



THE IMPACT OF INFORMATION SHARING AND IT USAGE ON SUPPLY CHAIN VISIBILITY :THE MEDIATING ROLE OF SUPPLY CHAIN PERFORMANCE IN PAKISTAN FOOD DEPARTMENT

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ABSTRACT

The food management system in Pakistan still experiences great coordination and visibility issues especially in such important commodities as wheat, rice and sugar. The problem of fragmented data systems and poor institutional connection on both federal and provincial level restrict the government to provide accurate measurement of production, stock levels and market flows. Lack of real-time information results in delays in policy formulation, decision inconsistency on procurement and unstable prices. Lastly, the use of intermediaries and outdated reporting channels creates a distorted view of real supply situations, which leads to inefficiencies and regular shortages. The challenges elicit more fundamental problems with governance, transparency, and Supply Chain Visibility. In order to solve these problems, there is the urgent necessity of the integrated digital monitoring systems with the support of centralized farmer and crop databases. Enhancing data transparency by use of real-time systems to strengthen coordination among institutions can greatly enhance decision-making and stabilize management on food supply. The paper is an analysis of how information sharing and the use of information technology (IT) affect the supply chain visibility where supply chain performance is a mediating factor in the Pakistan Food Department. The research is based on the theory of Resource-Based View (RBV) which assumes that strategic resources like information sharing and IT capabilities contribute to the organisational performance and result into better supply chain performance. Quantitative research design is used with the analysis of data by Structural Equation Modeling (SEM) on the basis of structured questionnaires. It is supposed that the findings will prove the value of effective information sharing and IT use as a major contributor to the better performance of the supply chain itself, which will lead to the higher level of supply chain visibility.

The research adds to the literature as it offers a combined framework between information sharing, IT use, and supply chain performance and the visibility results in the public sector. It also provides feasible repercussions to supply chain managers and policymakers to improve on food supply chain transparency, efficiency and resilience via digital transformation.

Keywords: Supply Chain Visibility, Information Sharing, Information Technology (IT) Usage, Supply Chain Performance, Digital Transformation, Resource-Based View (RBV), Supply Chain Management, Public Sector Supply Chain, Structural Equation Modeling (SEM).

INTRODUCTION: The agricultural sector in Pakistan is very important in the maintenance of food security in the country and the economy of the country as the major commodities in the agricultural industry have been wheat, rice and sugar as the backbones of food in the country. These commodities are not only needed to be consumed in the country but also to generate employment, provide livelihoods to the rural population as well as industrialization. Current estimates show that the wheat is produced in the range of 2829 million tons, rice is produced in the range of 9.497 million tons, and the refined sugar is produced in the range of 6.5 7 million tons based on 84 million tons of sugarcane. Even with these high levels of production, Pakistan has been faced with the repetition of the same difficulties like a lack of wheat, fluctuating sugar prices and a frequent supply problem. All these ongoing challenges are indicators that the issue is not that of production capacity but systemic inefficiencies of the food supply chain. The lack of visibility of the supply chain in various food system stages is a major problem that has contributed to these inefficiencies. Supply chain visibility means how well, timely, and relevant information are available throughout the supply chain network, thus making it possible to coordinate, monitor, and make decisions (Somapa et al., 2018; Roy, 2021). The lack of integrated information systems and real-time data sharing systems in



Pakistan is a major hamper to the government in its capacity to accurately gauge the level of production, stock, and market flows. Such a dilemma is further made worse by the lack of cohesiveness in institutions and institution-wide data systems that leads to variations in policy formulation and implementation between federal and provincial governments. As a result, decisions made are usually relying on late or unreliable information creating inefficiencies, unstable prices, and market failures.

In the production phase, lack of full and digitalized farmer registry severely affects proper data collection and monitoring. Sample survey and crop cutting experimentation are the main methods of crop production estimation that are susceptible to sampling errors, time lag, and manipulation. Moreover, absence of real time monitoring systems does not allow tracking the changes in the acreage and yield with respect to climatic conditions, availability of water, and use of inputs. This causes unpredictability in the production estimates, which causes poor forecasting and poor reaction to policies. Inefficiency at the procurement stage is characterized by government interventions that take long and dominance of the intermediaries also known as Arthis. These intermediaries usually force farmers who need urgent liquidity after harvest to sell their products to them instead of to the government procurement centers. The government procurement systems are often described as inaccessible, bureaucratic and delayed payment systems, which are not mostly appealing to farmers. Thus, much of the agricultural produce is sold in the informal market, with end result that there is a massive mismatch between the actual production and the data of the procurements reported.

In the same way, the lack of real-time monitoring systems and poor regulatory enforcement at the processing level, especially in the flour and sugar mills, opens up the opportunity of under-reporting and manipulating supply. Mills can choose to understate the level of production to avoid taxation or manipulate the supply in the market. This is more exaggerated in the sugar industry where the market forces are controlled by influential parties. Absence of automated reporting and digital monitoring systems also diminish the transparency thus creating distorted information on supply and creating fake shortages. There are also high inefficiencies in the storage stage as there is no centralized inventory management system. Varied agencies keep different records that are not always consistent and stock reporting is majorly relying on manual and paper records. The practices have the effect of increasing the chances of mistakes, delays, and data manipulation. Moreover, the actual stock is also decreasing due to losses caused by spoilage, leakage, and corruption. As a result, physical inventory is not reported in the inventory, thus making planning and decision-making capabilities ineffective.

Weaknesses in the tracking of the flow of wheat flour and sugar at the distribution stage also decrease supply chain visibility. After commodities pass through processing units, it is hard to know their movement through wholesalers, distributors and retailers. This is due to the lack of end-to-end tracking systems that enable other practices like hoarding and black marketing where traders intentionally reduce supply to inflate prices. Consequently, market shortages are common even in cases where the system has enough physical stock.

These problems are further complicated at the level of policy and decision making by poor coordination of federal and provincial governments, a slow pace of the decision making in imports and exports, and the use of old and incorrect data. The responses of the policy tend to be reactive rather than proactive whereby the policy ignores the crisis until it appears. This generates repeated seasons of deficits, price swings and market inefficiencies. All of these problems indicate that the food supply chain in Pakistan is limited not by the inability to



physically provide the required resources but the inherent inability to create visibility, transparency, and coordination.

Supply chain visibility as an issue has become increasingly popular in the recent years because of increased global uncertainties that include disruptions in the economy, pandemics, and climate-related shocks. Supply chain visibility allows organizations to track the operations in real time, detect possible disruptions, and make informed decisions, thus, improving efficiency and resilience (Somapa et al., 2018; Roy, 2021). Within the framework of the organizations of the public sector that control the distribution of essential goods, stability and fair distribution of resources are especially important, which means that visibility is the key to maintaining a stable situation. It is well known that information sharing is one of the most important enablement to supply chain effectiveness since it enables timely and accurate exchange of information among supply chain partners. It improves coordination, uncertainty, and decision-making power (Baah et al., 2022; Huo et al., 2021). Equally, information technology (IT) such as digital systems and data analytics tools allow real-time processing of data, improve communication, and facilitate effective operations in the supply chain (Dolgui & Ivanov, 2022; Chen et al., 2021). These will be required to enhance transparency and solve the structural inefficiencies in the food supply chain in Pakistan.

Supply chain performance is a very important mechanism in which information sharing and IT capabilities are converted to enhanced visibility. It includes the major dimensions that include efficiency, responsiveness, flexibility, and innovation that all define the effectiveness of supply chain operations (Sundram et al., 2020; Salah et al., 2023). Enhanced performance allows organizations to create the right and timely information and, thus, improve coordination and visibility within the supply chain network (Vitari and Raguseo, 2020; Saragih et al., 2020). The present research is based on the theory of Resource-Based View (RBV) which states that competitive advantage is gained in those companies that successfully use resources that are valuable and imitable. The ability to share information and IT infrastructure is regarded as strategic resources that contribute to the performance and visibility of the organization in the context of the supply chain management. Through these resources organizations are able to come up with capabilities that make them work successfully in dynamic and uncertain environments.

Although the literature is growing in number, little has been done to investigate the synergistic effects of information sharing and the use of IT on the supply chain visibility, especially in the context of the public sector in the developing countries like Pakistan. Moreover, supply chain performance as a mediating factor between these variables is not well studied. Thus, the purpose of conducting this study is to investigate how information sharing and IT use affect supply chain visibility and supply chain performance is a mediating variable in this case. This research offers theoretical and practical implications of enhancing the transparency, effectiveness, and resilience of the Pakistani food supply chain, through the creation of a unified framework.

LITERATURE REVIEW

2.1 Theoretical Background: Resource-Based View (RBV)

The Resource-Based View (RBV) theory offers a strong theoretical background based on the realization of the long-term competitive advantage in the organizations due to the efficient use of internal resources and capabilities. RBV assumes that valuable, rare, inimitable and non-substitutable resources can help firms to improve their performance. Under the scope of supply



chain management, the intangible resources including information sharing capabilities and information technology (IT) infrastructure are important in improving the efficiency and visibility of the operations. As supply chains are becoming more digitized, organizations are becoming more dependent on technological capacity to enhance the coordination, responsiveness, and decision-making. IT can help companies to handle a significant amount of data, improve communication between supply chain participants, and exchange information in real time (Dolgui and Ivanov, 2022; Chen et al., 2021). Such technological capabilities fall under RBV strategic capabilities because they enable firms to react well to any uncertainties and disruptions in the supply chain environment.

Another important resource in the organization is information sharing. Good communication of correct and prompt information to the members of the supply chain improves coordination between the members, minimizes the uncertainty and coordinates the operations. Companies that have high information-sharing levels can achieve a greater level of coordination, minimize inefficiency, and attain greater flexibility and responsiveness (Baah et al., 2022; Huo et al., 2021). Moreover, sharing of information can be used to transfer knowledge and be innovative, which is crucial to developing a sustainable competitive advantage in a changing environment (Ojha et al., 2023; Song et al., 2026). According to RBV perspective, the performance of the supply chain may be considered as a result of the successful use of these strategic resources. Companies that effectively incorporate information sharing and IT capabilities into their business operations have higher chances of ensuring high levels of performance, in terms of efficiency, responsiveness and innovation (Sundram et al., 2020; Salah et al., 2023). Such improved performance, in its turn, leads to the increased visibility of the supply chain, as the flow of information is accurate, and coordination within the supply chain network is improved. Hence, RBV offers an extensive model of the functioning of information sharing and IT use as strategic resources which have the impact on the supply chain performance and visibility. Through these capabilities, the organizations are able to enhance their operational effectiveness and attain sustainable competitive advantage in the context of more and more complex supply chain environments.

2.2 Supply Chain Performance and Visibility- Information Sharing

Exchange of information is an intrinsic element of a successful supply chain management since it enables the coordination, collaboration and timely decision-making of supply chain partners. It includes sharing of pertinent, precise and timely information, such as prediction of demand, inventory and delivery time. Proper information sharing would lead to decrease in uncertainty, increase in trust between stakeholders and it would also lead to better efficiency of the supply chain processes. Literature available continues to show that sharing of information has a huge positive influence to the performance of the supply chain. The active exchange of information enables organizations to better coordinate their activities, minimize lead times, and become more flexible in their reaction to the changes in the market (Baah et al., 2022; Huo et al., 2021). Besides, sharing of information facilitates learning and innovation in the supply chain, which allows companies to acquire adaptive capabilities and better operational performance (Ojha et al., 2023; Firmansyah and Siagian, 2022). Such advancements help in increasing efficiency, reliability as well as the quality of service in the chain of supply.

Besides influencing the performance, information sharing has a direct and significant role to play in improving the supply chain visibility. The visibility of the supply chains is determined by the accessibility and availability of correct information throughout the network. Sharing information helps organizations to gain transparency and real-time visibility into supply chain



operations and, thus, monitor and control them better (Roy, 2021; Freichel et al., 2022). Such transparency will enable companies to detect some disruptions, optimize the allocation of resources, and enhance the processes of decision-making. Moreover, digital information sharing will contribute to increased visibility through the integration of data in a seamless way and real-time communication between supply chain partners (Song et al., 2026; Baah et al., 2022). Consequently, when organizations engage in good information-sharing practices, there are high chances that the level of supply chain performance and visibility will be high. According to this discussion, the sharing of information is found to be a major contributor to the performance of supply chain as well as the visibility of supply chain which substantiates the proposed relationships in this study.

2.3 IT Usage, Supply Chain Performance and Visibility

With the development of information technology (IT), the supply chain management has greatly changed with organizations being able to enhance the process of coordinating, communication and decision making. IT usage in supply chains can be described as the use of digital systems, integrated platforms, and data analytics tools that can help to efficiently transfer information through various steps of the supply chain. The technologies are important in terms of improving the efficiency of operations and the ability of the organizations to adapt to the dynamic markets. The literature indicates that the use of IT has a close positive effect on the performance of the supply chain. Adoption of digital systems gives the organization the opportunity to automate operations, cut on manual errors, and enhance the accuracy of data. An example of this is that IT can be used to forecast demand, inventory, and logistics planning, which will improve the efficiency and cost-effectiveness (Sundram et al., 2020; Putra and Arifin, 2021). Moreover, IT systems help to process the information faster and communicate in real-time, which allows organizations to adjust to changes in demand and supply situations quite fast. This responsiveness is better, and it improves the performance of the supply chain. Besides efficiency, flexibility and adaptability of the supply chain are also brought about by IT usage. Companies that have sophisticated IT solutions have a greater capacity to realign their operations to uncertainties and disruptions. The supply chain partners coordinate through the digital platforms and this allows the supply chain partners to synchronize their operations and enhance better use of resources. Consequently, the use of IT enhances the sustainability and stability of complex supply chain settings of organizations. In addition, IT will be significant in improving the visibility of the supply chain. Digital systems provide the ability to track and monitor the activities of the supply chain in real time and organizations can achieve end-to-end visibility of the network. Transparency also increases, and informed decision-making becomes possible with the availability of real-time data (Dolgui and Ivanov, 2022; Sallam et al., 2023). The IT-based systems enable companies to track inventory, shipments, and possible bottlenecks and enhance control over the operations of the supply chain. Recent research also demonstrates that the digital transformation initiative contributes to supply chain visibility in the largest proportion since it allows information to be exchanged and shared in real-time with supply chain partners (Adeusi et al., 2024; Lee et al., 2024). Such capabilities enable organizations to minimise information asymmetry, enhance traceability and coordination, which are vital in increasing the level of visibility.

Hence, the use of IT is viewed as one of the key factors that drive supply chain performance and supply chain visibility. Those organizations that utilize IT capabilities efficiently will be in a better position to realize enhanced efficiency, responsiveness, as well as transparency, which enhance their effectiveness in the overall supply chain.

2.4 Supply Chain Performance and Supply Chain Visibility

The performance of supply chain is one of the major determinants of effectiveness and competitiveness of the supply chain operations. It is multidimensional in nature covering efficiency, responsiveness, flexibility, and innovation, which are all related to the capability of organizations to provide products and services efficiently. Well performing supply chains will be in a better position to handle uncertainties, lower cost of operations and enhance the level of services. Supply chain visibility and supply chain performance are the two phenomena that have been receiving more and more attention in recent literature. Enhanced performance also facilitates organizations to produce the right information at the right time and in a reliable manner that is necessary in enhancing greater visibility levels. The effective processes and the well-integrated systems enable the efficient data flow within the supply chain network that ensures the organizations can track the operations and make well-informed decisions (Sundram et al., 2020; Saragih et al., 2020).

In addition, the performance of supply chains will improve visibility as they can monitor and control activities of the supply chains in real time. The greater the level of operation efficiency and technological integration, the more effectively the organizations are able to capture, process and analyze data. This will make them better at recognizing disruptions, predicting risks, and acting proactively in response to evolving circumstances (Ivanov et al., 2023; Lee et al., 2024). The resultant effect is that there is increased transparency and coordination in the supply chain network as a result of improved performance. Moreover, there is improvement in performance, which contributes to improved planning, forecasting and resource allocation, which is necessary to attain supply chain visibility. Efficient organizations can be capable of keeping the records of inventory, production, and distribution activities accurate and, thus, minimize the information gap and increase the reliability of data. This enhances quality of data which enhances the decision making process and makes the management of the supply chain easier.

Such recent studies also underline the fact that the digital transformation and the optimization of performance are of great importance in enhancing the visibility of the supply chain. The combination of innovative technologies and performance-based approaches helps the organizations to create agile and transparent supply chains that are essential in dynamic and volatile situations (Yuan et al., 2024; Hennelly et al., 2020).

Hence, supply chain performance is a driving force to supply chain visibility. The higher the efficiency, responsiveness, and flexibility of an organization, the better placed are to increase transparency, increase coordination, and effective control of the supply chain operations. This is in favor of the suggested relationship between the supply chain performance and supply chain visibility in this research.

2.5 Mediating Role of Supply Chain Performance

The performance of supply chains is a critical mediator in the explanation of the relationship between the strategic resources (information sharing and the use of information technology (IT)) and the supply chain visibility. Mediation happens in case the influence of independent variables on a dependent variable passes through an intermediate one. In this paper, supply chain performance will be used as the mechanism where information sharing and IT capabilities will affect supply chain visibility. According to the literature that is available, the sharing of information is known to play a major role in improving the performance of the supply chain through the following ways: the improvement of coordination, the reduction of uncertainty, and improved decision-making procedures (Baah et al., 2022; Huo et al., 2021).



Companies that practice effective and efficient exchange of information can easily coordinate their activities, minimize the number of inefficiencies, and enhance responsiveness. In the same way, the use of IT allows improving performance through automation and data accuracy and real-time information processing (Dolgui and Ivanov, 2022; Chen et al., 2021). The abilities contribute to the effective use of resources and enhance the overall operational efficiency.

Enhanced supply chain visibility, in its turn, is a result of the improvement of the supply chain performance. Supply chains that are performing well have been described as having efficient processes, correct data generation, and coordination which altogether have facilitated better monitoring and transparency. The performance outcomes (efficiency, flexibility and innovation) serve as the essential connections between the organizational capabilities and visibility. Companies, which are more successful in reaching greater performance levels, have more opportunities to provide the presence of timely and reliable information throughout the supply chain network, which enhances visibility (Salah et al., 2023; Vitari and Raguseo, 2020). Moreover, the supply chain performance reinforces the indirect linkage between the information sharing, IT usage, and supply chain visibility because it allows the organizations to convert the technological and informational capability to actionable results. Real time flow of data, information asymmetry reduction and improved coordination between supply chain partners are made possible by efficient and responsive supply chain operations. Consequently, supply chain performance is an important mediator process that converts strategic resources to enhanced visibility.

Thus, we can say that supply chain performance plays an important mediating role in the connection of information sharing, IT usage, and supply chain visibility, which justifies the mediation relationships between these variables, as postulated in this research.

2.6 Research Gap and Hypotheses Development

Although the literature on supply chain management is increasing, there are still a number of gaps in comprehending the overall impact of information sharing and IT application on supply chain visibility. The available literature has been majorly studying these aspects individually; either as information sharing or technological adoption without taking into account the overall effect of the two on supply chain performance and visibility. Such a disjointed strategy makes it difficult to have an in-depth picture of the combined effect of these strategic resources on the supply chain results. Additionally, although earlier studies have revealed the significance of information sharing and utilization of IT in improving the supply chain performance, little focus has been placed on the mediating role of the supply chain performance in the connection of the variables on supply chain visibility. This mediating mechanism is also important to understand because it describes how the organizational capabilities can be transformed into better visibility results. Lack of such integrated frameworks is one of the major gaps in the literature. The other significant constraint of the previous studies is that the main research subjects include the organizations of the private sector and developed economies. Empirical evidence in the context of the public sector is insufficient especially in the developing world like Pakistan where structural issues such as fragmentation of data, poor institutional coordination and low technology adoption characterize most cases of supply chain inefficiencies. With regards to the Pakistan Food Department, supply chain visibility plays a critical role in ensuring proper management of resources, stability of prices as well as food security.

These gaps should be filled in order to come up with a holistic picture of the dynamics of supply chains in the public sector. Through the incorporation of information sharing and IT application



in one framework and the analysis of the mediating role of supply chain performance, the study targets to give both theoretical and practical explanations of the enhancement of supply chain visibility.

On the basis of the theoretical premise of the Resource-Based View (RBV) and empirical evidence presented in the literature, the following hypotheses can be formulated:

H1: There is a positive impact of information sharing to the supply chain performance.

H2: There exists a positive impact of IT usage to supply chain performance.

H3: Supply chain performance positively impacts the supply chain visibility.

H4: Sharing information positively influences visibility of supply chain.

H5: Supply chain visibility is positively influenced by the use of IT.

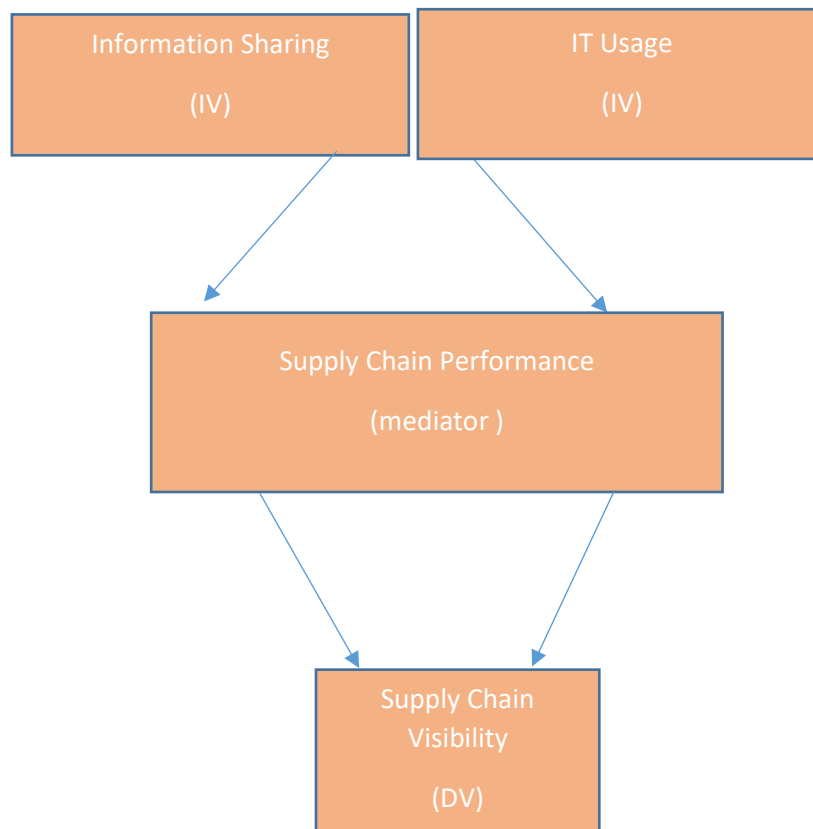
H6: The relationship between the supply chain visibility and the information sharing is mediated by the supply chain performance.

H7: Supply chain performance is an intervening variable in the relationship between supply chain visibility and IT usage.

2.7 Conceptual Framework :

This paper has put forward a theoretical framework based on the Resource-Based View (RBV) theory which highlights the importance of organizational capabilities and strategic resources in highly relative performance and competitive advantage. Within the framework of the supply chain management, information sharing and information technology (IT) applications are viewed as important strategic resources that can help organizations increase the level of coordination, decision-making, and optimization of operational processes. According to the framework, there are both direct and indirect impacts of information sharing and IT usage on the supply chain visibility. Sharing of information helps in sharing accurate and timely information among the supply chain partners thereby minimizing uncertainty and increasing coordination. Likewise, the use of IT facilitates real time processing of data, integration of supply chain processes and enhanced communication among various supply chain processes. These features lead to the enhanced transparency and visibility. Concurrently, the framework suggests that the performance of the supply chain is a mediating variable in this correlation. Information sharing and effective use of IT can improve the supply chain performance in the form of efficiency, responsiveness and flexibility. Increased performance, on its part, helps organizations to produce the right and timely information, a factor that increases monitoring, coordination, and complete visibility of the supply chain. In such a way, the framework emphasizes that supply chain performance is one of the major mechanisms wherein information sharing and IT application can be transformed into better visibility results. The incorporation of these variables brings in a holistic view of the impact of strategic resources and organizational capabilities on the effectiveness of the supply chain in the public sector setting.

Conceptual Framework



METHODOLOGY

This paper will be based on a quantitative research design, which seeks to investigate the relationships between information sharing, the use of information technology (IT), supply chain performance, and supply chain visibility within the Pakistan Food Department. Quantitative approach is suitable because it allows empirical testing of hypotheses and statistical testing of relationships among variables. The research is deductive in nature, since it is based on the theory of Resource-Based View (RBV) and seeks to verify hypotheses that are developed in theory. The research design that will be used is a cross-sectional design where data will be gathered at one time, but of respondents engaged in the supply chain operations. This method is popular in the research of supply chains to study organizational performance and practices (Sundram et al., 2020; Saragih et al., 2020).

This study targets employees who are employed in the Pakistan Food Department, and especially those employees that are involved in functions related to the supply chain, which include procurement, storage, distribution, and information management. These people are chosen due to their direct interaction and practical experience on the supply chain operations. Purposive sampling method will be employed to make sure that only respondents of interest are involved in the study. Following the Structural Equation Modeling (SEM) requirements, the sample size of about 250 to 300 respondents is deemed to be relevant to guarantee the reliability and validity of the findings. A structured questionnaire based on the previously



validated measurement scales that are found in the existing literature is used to collect data. The questionnaire also has questions on information sharing, IT use, performance of supply chain and visibility of supply chain. All constructs are measured with the help of a five-point Likert scale (strongly disagree to strongly agree), which is a consistent and easily interpretable scale in quantitative research (Baah et al., 2022; Huo et al., 2021). The questionnaire will be administered online and in physical form to enhance the response rate and also the respondents will maintain confidentiality and anonymity.

Variables are measured using set scales to maintain reliability and validity. The sharing of information is evaluated by questions regarding how true, timely, and complete information shared between the members of the supply chain is (Baah et al., 2022; Huo et al., 2021). The use of IT is quantified with the help of indicators that reflect the degree of digital systems and data integration, as well as information processing ability application in supply chain processes (Sundram et al., 2020; Chen et al., 2021). The efficiency, responsiveness, and flexibility of supply chains are considered as the dimensions of the supply chain performance (Salah et al., 2023; Saragih et al., 2020), and the supply chain visibility is measured in terms of transparency, availability of real-time information, and monitoring capabilities within the supply chain network (Somapa et al., 2018; Roy, 2021). The obtained data are processed through Structural Equation Modeling (SEM) with the assistance of such statistical software as AMOS or SmartPLS. SEM is also especially applicable to this study because it enables the presence of multiple relationships between latent constructs and is useful in testing direct and mediating effects. The analysis is carried out in two phases that involve evaluation of the measurement model and the structural model. Indicators used in assessing reliability and validity include Cronbachs alpha, composite reliability, factor loading and average variance extracted (AVE) whereas path analysis is used in hypothesis testing. SEM can also be used to study the mediating effect of supply chain performance in the correlation between information sharing, IT usage, and supply chain visibility (Vitari and Raguseo, 2020; Salah et al., 2023). Ethics is an issue that is strictly adhered to during the study. It is voluntary and the respondents are aware of the purpose of the study. The information will be kept confidential and anonymous and data collected will be utilized only to serve academic purposes. Such a methodological approach offers a powerful guide to the empirical study of the proposed relationships and helps to better understand how information sharing and IT utilization can affect the supply chain visibility with the help of the mediating variable of supply chain performance.

CHAPTER 4 DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the statistical analysis of the survey data collected for the study. A total of 209 completed questionnaires were available for analysis. The chapter begins with data screening and respondent profiling, followed by descriptive statistics, reliability analysis, correlation analysis, and multiple regression analysis. The purpose is to determine how information sharing, IT systems, and Supply Chain Visibility are associated with supply chain performance.

4.2 Data Screening and Preparation

Before inferential analysis, the dataset was screened for completeness, coding consistency, and duplicate wording. All Likert-scale responses were coded on a five-point scale where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. A small text



inconsistency in the response option “Strongly agree” was standardized to “Strongly Agree”. Two items appearing in the third questionnaire block duplicated earlier supply chain performance wording; therefore, these duplicated items are shown in the descriptive results but were excluded from construct-level reliability, correlation, and regression testing to avoid double-counting the same concept.

Table 4.1 Data screening summary

Item	Value
Returned questionnaires	209
Usable questionnaires for scale analysis	209
Missing responses in Likert items	0
Raw entries standardized from “Strongly agree” to “Strongly Agree”	99
Invalid / non-usable age entries excluded from age-only summaries	2
Duplicated wording items flagged and excluded from construct scoring	2

Table 4.2 Duplicated questionnaire items and treatment

Code	Statement	Treatment
Duplicate item 1	Q5: All Assets are fully utilized in my department due to effective supply chain performance ?	Reported in item-level tables only; excluded from construct-level tests
Duplicate item 2	Q6: Reliability is achieved in my department due to effective supply chain performance ?	Reported in item-level tables only; excluded from construct-level tests

4.3 Respondent Profile

The respondent profile shows that the sample is dominated by male respondents, middle-aged participants, food-related departments, and managerial positions. Department and designation labels contained several spelling and case variations in the raw file; therefore, closely related entries were grouped into analytically meaningful categories to produce a readable profile table.

Table 4.3 Gender profile of respondents

Category	Frequency	Percent
Male	154	73.7
Female	55	26.3

Note. n = 209.

Table 4.4 Age profile of respondents

Category	Frequency	Percent
20-29	44	21.1
30-39	79	37.8
40-49	54	25.8
50 and above	30	14.4



Category	Frequency	Percent
Invalid / missing	2	1.0

Note. Two age entries were invalid or non-usable and were therefore kept only in the invalid/missing category.

Table 4.5 Department profile of respondents

Category	Frequency	Percent
Food / public food departments	112	53.6
Food industry	74	35.4
Government / administration	12	5.7
Education / professional	8	3.8
Operations / logistics	3	1.4

Table 4.6 Designation profile of respondents

Category	Frequency	Percent
Managerial / executive	152	72.7
Government / regulatory	20	9.6
Other	19	9.1
Market intermediary / supplier	15	7.2
Professional / academic	3	1.4

As shown in the demographic tables, 154 respondents (73.7%) were male and 55 respondents (26.3%) were female. The largest age group was 30–39 years with 79 respondents (37.8%), followed by 40–49 years with 54 respondents (25.8%). Food/public food departments and food industry together accounted for the majority of the sample, while managerial and executive roles represented the largest designation category.

4.4 Descriptive Analysis of Questionnaire Items

This section reports the exact frequency, percentage, mean, and standard deviation for each questionnaire item. The pattern across the instrument is consistently tilted toward disagreement, indicating weak perceptions of information sharing, digital support, integration, and performance in the surveyed supply chain environment.

Table 4.7 Information sharing items

Item	SD	D	N	A	SA	Mean	SDv
IS1. Share information with customers	0 (0.0%)	159 (76.1%)	39 (18.7%)	4 (1.9%)	7 (3.3%)	2.33	0.68
IS2. Share information with suppliers	0 (0.0%)	136 (65.1%)	47 (22.5%)	9 (4.3%)	17 (8.1%)	2.56	0.91
IS3. Intra-organizational information sharing exists	0 (0.0%)	141 (67.5%)	46 (22.0%)	12 (5.7%)	10 (4.8%)	2.48	0.81

Item	SD	D	N	A	SA	Mean	SDv
IS4. Inter-functional information sharing exists	0 (0.0%)	147 (70.3%)	46 (22.0%)	8 (3.8%)	8 (3.8%)	2.41	0.74
IS5. Partners inform in advance of changing needs	0 (0.0%)	142 (67.9%)	55 (26.3%)	5 (2.4%)	7 (3.3%)	2.41	0.70
IS6. Partners keep each other informed about work issues	0 (0.0%)	141 (67.5%)	45 (21.5%)	19 (9.1%)	4 (1.9%)	2.45	0.74
IS7. Partners share knowledge of core processes	0 (0.0%)	155 (74.2%)	34 (16.3%)	12 (5.7%)	8 (3.8%)	2.39	0.77
IS8. Partners inform events affecting other suppliers	0 (0.0%)	157 (75.1%)	33 (15.8%)	12 (5.7%)	7 (3.3%)	2.37	0.74

Within information sharing, the highest mean was recorded for IS2 (share information with suppliers) at 2.56, while the lowest mean was recorded for IS1 (share information with customers) at 2.33. Even the highest mean remains close to the disagreement side of the scale, suggesting that information sharing is generally weak rather than strong.

Figure 4.1: Mean Scores of Information Sharing Items (IS1–IS8)

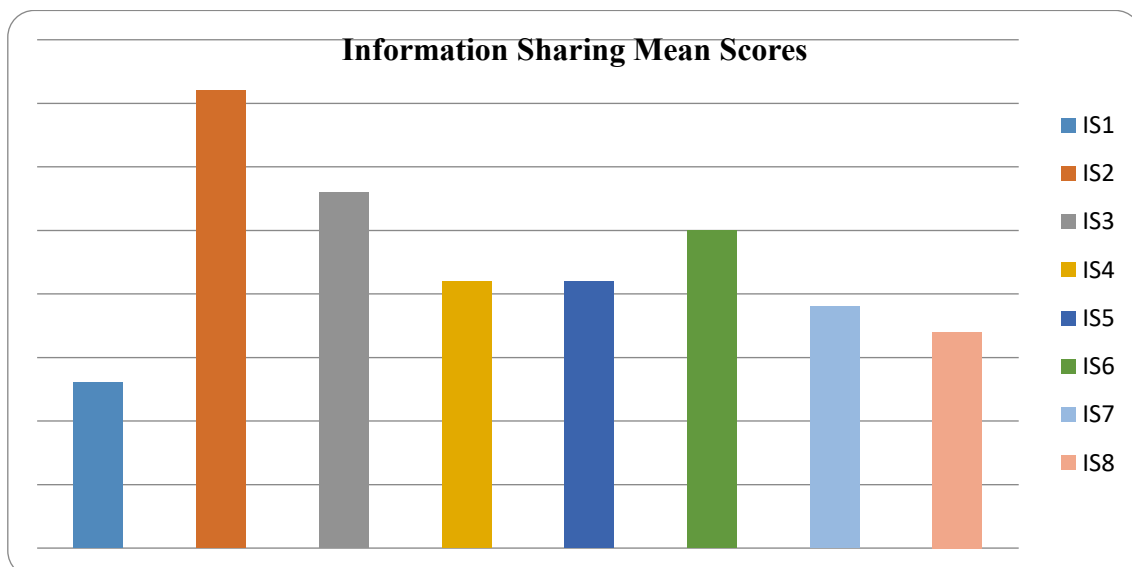


Table 4.8 Supply chain performance items

Item	SD	D	N	A	SA	Mean	SDv
SCP1. Cost expenses are reduced	0 (0.0%)	159 (76.1%)	32 (15.3%)	11 (5.3%)	7 (3.3%)	2.36	0.73
SCP2. Assets are fully utilized	0 (0.0%)	151 (72.2%)	31 (14.8%)	14 (6.7%)	13 (6.2%)	2.47	0.87
SCP3. Reliability is achieved	0 (0.0%)	156 (74.6%)	32 (15.3%)	13 (6.2%)	8 (3.8%)	2.39	0.77
SCP4. Responsiveness is achieved	0 (0.0%)	162 (77.5%)	28 (13.4%)	13 (6.2%)	6 (2.9%)	2.34	0.72
SCP5. Flexibility is achieved	0 (0.0%)	163 (78.0%)	31 (14.8%)	10 (4.8%)	5 (2.4%)	2.32	0.68

For supply chain performance, the highest mean was observed for SCP2 (assets are fully utilized) at 2.47, whereas the lowest mean was observed for SCP5 (flexibility is achieved) at 2.32. These results imply that respondents do not view current supply chain performance as strong or consistently effective.

Figure 4.2: Mean Scores of Supply Chain Performance Items (SCP1–SCP5)

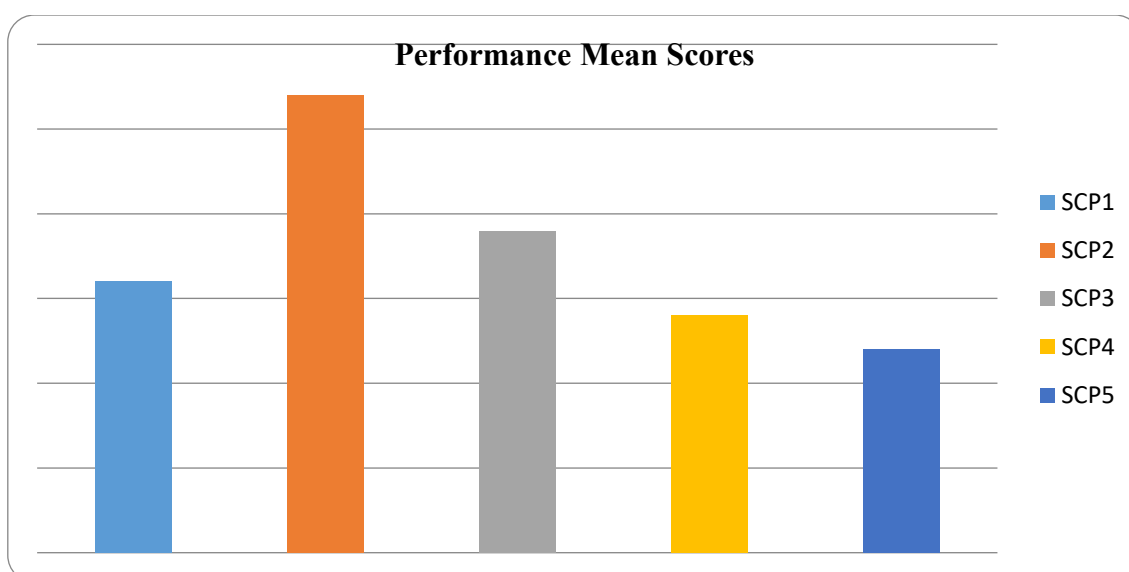


Table 4.9 IT systems items

Item	SD	D	N	A	SA	Mean	SDv
IT1. CRM system is used for market information	0 (0.0%)	166 (79.4%)	23 (11.0%)	7 (3.3%)	13 (6.2%)	2.36	0.82
IT2. Website system integrates supply chain partners	0 (0.0%)	165 (78.9%)	22 (10.5%)	5 (2.4%)	17 (8.1%)	2.40	0.88
IT3. Customers/suppliers use website to book stock	0 (0.0%)	163 (78.0%)	27 (12.9%)	10 (4.8%)	9 (4.3%)	2.35	0.77
IT4. Online transactions reduce operational cost	0 (0.0%)	166 (79.4%)	27 (12.9%)	6 (2.9%)	10 (4.8%)	2.33	0.75

Note. Cells show frequency with percentage in parentheses. Mean and SD are based on the five-point coding scheme.

The IT systems block also shows low mean scores. IT2 (website system integrates supply chain partners) obtained the highest mean at 2.40, while IT4 (online transactions reduce operational cost) obtained the lowest mean at 2.33. The pattern indicates limited digital support for supply chain coordination.

Figure 4.3: Mean Scores of IT Systems Items (IT1–IT4)

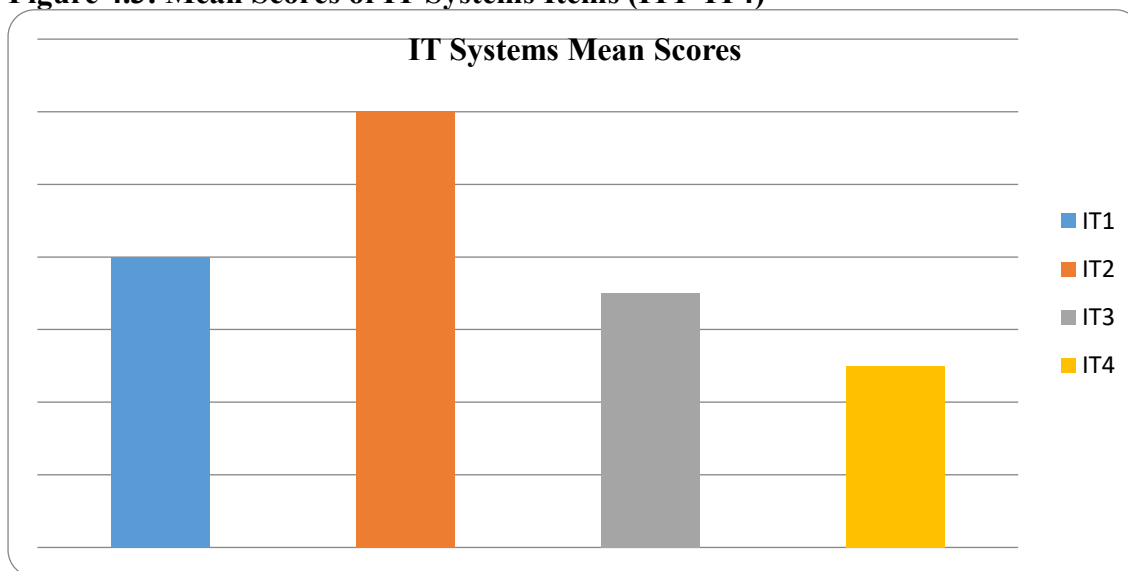


Table 4.10 Duplicated wording items (reported for transparency only)

Item	SD	D	N	A	SA	Mean	SDv
DUP1. Assets are fully utilized (duplicate wording)	0 (0.0%)	169 (80.9%)	25 (12.0%)	8 (3.8%)	7 (3.3%)	2.30	0.70



Item	SD	D	N	A	SA	Mean	SDv
DUP2. Reliability is achieved (duplicate wording)	0 (0.0%)	154 (73.7%)	41 (19.6%)	8 (3.8%)	6 (2.9%)	2.36	0.69

Table 4.11 Supply Chain Visibility items

Item	SD	D	N	A	SA	Mean	SDv
SCI1. Partners inform in advance of changing needs	11 (5.3%)	161 (77.0%)	25 (12.0%)	9 (4.3%)	3 (1.4%)	2.20	0.66
SCI2. Workers share knowledge of core process routinely	7 (3.3%)	165 (78.9%)	24 (11.5%)	12 (5.7%)	1 (0.5%)	2.21	0.62
SCI3. Partners inform future supplier/customer needs	4 (1.9%)	157 (75.1%)	34 (16.3%)	12 (5.7%)	2 (1.0%)	2.29	0.65
SCI4. Team communicates future strategic needs	8 (3.8%)	154 (73.7%)	35 (16.7%)	7 (3.3%)	5 (2.4%)	2.27	0.70
SCI5. Integration of activities continues to improve	5 (2.4%)	159 (76.1%)	33 (15.8%)	10 (4.8%)	2 (1.0%)	2.26	0.63
SCI6. Team shares problems, market and inventory information	2 (1.0%)	167 (79.9%)	25 (12.0%)	11 (5.3%)	4 (1.9%)	2.27	0.66
SCI7. Team collaborates to monitor product movement	2 (1.0%)	164 (78.5%)	31 (14.8%)	8 (3.8%)	4 (1.9%)	2.27	0.64

Supply Chain Visibility was the weakest construct overall. The highest mean in this block was 2.29 for SCI3, whereas the lowest mean was 2.20 for SCI1. Respondents were especially unconvinced that partners inform each other in advance of changing needs or routinely share process knowledge across the chain.

Figure 4.4: Mean Scores of Supply Chain Visibility Items (SCI1–SCI7)

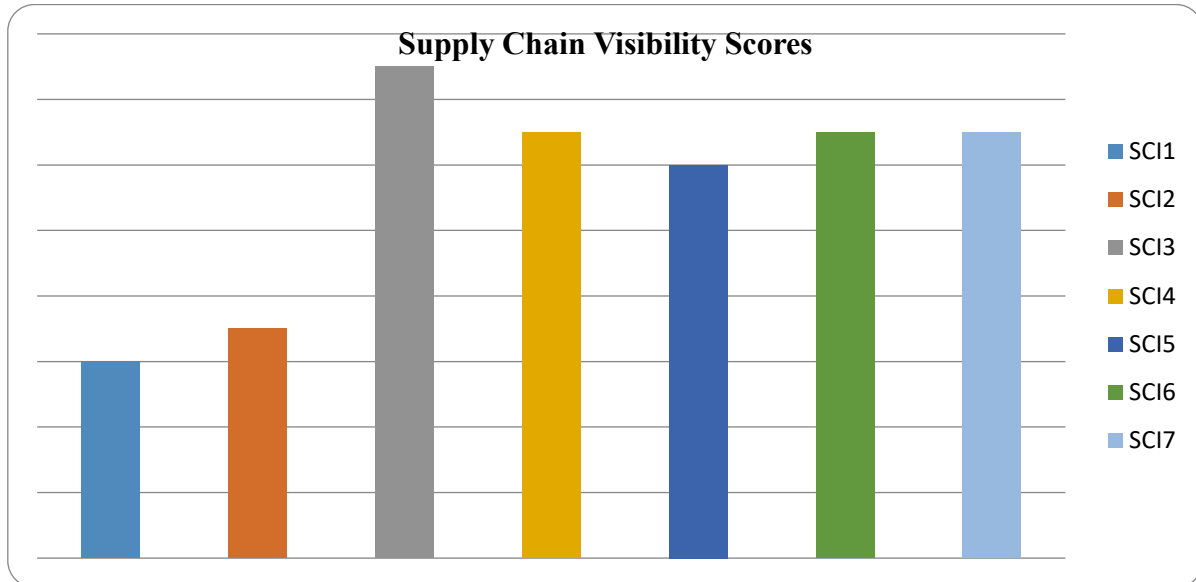


Table 4.12 Aggregate response distribution by construct

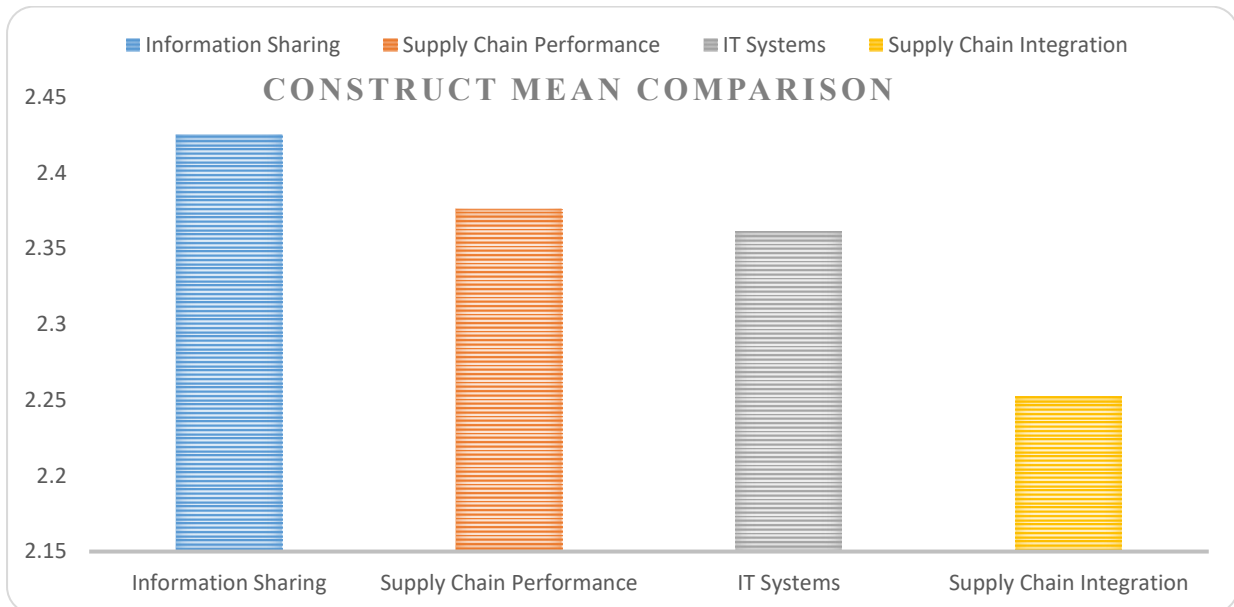
Construct	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Information sharing	0 (0.0%)	1178 (70.5%)	345 (20.6%)	81 (4.8%)	68 (4.1%)
Supply chain performance	0 (0.0%)	791 (75.7%)	154 (14.7%)	61 (5.8%)	39 (3.7%)
IT systems	0 (0.0%)	660 (78.9%)	99 (11.8%)	28 (3.3%)	49 (5.9%)
Supply Chain Visibility	39 (2.7%)	1127 (77.0%)	207 (14.1%)	69 (4.7%)	21 (1.4%)

Table 4.13 Construct-level descriptive statistics and ranking

Construct	Items	Mean	SD	Rank
Information sharing	8	2.425	0.586	1
Supply chain performance	5	2.376	0.621	2
IT systems	4	2.361	0.655	3
Supply Chain Visibility	7	2.252	0.535	4

At the construct level, information sharing recorded the highest mean (2.425), followed by supply chain performance (2.376), IT systems (2.361), and Supply Chain Visibility (2.252). Although information sharing ranked first, all construct means remain low on a five-point scale, showing that the respondents generally leaned toward disagreement or only weak neutrality regarding positive supply chain practices and outcomes.

Figure 4.5: Construct-Level Mean Comparison of Study Variables



4.5 Reliability Analysis

Reliability analysis was conducted using Cronbach’s alpha to determine the internal consistency of each multi-item construct. Values above 0.70 are generally considered acceptable for survey research, and all retained constructs exceeded this threshold comfortably.

Table 4.14 Reliability statistics

Construct	Items	Cronbach alpha
Information sharing	8	0.900
Supply chain performance	5	0.877
IT systems	4	0.827
Supply Chain Visibility	7	0.921

The alpha values ranged from 0.827 to 0.921, indicating strong internal consistency across the measurement scales. Supply Chain Visibility had the highest reliability (alpha = 0.921), followed by information sharing (alpha = 0.900), supply chain performance (alpha = 0.877), and IT systems (alpha = 0.827). This confirms that the retained constructs are reliable enough for correlation and regression analysis.

4.6 Correlation Analysis

Pearson correlation analysis was used to examine the direction and strength of associations among the study constructs. The correlation matrix demonstrates that all relationships are positive and statistically significant at the 0.001 level.

Table 4.15 Correlation matrix

Variable	Information sharing	Supply chain performance	IT systems	Supply Chain Visibility
Information sharing	1.000	0.778***	0.587***	0.720***
Supply chain performance	0.778***	1.000	0.697***	0.742***



Variable	Information sharing	Supply chain performance	IT systems	Supply Chain Visibility
IT systems	0.587***	0.697***	1.000	0.673***
Supply Chain Visibility	0.720***	0.742***	0.673***	1.000

Note. *** Correlation is significant at $p < 0.001$. Diagonal values are 1.000 by definition. Supply chain performance was strongly correlated with information sharing ($r = 0.778$), IT systems ($r = 0.721$), and Supply Chain Visibility ($r = 0.742$). The positive signs indicate that better information flow, stronger digital support, and higher integration are associated with better perceived performance. The correlations among the independent variables were moderate to strong but not excessive, suggesting that the variables are related yet still distinct.

4.7 Multiple Regression Analysis

Multiple regression analysis was performed to test the combined and individual effects of information sharing, IT systems, and Supply Chain Visibility on supply chain performance. Supply chain performance was entered as the dependent variable, while the other three constructs were used as predictors.

Table 4.16 Model summary

R	R square	Adjusted R square	Std. error of estimate	F statistic	Sig.
0.845	0.714	0.710	0.334	170.483	<0.001

Note. Dependent variable: supply chain performance.

Table 4.17 ANOVA for regression model

Source	Sum squares	df	Mean square	F	Sig.
Regression	57.224	3	19.075	170.483	<0.001
Residual	22.937	205	0.112		
Total	80.160	208			

Note. The ANOVA table tests whether the overall regression model significantly predicts supply chain performance.

Table 4.18 Regression coefficients

Predictor	B	Std. error	Beta	t	Sig.
Constant	-0.003	0.108		-0.024	0.981
Information sharing	0.472	0.058	0.446	8.111	<0.001
IT systems	0.263	0.049	0.277	5.377	<0.001
Supply Chain Visibility	0.272	0.070	0.235	3.901	<0.001

Note. Beta values are standardized coefficients. B values are unstandardized coefficients.

Figure 4.6: Regression Coefficients of Predictors on Supply Chain Performance

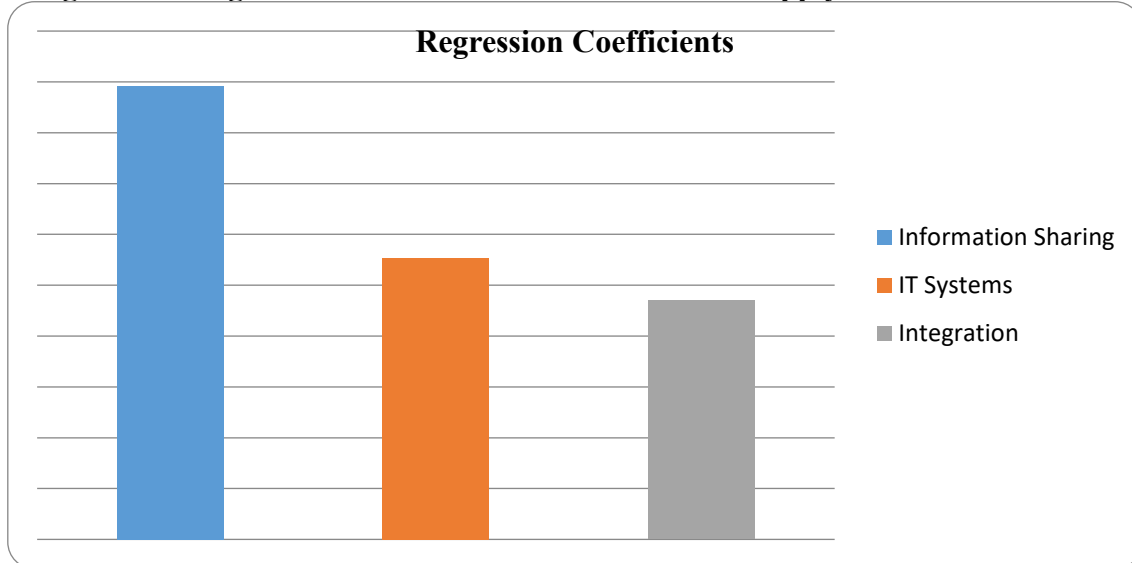


Table 4.19 Multicollinearity diagnostics (VIF)

Variable	VIF
Constant	21.905
Information Sharing	2.165
IT Systems	1.902
Supply Chain Integration	2.593

Note. VIF values below commonly used cut-off levels indicate that multicollinearity is not a serious concern.

The model explained 71.4% of the variance in supply chain performance (R square = 0.714; adjusted R square = 0.710). The overall model was statistically significant, $F(3, 205) = 170.483$, $p < 0.001$, which means that the three predictors jointly provide strong explanatory power for supply chain performance. The standard error of estimate was 0.335, indicating a reasonably tight fit of the regression line around the observed values.

Among the predictors, information sharing emerged as the strongest predictor of supply chain performance (beta = 0.446, $t = 8.111$, $p < 0.001$). IT systems also had a positive and significant effect (beta = 0.277, $t = 5.377$, $p < 0.001$), followed by Supply Chain Visibility (beta = 0.235, $t = 3.901$, $p < 0.001$). Because all predictor coefficients were positive and statistically significant, the results indicate that improvements in each of these three areas are associated with better supply chain performance. The VIF values for the retained predictors ranged from 1.902 to 2.593, which does not indicate problematic multicollinearity.

4.8 Hypotheses Testing Summary

Table 4.20 Summary of hypotheses testing

Hypothesis	Statement	Beta	t	p-value	Decision
H1	Information sharing has a positive and significant effect on supply	0.446	8.111	<0.001	Supported

Hypothesis	Statement	Beta	t	p-value	Decision
	chain performance.				
H2	IT systems have a positive and significant effect on supply chain performance.	0.277	5.377	<0.001	Supported
H3	Supply Chain Visibility has a positive and significant effect on supply chain performance.	0.235	3.901	<0.001	Supported

Note. All decisions are based on the regression coefficients reported in Table 4.18.

All three hypotheses were supported. Information sharing, IT systems, and Supply Chain Visibility each had a positive and statistically significant effect on supply chain performance. The strongest support was observed for information sharing, which reinforces the central argument that the performance problems in the surveyed supply chain are closely linked to weak information flow and coordination.

Discussion

The findings of the study give good empirical evidence to the suggested theoretical framework that relies on the Resource-Based View (RBV). The results show that information sharing, IT systems and integration of supply chain have great positive impacts on supply chain performance thus supporting the proposed hypotheses. In particular, information sharing emerged as the strongest predictor ($\beta = 0.446$, $p < 0.001$), followed by IT systems ($\beta = 0.277$, $p < 0.001$) and Supply Chain Visibility ($\beta = 0.235$, $p < 0.001$). These findings affirm that strategic assets including information sharing and digital strengths are significant in improving operational effectiveness and coordination in supply chains. The results are aligned with the previous literature that also highlights that effective information sharing can boost the performance of supply chains by improving coordination, reducing uncertainty, and providing an opportunity to make better decisions (Baah et al., 2022; Huo et al., 2021; Ojha et al., 2023). In the same vein, the beneficial effect of IT systems is consistent with the current literature, where the importance of digital technologies in enhancing the communication process, real-time data processing, and operational efficiency is emphasized (Dolgui and Ivanov, 2022; Chen et al., 2021; Preindl et al., 2020). Moreover, the findings also substantiate the claim that the integration and digitalization of the supply chain leads to better performance and resiliency in the challenging supply chain contexts (Ivanov et al., 2023; Yuan et al., 2024). Nevertheless, although the theoretical relationships have been well supported by the regression outcomes, the descriptive analysis does show an opposite scenario of the real supply chain practices in the context of Pakistan. The averages of all constructs such as information sharing ($M = 2.425$), supply chain performance ($M = 2.376$), IT systems ($M = 2.361$) and Supply Chain Visibility ($M = 2.252$) are quite low, which also means that respondents mostly disagreed with statements that characterized effective supply chain practices. This implies that, despite the theoretical



model being accepted, it is not practical and underdeveloped in Pakistan Food Department. This practice-theory gap is a finding of the study of crucial importance. Although past studies prove that the information sharing is a key factor that positively affects visibility and performance (Baah et al., 2022; Sundram et al., 2020), the recent results suggest that these practices are not adopted effectively in the researched context. The fact that there is not much information sharing indicates a lack of coordination and communication between supply chain partners and is consistent with previous findings of a disjointed data system and the absence of real-time information flow.

Equally, low level of adoption of IT systems indicates low level of digital integration in the supply chain. Current literature emphasizes that digital transformation allows to have a real-time presence, better tracking, and better decision-making (Lee et al., 2024; Chen et al., 2021; Hennelly et al., 2020). But the fact that the mean values are low show that either these technologies have not been adopted and/or they have not been used efficiently in the Pakistan Food Department. The absence of digital infrastructure is one of the factors that add inefficiencies, delays, and decreased supply chain transparency. In addition, the results indicate that Supply Chain Visibility is especially low, in that, the mean values are the lowest across all constructs. This indicates that there is a low degree of collaboration and coordination among supply chain stakeholders and as such, there is a limited ability to attain optimum performance results. Earlier research has highlighted the idea that to become efficient and responsive in supply chains, integration is a must (Saragih et al., 2020; Salah et al., 2023), but the present findings show that this ability has not been worked out completely in reality.

Contextualizing Findings with National Production Data

Production Capacity vs Supply Problems: Although the empirical data show that there is weak usage of information sharing and IT systems, the agricultural production data in Pakistan suggests that the problem lies not in the lack of production but in the inefficiency in the management of the supply chain. Recent estimates indicate that the production of wheat is about 28-29 million tons, 9.4-9.7 million tons of rice, and 6.5 million tons of refined sugar, all of which are based on 84 million tons of sugarcane. Such numbers reveal that Pakistan has a huge agricultural potential that can supply domestic requirements. The relentless nature of shortages and price volatility as determined in the research however shows that production in itself is not enough, but there is need to have effective information flow and the coordination of systems to ensure that output is converted to stable market supply.

Regional Concentration and Integration Problems: The provincial spread of production further underscores the need to integrate supply chains. One quarter to half of wheat (some 20-21 million tons), one quarter to half of rice (some 50-55 million tons) and one quarter to half sugarcane is produced in Punjab. This high rate of concentration of production in only one province requires well-coordinated inter-regional coordination and data integration systems. Nevertheless, the study results indicate that there are low scores on Supply Chain Visibility which implies that the advantages of production are not capitalised nationally. The absence of coordination of provinces and poor data-sharing systems restrain chances of streamlining distribution, causing inefficiencies and inner-regional imbalances in supply.

Gaps in data and information sharing: The structural problems in agricultural data collection can further explain the study findings about weak information sharing. Sample surveys and crop-cutting experiments are the primary means of estimating crop production in Pakistan, and can be subject to error by up to 5-10% or more. Besides that, there are no real-time acreage and yield tracking systems to make accurate and timely predictions. These constraints greatly



decrease the reliability of information that can be made available to policy makers and supply chain actors. Subsequently, although sharing of information is deemed to be important in terms of performance, this does not happen due to the low quality and slow speed of the underlying data.

Visibility Constraints and informal Economy: The other key reason that has led to low supply chain performance is the prevalence of the informal economy which has about 60-70 percent of the agricultural practices having no records at all. Much of the crop trading is outside the formal procurement and monitoring systems especially because of the involvement of middlemen like Arthis. Such informal documentation introduces significant openings in visibility, which restrict the usefulness of IT systems and integration work determined in the empirical model. As a result, despite the availability of adequate production volumes, due to the lack of an end-to-end transparency, discrepancies between actual availability and reported information will arise, confirming inefficiencies, market distortions, and misalignment of policies.

Notably, the findings confirm the thesis that supply chain performance is one of the major processes that information sharing and IT capabilities affect the overall results. This aligns with the RBV view, according to which organizational resources should be efficiently used to create performance gains (Vitari and Raguseo, 2020). But the results also show that the benefits of such resources are yet to be reaped because of the structural and institutional constraints in the case of Pakistan.

That is why, it is possible to conclude that the theoretical relationships are well supported but practical process of information sharing, IT usage and integration is insufficient. That is why we still have the same problems of insurfaces of supply, unstable prices, and incompetency despite the identification of the significance of these factors.

This research has a critical implication: with the deployment of effective information sharing and IT systems, supply chain performance might have been achieved at a vast level, resulting in improved visibility and more efficient management of the food supply chains. This correlates with the works of other authors who propose that digital transformation and a better information flow could be used to increase supply chain resilience and stability (Ivanov, 2022; Abideen et al., 2021).

To sum up, the research gives an obvious indication of the mismatch between theoretical possibilities and reality. Although the aspects of supply chain theories substantially underline the beneficial effects of information sharing and use of IT, the present phase of implementation in Pakistan hampers the fulfillment of the advantages. To find a solution to this gap that requires the use of digital transformation, better governance, and more effective coordinating mechanisms that will lead to better functioning of the supply chain and guarantee food security in the country.

CONCLUSION

The purpose of this study was to research the effects of information sharing and information technology (IT) utilization on supply chain visibility, and the mediating role of supply chain performance that applies to the situation of Pakistan Food Department. The proposed study was based on the theory of Resource-Based View (RBV), and it hypothesized that information sharing and IT capabilities are strategic resources that can help to improve the performance and visibility of supply chains. The empirical results do validate that information sharing, IT systems and Supply Chain Visibility possess great positive impacts on the performance of the supply chain and thus corroborate the proposed hypotheses. Of these, the strongest predictor



was information sharing, which points to its utmost importance in enhancing coordination and efficiency in operations. The results align with the existing literature that suggests that introducing one of the most effective information exchange and digital capabilities improves the performance of supply chains and the process of decision-making (Baah et al., 2022; Huo et al., 2021; Sundram et al., 2020).

Nevertheless, regardless of the statistical justification of the theoretical model, the study shows a gaping gap between the theory and practice. During the descriptive analysis, it is observed that the practice of information sharing, IT use, and Supply Chain Visibility at Pakistan Food Department is still weak. The level of adoption of these practices generally was low, which indicated low levels of coordination, insufficient digital infrastructure, and lack of information flow across the supply chain, which was reported by the respondents. This inconsistency implies that the theoretical framework is a valid and widely supported one; however, its advantage is not full for the existing context because of structural and institutional limitations. Hence the inefficiencies, lack of transparency and instability of food supply chain that have plagued the Pakistani food supply chain is not the lack of strategies, but the inability to make them work. Finally, the paper points out that sharing information and use of IT can greatly enhance supply chain performance and visibility. These benefits, however, can only be realized with proper implementation, enhanced coordination and by building digital capabilities. To address this gap between theoretical possibilities and practical reality is what is required to make supply chains more efficient and secure food in Pakistan.

PRACTICAL RECOMMENDATIONS

To enhance efficiency, transparency, and sustainability of the agricultural supply chain, it is suggested to implement the following recommendations: Satellite imagery and Geographic Information System (GIS) tools should be used to implement digital crop monitoring systems to estimate the area of crops cultivated, crop health, and anticipated yields in real time. The method eliminates the need to use time-consuming field surveys and enables the detection of possible shortages or excess early. As an example, forecasting systems based on satellite have been used successfully to assist in production planning and policy decisions.

An integrated system combining farmers data with land records and national identification systems needs to be created to create a centralized farmer registry. This would allow proper mapping of agricultural production and allow specific policy interventions like subsidies, procurement, and insurance schemes. These systems have the potential to increase transparency and the resource allocation. A centralized digital system must be put in place to check on stock levels in real time in warehouses, mills and government departments. It would give a nationwide perspective on food supply, which would guide policy makers to make effective and timely decisions. Barcodes or QR codes track and trace systems should be implemented to track agricultural commodities across the supply chain. This would enhance transparency, minimize leakage, limit hoarding and limit fraudulent activities by holding accountability at every level.

The use of mandatory digital reporting of the production activities, including sugar processing and flour production, should be implemented. Data submission can be implemented in an automated system to provide real-time monitoring and minimize under-reporting so that the regulatory oversight can be elevated. A national dashboard needs to be created in order to bring together the data of the provinces, storage facilities, and markets into one platform. This would improve the coordination of the stakeholders and evidence-based decision-making. The government needs to focus on the creation of large, modern storage facilities rather than



use the small, decentralized warehouses at the district level. There should be promotion of farmers to store their produce in government owned warehouses where need be facilitated. This will provide a safer means of transportation and storage of crops and also allow authorities to have accurate monitoring and visibility of available stock levels.

The government is also supposed to carry out sensitization programs and avail the necessary agricultural inputs such as quality seeds, urea and modern machinery to the farmers. Also, the policies are to be shaped in such a way that they will motivate farmers to sell their products to government procurement mechanisms. This will aid in doing away with the middlemen, and the farmers will enjoy good and prompt profits. These steps will aid in stabilizing prices, transparency in markets and fair distribution of benefits.

These measures will greatly increase the motivation and involvement of farmers in farming activities. A significant problem facing farmers is financial constraints and hence the government can assist farmers by providing subsidies or direct payments to farmers to buy seeds and inputs. This means that farmers will be in a better place to grow agricultural output and help in general food security.

Lastly, good governance systems ought to be instituted by having independent regulatory bodies, transparent reporting systems and less political interference. These are necessary in order to discourage manipulation of the market and to encourage fairness in the agricultural industry.

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