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The Role of Supply Chain Management Practices on Supply Chain Performance in Healthcare Industry in Karachi

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Abstract
This study explains specific supply chain management (SCM) practices that can boost the effectiveness of the healthcare supply chain in Karachi, Pakistan. The study focuses on three critical practices: careful planning, effective communication, and the development of strong relationships with suppliers. Additionally, it looks into how integrating these practices through advanced systems can make them even more impactful. The research involved conducting a detailed survey of professionals working within the healthcare supply chain sector. These professionals provide the insights into the real-world application of these SCM practices. The data collected from these surveys were then analyzed using a variety of statistical techniques to uncover the key factors contributing to improved supply chain performance. The findings are quite revealing: when supply chains are precisely planned, communication is kept clear and consistent, and strong relationships with suppliers are maintained, the overall performance of the supply chain sees significant improvement. Furthermore, when these practices are combined within an integrated system, their positive effects are increased, leading to even better outcomes. This study not only develops our understanding of how SCM functions within the healthcare sector but also provides practical, actionable recommendations for enhancing healthcare services in Karachi. Future research should aim to explore how these improvements hold up over time and consider how similar practices might be applied across different regions and industries to yield comparable benefits.

Keywords: Supply Chain Management, Supply Chain Performance, Healthcare Industry

Background of Study
The basis of the research is that the healthcare industry faces challenges in Karachi due to maintaining efficient supply chain practices evolving around supply chain planning which is crucial for the timely delivery of medical and surgical disposables supplies and medical equipment. It is essential to adopt sustainable supply chain practices which is required to balance the cost-effectiveness to patient care with high-quality care in the healthcare supply chain.(Vishwakarma et al., 2024) To ensure the health of Karachi population is utmost import, when there are different challenges come across as growth of country increasing. Successfully managing and organizing

the healthcare supply chain performance is critical for this industry. This includes careful planning, information sharing, adopting strong relationship with healthcare supplier.

Supply chain planning is an important factor in any healthcare industry which will impact the performance of healthcare supply chain. The effective supply chain is responsible for ensuring that healthcare facilities to control and maintain the inventory stockouts or overstocking situations of medical supplies by reducing their inventory levels to optimal, which improves the performance of supply chain and ensuring the availability of medical supplies when needed with minimum delays.(Bialas et al., 2023)

The availability of medical supplies in healthcare industry demand on information sharing with stakeholders. Information sharing is another aspect of supply chain practices that collaboration with your partners which provides you the medical supplies to make sure they have enough stock for your demand to ensuring that supply chain of healthcare providers provides the demand forecast, inventory levels and delivery schedules by sharing these information to your partners to reducing the risk of stakeouts and overstocking and manages the supply chain better.(Simwita & Salema, 2023).

Problem Statement

Supply chain planning, information sharing and relationship with healthcare suppliers have significant challenges in Karachi's healthcare industry. These challenges effect cost, interferences which delaying the efficient delivery to whole population of healthcare services.

Although, the recognized significance of organized systems and combined efforts in resolving these challenges there remains a gap in considerate the particular issues within the healthcare that contribute to inefficiencies. Real-life shortage of evidence on the direct effect of practices of SC on performance makes problem worse. We need to look carefully at these supply chain problems and their effect on healthcare delivery in Karachi to find ways to work the supply chain effectively, so people get better healthcare.(Malik et al., 2022).

Research Gap

There is a research gap in consideration, how practices of SCM positive influence the performance of SC directly in healthcare delivery in Karachi. To maintain the healthcare quality combined relationship and coordinated system are necessary for addressing challenges and make sure affordability and timely access as there is inadequate experimental evidence on the particular mechanism through which these practices impact performance of SC. Consequently, this will fill the gap by investigating the relationship between practices of SC and performance of SC in Karachi healthcare and make sure effective strategies to improve healthcare delivery. Alahmad et al, (2021).

Research Aim

Research aim is to examine and evaluate effect of supply chain planning, information sharing and supplier relationship and integrated system provides the mediating effect on performance of SC in healthcare industry in Karachi.

Research Objective

1) To analyze the impact of chain planning, information sharing, and supplier relationships on supply chain performance.
2) To analyze the mediating effect of integrated systems between supply chains planning, information sharing, and supplier relationships on supply chain performance.

Research Question

1) What is the individual impact of supply chain planning, information sharing, and supplier relationships on supply chain performance?
2) What is the mediating effect of integrated systems between supply chain planning, information sharing, and supplier relationships on supply chain performance?

Literature Review

It has been seen in a recent year that supply chain is evolving the significance of changed aspects and its effect in supply chain performance. The complicated changing aspect of SC management developing importance and its impact on performance. The literature review targets to combine and evaluate the past research findings connected to dealing with supply chain planning, information sharing and supplier relationship practices, and supply chain performance. It discovers how supply chain practices factor like SC planning, information sharing and supplier relationship influence the overall supply chain and integrated system play a mediating role between SC practices and SC performance. This review tries to find a complete understanding of the key factors of SC performance and provide an important association for practitioners and researchers in the field of SC management.

Supply Chain Performance

Alahmad et al. (2021) study provides the insights of the Saudi Arabian business background which reviewing the effect of SCM practices on the efficiency and effectiveness of supply chains within this region. The results show that enterprises in Saudi Arabia that implement supply chain management (SCM) methods have better supply chain performance.

In this study designed by Sukati et al. (2020) which is focusing the service industry have their comprehensive investigate and explain the positive impact of role of SC management practices which impact the organizational overall performance. the concept of effective SC management strategies and are encouraging to achieve operational quality and advantage in the service sector which shift the focus on technology advancement in SC management.

Supply Chain Planning

Chen & Paulraj (2004) addresses the emerging challenges in supply chain management (SCM) due to increasing international cooperation and vertical disintegration, which have transformed firms into integral components of a networked supply chain. Despite growing research interest in SCM, there has been a lack of systematic development of SCM tools. To fill this gap, the study conducts a comprehensive analysis of over 400 articles to identify and consolidate various SCM initiatives and factors. Through successive stages of measurement analysis and refinement, the study develops a set of reliable, valid, and unidimensional measurements for key SCM constructs. These measurements can be applied across different contexts to refine or extend conceptualizations, test theoretical models, and facilitate theory building in SCM, thus contributing to the advancement of the field.

Integrated System

K. Lee et al. (2022) investigate into the implications of Internet of Things (IoT) adoption among companies in Malaysia. IoT in optimizing supply chain processes and encouraging organizational performance through integration of IoT technologies into supply chain operations which highlight the transformative potential change.

K. L. Lee et al. (2022) extend this exploration by investigating the domain of Digital Supply Chain (DSC) within Malaysian manufacturing firms. In this study digitalization importance is focusing

in supply chain operations which lead to enhancing the organizational competiveness and gain efficiency.

The key finding emphasizing supply chain integration strategies are always align with market and product diversification strategies which will affecting a firm's competitive performance by Narasimhan & Kim (2002). There will always be alignment of supply chain integration strategies with a company market and product strategy. Their study also indicate that effects of integration and diversification on performance of SC and also indicate that after some modification there will some relationship between integration and diversification on performance of SC. They also reveal that a company supply chain performance influence through combine method of supply chain integration and diversification strategy. It is also discussed in this study that if you want to competitive in a todays' business world supply chain strategy should give importance and integration plays a vital role to market and product diversification.

Supplier Relationship

Expanding the research scope to encompass the dynamics of inter-organizational collaboration, Alshurideh et al. (2022) investigate into the workings of supply chain partners' integration in Jordan outcomes. Their findings provide important trust and cooperation among SC partners which achieving mutually beneficial outcomes and sustaining competitive advantage in the Jordanian businesses. Alshurideh and his team through explain the collaborative relation-ship between SC practices and organizational performance through their rigorous analysis. Kurdi et al. (2022) study design examining the impact of blockchain technology and smart inventory systems on supply chain performance within the retail sector of the UAE. The study design is also highlights the blockchain technology potential change which lead to enhance transparency, traceability, and efficiency across supply chain operations.

Information Sharing

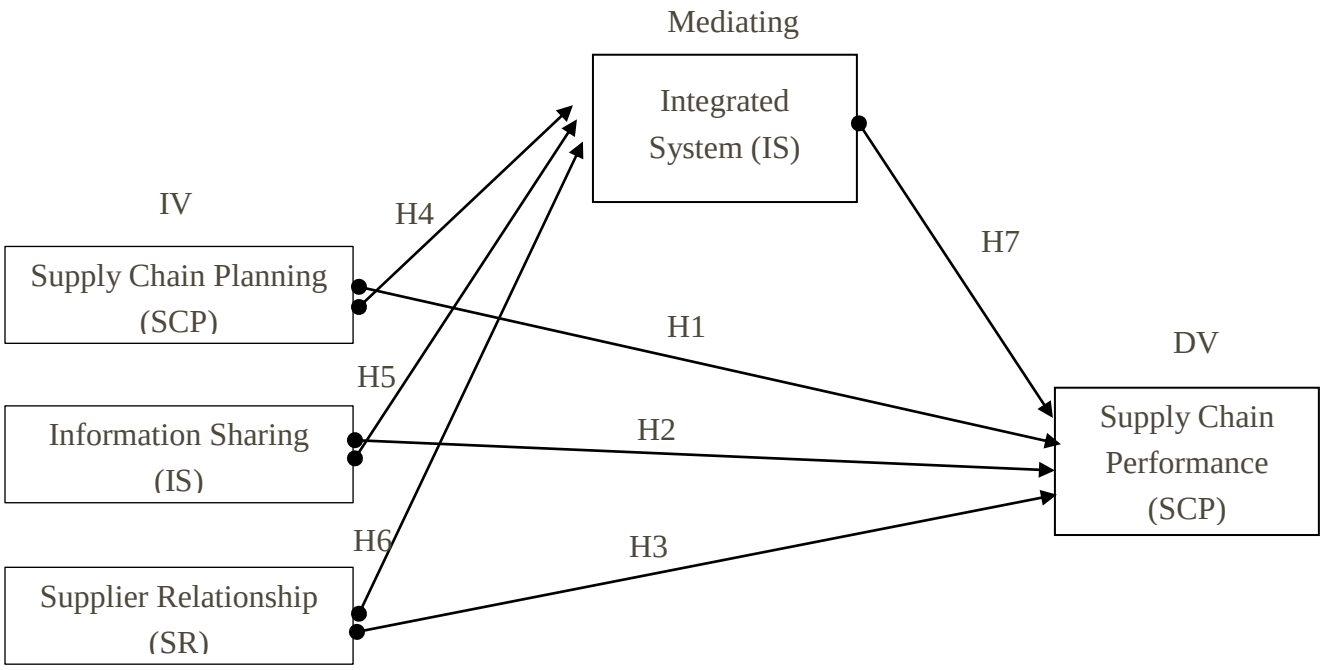
Simatupang (2005) key finding emphasizing the introduction of new approach in supply chain collaboration between companies and suppliers for external and teamwork among the company. This will be carried out through the five key collaborate element which are teamwork, information sharing, quick decision, incentive alignment and integration between supply chain processes which they are called collaboration framework. In the past studies there is only focus on one collaboration aspect which is information sharing now forming this framework provides the connections between the various collaboration features which will lead to the betterment of the supply chain performance as all partners are interdependent on each other efforts to achieve a single goal which this framework provides. To perform better supply chain performance this tool give individual to asses and improve their work across the collaborate network to give much improved outcomes. Through this research a whole new complete view of supply chain collaboration dynamics giving ideas to the further researchers and implement in practical application in supply chain.

Theoretical Framework

The theoretical framework for this study relies on several important ideas from supply chain management theories to help understand the connections mentioned in the hypotheses. Vance (2012) The **Resource-Based View (RBV)** theory talks about how both inside and outside resources are important for achieving competitive advantage, which aligns with hypotheses H1, H2, and H3. These hypotheses discuss how supply chain planning, sharing information, and relationships with suppliers improve overall performance.

Supply Chain Integration Theory agrees with hypotheses H4, H5, and H6 by stating that integrating different supply chain components enhances performance by improving coordination. Lastly, Fama & Jensen (1983).

Conceptual Framework



Research Hypothesis

H_1: There is a positive impact of Supply Chain Planning on Supply Chain Performance.
H_2: There is a positive impact of Information Sharing on Supply Chain Performance.
H_3: There is a positive impact of Supplier Relationship on Supply Chain Performance.
H_4: There is a positive impact of Supply Chain Planning on Integrated System.
H_5: There is a positive impact of Information Sharing on Integrated System.
H_6: There is a positive impact of the Supplier Relationship on Integrated System
H_7: There is a positive impact of Integrated System on Supply Chain Performance.

Research Methodology

The well designed survey questionnaire based on the researcher's questions and objectives from healthcare industry, including healthcare professionals, suppliers, and regulatory bodies. Creswell, J. W. (2014). The relationship of SC practices will be evaluated on performance through planning, information sharing, supplier relationship and mediating effect of integrated system Data will be collected via Consecutive Non-random Sampling Method on questionnaires from healthcare sector in Karachi and will be analyzed by using PLS-SEM via SMARTPLS. Descriptive statistics will be used for data analysis. This encompasses individuals and organizations responsible for various aspects of SC management, such as procurement, inventory management, & distribution. Healthcare sector supply chain in Karachi, including healthcare professionals, suppliers, and logistics providers will be the population. The sample frame refers to the list or source from which the sample will be drawn. This includes hospitals, clinics, pharmacies, medical equipment suppliers, pharmaceutical companies, and transportation providers involved in the healthcare supply chain. The sample size refers to the amount of participants selected from the population in

the study. The sample size is around the 384 participants from different areas of healthcare sector in Karachi.

Data Analysis

Demographic Analysis of Respondents:

The study used a self-administered questionnaire to analyze the impact of independent variables of Supply Chain Practices on Supply Chain Performance through a mediator. The questionnaire was filled by 404 participants who have been working in the healthcare sector in Karachi. Among the participants, 54 were females (13%) and 350 were males (87%). The largest demographic of age was 30 – 39 years of age group comprising of 184 participants (46%). A total of 150 participants (37%) had an average experience of greater than 10 years of working with the Supply Chain Industry and 268 (66%) had master education level. The data is laid out in Table 1 as follows;

Table 1: Demographic characteristics of the participants

Sample Characteristics	N	%
Gender		
Male	350	87%
Female	54	13%
Age		
20-29	35	9%
30-39	184	46%
40-49	175	43%
50-59	9	2%
60 and Above	1	0.25%
Work Experience		
1-2 years	25	6%
3-5 years	83	21%
6-10 years	146	36%
Greater Then 10 years	150	37%
Education		
Ph. D	3	0.74%
Masters	268	66%
Graduate	125	31%
Intermediate	8	2%

Outer Loading, Reliability and Average Variance Extracted:

According to the PLS-SEM Glossary, the Outer Loadings are the bi-variable relationship between indicators and the construct which calculates how much does an indicator partakes for its construct. On the other hand, Average Variance Extracted (AVE) measures the extent of variation of indicator by its construct. Composite Reliability measures if the internal consistency of the constructs is reliable enough without assuming that indicator loadings are equal, as opposed to Cronbach's Alpha value.. Cronbach's Alpha is used for internal validation of the constructs (Hair et al., 2022). Outer loadings with a value >.0.7, Cronbach's Alpha value >0.6 & 0.7, Composite Reliability values of >0.7, and AVE >0.5 are considered acceptable (Mohd Dzin et. al., 2021). Our

data is laid out in Table 2A and 2B for Outer Loadings, Cronbach's alpha and AVE and can be seen to have values within the acceptable limit range.

Table 2A: Outer Loadings

	Outer loadings
IS1 <- IS	0.739
IS2 <- IS	0.759
IS3 <- IS	0.871
ITS1 <- ITS	0.791
ITS2 <- ITS	0.806
ITS3 <- ITS	0.754
SCM1 <- SCM	0.857
SCM2 <- SCM	0.803
SCM3 <- SCM	0.886
SCP1 <- SCP	0.801
SCP2 <- SCP	0.857
SCP3 <- SCP	0.764
SR1 <- SR	0.897
SR2 <- SR	0.860
SR3 <- SR	0.908

Table 2B Cronbach's alpha, Composite Reliability and AVE

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
IS	0.713	0.763	0.834	0.627
ITS	0.687	0.688	0.827	0.615
SCM	0.809	0.819	0.886	0.722
SCP	0.743	0.782	0.850	0.654
SR	0.871	0.929	0.918	0.790

Fornell-Larcker Criterion:

Fornell-Larcker criterion is used to assess the discriminant validity of the constructs. As defined in the PLS-SEM Glossary, the Fornell Larcker Criterion is, "a measure of discriminant validity that compares the square root of each construct's average variance extracted with its correlations with all other constructs in the model" (Hair et. al., 2022). The Table 3 shows the values of our constructs as follows;

Table 3

	IS	ITS	SCM	SCP	SR
IS	0.792				
ITS	0.757	0.784			
SCM	0.540	0.671	0.850		
SCP	0.551	0.566	0.407	0.808	
SR	0.487	0.563	0.449	0.425	0.889

Collinearity (VIF)

When two variables are correlated to each other, Collinearity is said to exist. The VIF or Variance Inflation Factor can measure how much collinearity exists between the indicators (Hair et. al., 2022). VIF values in between 5 – 10 are said to show collinearity and with higher degree when VIF exceeds 10 (Kim et al., 2019).

Table 4: Collinearity (VIF)

	VIF
IS1	1.549
IS2	1.249
IS3	1.572
ITS1	1.320
ITS2	1.442
ITS3	1.296
SCM1	2.874
SCM2	1.341
SCM3	2.966
SCP1	1.469
SCP2	1.444
SCP3	1.528
SR1	2.770
SR2	2.399
SR3	2.055

Coefficient of Determination - r^2 and the adjusted r^2 values:

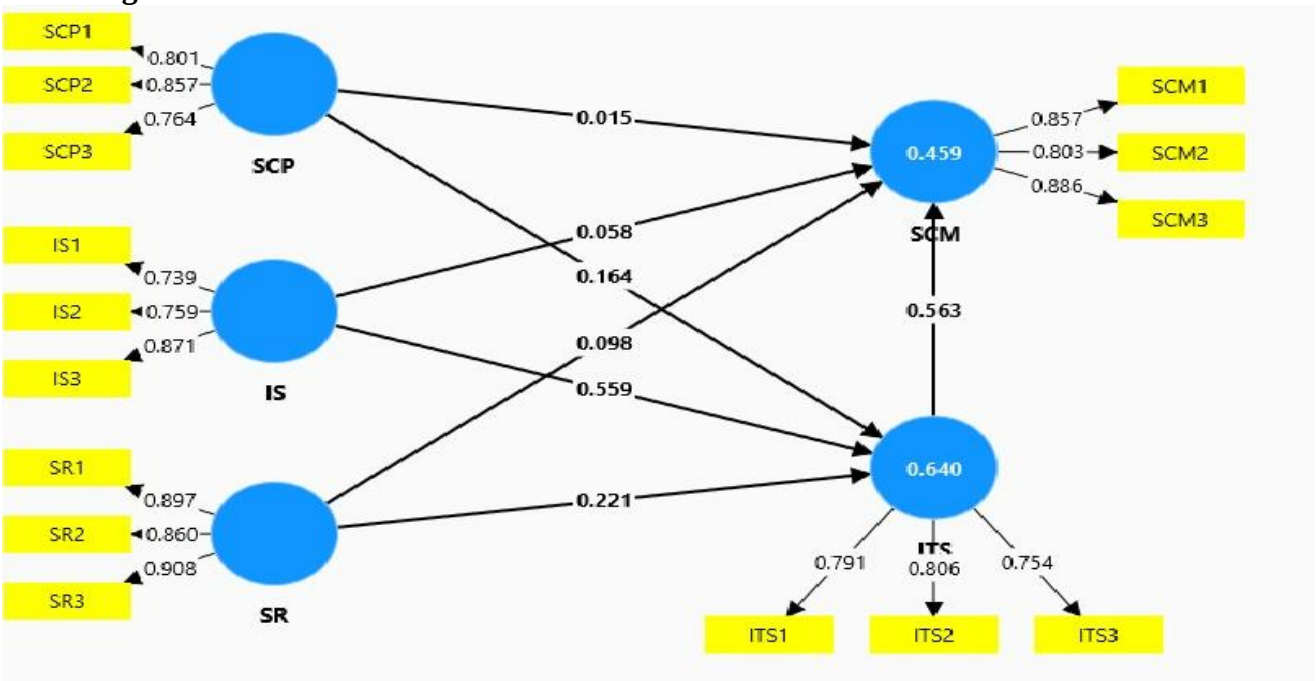
The coefficient of Determination, or the r^2 value, is used to show the power of explanation of a model with regards to its constructs and the adjusted value shows for the number of indicators of the model (Hair et. al., 2022). In other words, it can show the degree of variation among variables in a regression model. The more its value is closer to 1, the better is the explanation of the model by its indicators. Table 4 shows both values as follows;

	R-square	R-square adjusted
ITS	0.640	0.637
SCM	0.459	0.454

Hypothesis Testing:

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
IS -> ITS	0.559	0.559	0.040	13.985	0.000
IS -> SCM	0.373	0.372	0.051	7.316	0.000
ITS -> SCM	0.563	0.566	0.066	8.557	0.000
SCP -> ITS	0.164	0.165	0.036	4.538	0.000
SCP -> SCM	0.107	0.108	0.045	2.372	0.018
SR -> ITS	0.221	0.220	0.040	5.554	0.000
SR -> SCM	0.222	0.222	0.047	4.735	0.000

Path Diagram:



Discussion and Conclusion

Discussion and Findings

The analysis of the data shows that effective supply chain planning, information sharing, and strong supplier relationships greatly improve the performance of the healthcare supply chain in Karachi, confirming the initial hypotheses of this study. Proper supply chain planning helps improve performance by reducing inventory issues, avoiding stakeouts and overstocking, and ensuring that medical supplies are delivered on time. This finding supports the research by (Chen & Paulraj, 2004), which highlighted the importance of careful planning in achieving supply chain efficiency. Sharing information effectively increases transparency and collaboration among all parties, leading to better decision-making and faster responses. This aligns with the work of (Setyawan Firmansyah & Siagian, 2022), who stressed the importance of accurate and timely information sharing within the supply chain. Building strong relationships with suppliers creates trust and cooperation, which are essential for the smooth functioning of the supply chain. This finding is consistent with (Alshurideh et al., 2022), who noted the positive effects of strategic supplier partnerships. Integrating all parts of the supply chain into a unified system boosts overall performance by enabling real-time data sharing and decision-making. This finding supports the study by (Lee et al., 2022), which showed how integrated technological solutions can transform supply chain operations.

Theoretical Implications

The results of this study add valuable insights to what we already know about supply chain management in healthcare, especially in developing areas like Karachi. The research backs up the Resource-Based View (RBV) theory by showing that both internal and external resources—like careful supply chain planning and strong supplier relationships—are key to gaining a competitive edge.

Practical Implications

Healthcare organizations in Karachi can use these insights to make a real difference in their supply chains. By focusing on thoughtful planning, building strong connections with suppliers, and seamlessly integrating their systems, they can improve how they deliver healthcare services. This means better access to care and more affordable options for everyone. When these elements are managed well, it leads to a more efficient and cost-effective system, helping to overcome logistical and financial challenges. By adopting these strategies, healthcare providers can transform their services, making them more accessible and affordable for the community.

Future Research Directions

Future research could use a long-term approach to see how supply chain management practices impact performance over time. It would also be helpful to look at these practices in different regions or industries to get a better overall understanding of their effects.

Conclusion

This study explains the crucial role that effective Supply Chain Management (SCM) practices play in improving healthcare supply chains in Karachi, Pakistan. By focusing on essential aspects like planning, sharing information, and building strong relationships with suppliers, the research shows that these practices are key to making healthcare delivery more efficient and reliable. When these practices are well-coordinated, they lead to tangible benefits, such as ensuring that medical supplies reach those who need them on time and at a lower cost, ultimately improving patient care.

One of the key takeaways from this study is the importance of creating a system that integrates these SCM practices, making them work together seamlessly. The study offers practical advice for healthcare organizations in Karachi, suggesting that they adopt more advanced planning techniques, encourage open and honest communication with their suppliers, and use technology to streamline their operations. These steps are essential for reducing delays, cutting costs, and improving the overall reliability of healthcare services. The study also recognizes that there's more to explore. Future research should look into how sustainable these practices are in the long run and whether they can be applied to other regions and industries facing similar challenges. In the end, this study provides valuable insights into how better-managed supply chains can lead to significantly improved healthcare outcomes, benefiting the people of Karachi and potentially beyond.

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