 0.3$

Rashid et al. (2024a) also cited that R^2 values should be greater than 26% to be considered significant. Table 7 provides the R^2 values, which explain the model's goodness of fit.

Another measure for evaluating model accuracy is cross-validated redundancy (Q^2). The Q^2 value assesses the predictive relevance of the inner model, and it is estimated using the blindfolding technique. For a model to be considered significant, the Q^2 value must be greater than zero. The Q^2 values are also presented in Table 7, confirming that all values are above zero, indicating a good model fit.

Table 7: R Square/Q Square

	R Square	Q Square
SCP	0.359	0.090

Source: SmartPLS output

4.3 Structural Model and Hypothesis Testing:

After analyzing the external calculation template, the next step is to analyze an internal calculation template. Hypothesis test using Structural Equation Modeling (SEM) in Smart PLS with bootstrapping. Researchers usually used smart PLS because it gives better results, and the comparatively controlled complex and difficult models confirm the significance level at their threshold value, i.e. p <0.05.

Table 8: Reflective Construct For Supply Chain Performance

	Estimates	Standard Error	T Statistics	P Values
SCP -> FL	0.707	0.074	9.509	0.000
SCP -> IC	0.512	0.090	5.715	0.000
SCP -> INV	0.774	0.042	18.545	0.000
SCP -> OP	0.740	0.060	12.237	0.000

Source: SmartPLS output

Table 8 above explains that the reflective constructs for SCP have a significant relationship with OP, FL, IC, and INV under P-value criteria, H. less than 0.05, and their estimated values for all variables mentioned. The P threshold for this study is 0.05, which allows for a significant relationship.

4.3.1 Assumption evaluate

Table 9: Hypothesis Test Results

H1	SCIM -> II	0.342	0.122	2.799	0.005
H2	SCIM -> CI	0.227	0.106	2.154	0.032
H3	SCIM -> SCP	0.211	0.105	2.017	0.044
H5	SCISI -> CI	0.224	0.111	2.025	0.043
H4	SCISI -> II	0.395	0.060	6.558	0.000
H6	SCISI -> SCP	0.072	0.094	0.768	0.443
H7	II -> SCP	0.344	0.117	2.948	0.003
H8	CI -> SCP	0.154	0.079	1.964	0.050

Source: SmartPLS output

Table 9 provides the hypothesis test results, indicating whether each hypothesis is accepted or rejected based on this study's benchmark p-value of 0.05. The table lists eight hypotheses, out of which one hypothesis (SCISI -> SCP) is not accepted because its p-value exceeds 0.05 (p = 0.443). The remaining seven hypotheses are accepted, as their p-values are less than 0.05.

5. Discussion, Conclusion and Recommendations

5.1 Discussion

First, the results show that supply chain information management (= 0.342 and P-value = 0.005, P <0.05) has huge and beneficial effects on internal integration. Information management between supply chain partners helps organizations respond to market conditions. Consequently, a theory (H1) is upheld after the effect of a current review. Second, supply chain information management (= 0.227 and P-value = 0.032, P <0.05) has huge and beneficial outcomes effects on customer integration. Customer response and company performance improve the exchange of data between SC friends. Thus, a hypothesis (H2) is supported by the result of the current study. Third, supply chain information management (= 0.211 and P-value = 0.044, P <0.05) has huge and beneficial outcomes effects on SCP. Narasimhan and Nair (2005) design the link between the exchange of information on the development of strategic agreements and supply chain performance. Consequently, the theory (H3) helps the current research.

Fourth, the supply chain information system infrastructure (= 0.395 and P-value = 0.000, P <0.05) has huge and beneficial outcomes effects in ii. Incorporated data frameworks on assembling empower further developed navigation and further developed collaborations with production network accomplices. Hence, hypothesis H4 is supported by the results of the current study. Fifth, a supply chain information system infrastructure (= 0.224 and P-value = 0.043, P <0.05) has huge and beneficial outcomes effects on CI. Makers incorporate information system capacities and offer consistent and predictable entrance and straightforwardness in important client, creation, request, trade information, and work with coordination in production network accomplices. Thus, a speculation (H5) is supported by the result of the current study. Sixth, the supply chain information systems infrastructure (= 0.072 and P-value = 0.443, P> 0.05) has a negligible effect on SCP. Therefore, the results of the current study do not support the hypothesis (H6). Seventh, internal integration (= 0.344 and P-value = 0.003, P <0.05) has huge and beneficial outcomes effects on scp. SCI is one of theof the possible instruments for improving the determination and service drop ship on companies. Thus, the speculations (H7) are supported by the result of the current study. Finally, customer integration (= 0.154 and P-value = 0.05, P <0.05) has huge and beneficial outcomes effects on SCP. Clients, representatives, and parts on trade and item that execution and incorporated about functional productivity calculate on address & exact & thorough size on the viability of assembling execution. Thus, the speculation (H8) is supported by the result of the current study.

5.2 Conclusion

This model provides a better understanding of the effects of Supply Chain Integration (SCI) and supply chain data processes in manufacturing companies. Effective data management within the supply chain is critical for coordinating information among participants in supply chain networks. By leveraging a robust supply chain, companies can continuously evaluate and select appropriate information strategies. The results offer valuable insights into the significance of Supply Chain Information System Infrastructure (SC ISI). From an academic perspective, several conclusions regarding SCI and supply chain information practices can be drawn. Firstly, the findings indicate that data practices within supply chains serve as essential strategic resources, particularly in manufacturing. However, their impact on supply chain performance largely depends on the level of integration within the manufacturing sector's supply chains. Furthermore, supply chain management (SCM) practices must be employed to facilitate the integration of the entire value chain, including internal processes, within a manufacturing organization's supply chain network. The findings align with those of other researchers, highlighting that implementing supply chain information strategies, such as SC ISI and SCIM (Supply Chain Information Management), significantly contributes to the long-term success of manufacturing companies in Pakistan. Researchers can use these outcomes to generate ideas for future studies, while top managers can gain critical insights into how SCI and information practices positively influence supply chain performance (SCP).

5.3 Research Implications

5.3.1 Managerial implications

This study provides critical insights for supply chain managers and professionals, emphasizing the importance of robust Supply Chain Integration (SCI) and Supply Chain Performance (SCP) practices through effective Supply Chain Information Management (SCIM) and system infrastructure. Supply chain professionals should recognize and implement effective SCI data practices and capabilities to improve supply chain performance in manufacturing companies. Additionally, supply chain management administrators can leverage these findings to develop optimal methods for assessing and enhancing the effectiveness of information system management and SCIM practices. The study underscores the significant relationship between SCI integration, SCI data strategies, and SCP, emphasizing that SCI practices directly and indirectly influence supply chain performance. This insight helps decision-makers align their strategies to maximize SCP outcomes. Managers are encouraged to implement robust SCI integration strategies to improve operational objectives within manufacturing organizations. Strengthening SCI practices directly enhances SCP and aligns with broader organizational strategies. Furthermore, the study suggests that policymakers and supply chain stakeholders should adopt and support SCI data and integration regulations. These measures will accelerate Information Technology (IT) and Information System (IS) practices, ultimately fostering economic growth and organizational competitiveness in the manufacturing sector.

5.3.2 Empirical implications

The study also presents valuable empirical contributions that have significant implications for researchers, policymakers, and stakeholders, particularly in emerging economies like Pakistan. It highlights the critical role of advancing industrial growth through technology by emphasizing the importance of supply chain vertical integration, big data analytics, additive manufacturing, and enhanced information systems. These technological advancements provide substantial opportunities for growth and competitiveness in the manufacturing industry. The research further underscores the importance of government support in facilitating industrial growth. Strategic allocation of financial resources for IT/IS infrastructure is crucial for supporting research and development, facilitating data dissemination, and enhancing manufacturing operations. This study also highlights the manufacturing sector's contribution to Pakistan's economy, as it is a significant source of employment, exports, GDP, and foreign direct investment (FDI). Implementing strategic integration and information systems offers direct and indirect advantages to internal and external stakeholders, improving operational efficiency and economic outcomes. Globally, this study's integration of theoretical and practical insights offers a universal framework that can be applied across developing economies. It demonstrates the necessity of cohesive SCI and SCIM practices for fostering growth and competitiveness, particularly in emerging markets like Pakistan. By addressing these managerial and empirical implications, this study contributes to a deeper understanding of the critical role of SCI and SCIM in enhancing supply chain performance and driving sustainable economic growth.

5.4 Recommendations

Future researchers are encouraged to collect a larger sample size to ensure more robust and reliable results. Conducting interviews with participants who may encounter difficulties completing questionnaires is also recommended, as this can help gather more prosperous and more comprehensive data. This approach would enhance the overall understanding of Supply Chain Information Management (SCIM) and its impact on supply chain performance. For future exploration, researchers are advised to focus on a broader range of manufacturing industries in Pakistan, including chemicals, oil and chemical products, textiles, clothing, footwear, transportation equipment, construction materials, wood and wood products, beverages, tobacco products, and food. Targeting diverse industrial sectors would provide varied insights into SCIM practices, network management, system infrastructure, and their implications for supply chain performance. Future studies could also incorporate additional variables, such as information integration, logistics and supplier integration, strategic supplier partnerships, and risk and reward sharing. These factors further enhance the understanding of elements that influence and improve supply chain performance in manufacturing companies.

Manufacturing organizations are recommended to prioritize supply chain management practices to optimize processes. This can be achieved by adopting appropriate systems that support information management and transparency, thereby enhancing the overall performance of the supply chain. Researchers can build on the findings of this study to develop new ideas for future investigations. At the same time, senior managers can gain valuable insights into SCIM integration and information practices that positively affect supply chain performance. Additionally, the Pakistani government should prioritize developing policies and regulations that encourage organizations to make significant investments in the manufacturing sector. Emphasis should be placed on adopting advanced information systems and technologies to support organizational operations. Investing in IT infrastructure and fostering technological innovation will enhance the competitiveness of the industrial manufacturing sector, enabling it to achieve sustainable growth in the global market.

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