




Investigating the Impact of COVID-19 Consequences on Supply Chain Integration and Performance with the Mediating Role of Organizational Strategic Flexibilities (Case Study: Iranian Airlines)

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ABSTRACT

Objective: This study aims to investigate the effect of COVID-19 consequences on supply chain integration and supply chain performance, considering the mediating role of strategic flexibility in Iranian airline companies.

Methods and Materials: This applied, descriptive-correlational study examined employees of airline companies in Tehran as the statistical population (N = 3400). Using Cochran's formula, a sample of 240 participants was selected through purposive sampling. Data were collected via a Likert-scale questionnaire whose reliability was confirmed through Cronbach's alpha coefficients exceeding 0.70. Data analysis was conducted using SPSS and PLS software at both descriptive and inferential levels. Descriptive indicators such as mean, standard deviation, and frequency distribution were used, while structural equation modeling (SEM) and path analysis tested the research hypotheses. Additional indices such as CR, AVE, Q², SRMR, NIF, and GOF were used to evaluate model fit. The Sobel test was applied to assess the mediating role of strategic flexibility.

Findings: Results indicated that COVID-19 consequences significantly affected supply chain integration ($\beta = 0.456$, $t = 10.100$) and supply chain performance ($\beta = 0.325$, $t = 10.222$). COVID-19 also had a significant effect on strategic flexibility ($\beta = 0.258$, $t = 7.455$). Strategic flexibility significantly influenced supply chain integration ($\beta = 0.459$, $t = 8.200$) and supply chain performance ($\beta = 0.369$, $t = 12.123$). Sobel test results confirmed the mediating role of strategic flexibility, with indirect effects of 0.39 and 0.44, both with confidence intervals above zero. Model fit indices and R² values supported strong predictive power and high model adequacy.

Conclusion: The findings demonstrate that COVID-19 consequences significantly shape supply chain integration and performance, and strategic flexibility serves as a vital mediating mechanism that enhances organizational resilience and operational effectiveness within Iranian airline supply chains.

Keywords: COVID-19 consequences; supply chain integration; supply chain performance; strategic flexibilities

1 Introduction

The growing complexity, volatility, and interconnectedness of contemporary supply chains have turned supply chain integration, information sharing, and strategic flexibility into central pillars of competitive advantage across global industries. Over the past decade, the pace of digital transformation, technological advancements, globalization, and unprecedented disruptions—such as pandemics, geopolitical tensions, and resource shortages—have made organizations increasingly dependent on integrated and information-driven supply chain systems to maintain continuity and performance. Early studies in logistics highlighted the transformative megatrends reshaping logistics networks, emphasizing the role of advanced communication infrastructure, global collaboration, and information connectivity in enhancing responsiveness and performance (Bowersox et al., 2019). As supply chains expanded in scale and complexity, the strategic importance of knowledge management and customer-driven intelligence also grew, with scholars emphasizing that leveraging an organization's knowledge base enhances its ability to sustain competitive advantage in dynamic environments (Ofek & Sarvary, 2018). These conceptual foundations were further developed in domains such as information sharing frameworks that enable more efficient coordination of production, procurement, and distribution processes (Sun & Yen, 2021), reinforcing the idea that modern supply chains require tight integration to withstand environmental turbulence.

Information sharing and digital connectivity are widely recognized as primary drivers of supply chain integration. The ability to share accurate, real-time information across supply chain partners reduces uncertainty, increases process transparency, and promotes synchronized operational decision-making (Li & Lin, 2021). Studies examining information quality reveal that reliable data exchange directly supports high-performance supply chain decision systems, which in turn improve agility and responsiveness (Tanhai & Ahmadi Motlagh, 2022). Similar perspectives highlight the significance of collaborative behaviors in the effectiveness of knowledge-based companies, arguing that information sharing is fundamental to optimizing supply chain performance (Mohammad Salahi, 2021). In manufacturing and service environments, effective information sharing not only accelerates production processes but also stabilizes supply chain dynamics by reducing variability and enabling early detection of potential

disruptions (Huang et al., 2021). Moreover, conceptual frameworks developed to unify information-sharing processes emphasize the importance of integrating technological features, structural relationships, and operational decision rules to create seamless information supply chains (Sun & Yen, 2021). These insights collectively underscore that supply chain integration is a multidimensional construct grounded in information exchange, relationship quality, collaboration, and technological connectivity.

The emergence of digital technologies such as blockchain, artificial intelligence, and advanced analytics has dramatically reshaped the supply chain environment. Blockchain technology, in particular, has received significant attention for its ability to enhance information transparency, traceability, and trust among supply chain partners. Numerous empirical and conceptual studies have explored blockchain's benefits and limitations in improving supply chain management, highlighting its role in increasing transactional visibility, reducing fraud, and streamlining compliance processes (Shafiei Alavi & Estakhrian Haghighi, 2021). Other research demonstrates that blockchain can facilitate supply chain performance improvements by fostering real-time data verification, improving collaborative processes, and supporting strategic decision-making (Zahedi & Naghdi Khanehchah, 2020). Insights from national and international conferences indicate that blockchain adoption can significantly strengthen competitive advantage through its contributions to transparency, knowledge flow, and strategic leadership capabilities (Akbari Noghabi et al., 2020; Rahim & Bushehri, 2019). Conceptual frameworks developed through meta-synthesis methods further emphasize that blockchain's transformational potential extends to resilience building, logistics coordination, and interorganizational communication (Maleki & Maleki, 2021). Taken together, these studies show that blockchain adoption is a strategic enabler of supply chain integration, especially in uncertain and rapidly changing environments.

Parallel to blockchain developments, advances in artificial intelligence (AI) have opened new avenues for coordinated and resilient supply chain operations. Studies on AI integration in supply chain management suggest that AI enhances the ability of organizations to diversify their supply chain strategies, manage risks more effectively, and respond to environmental uncertainties (Zhou et al., 2024). More recent work highlights the complementary role of AI and strategic human resource management (SHRM) in

improving supply chain agility and resilience, demonstrating that digital decision support systems and data-driven forecasting significantly enhance organizational responsiveness (Yamin et al., 2024). Subsequent empirical findings indicate that AI-enabled analytical tools can optimize supply chain processes, increase operational flexibility, and strengthen relationships among supply chain partners, ultimately contributing to higher levels of adaptability and performance (Varkiani Pour & Sarhadi, 2024). These insights collectively highlight that AI is not simply a technological enhancement; rather, it is a strategic tool that elevates organizational capabilities in navigating volatile supply environments.

In line with the technological transformation of supply chains, strategic flexibility has emerged as an essential factor for organizations operating in uncertain contexts. Strategic flexibility encompasses an organization's capacity to adjust resources, restructure internal processes, and realign strategic priorities in response to environmental changes. Empirical studies indicate that strategic flexibility plays a mediating role between integration practices and competitive performance outcomes (Masadeh et al., 2023). Additional evidence suggests that structural supply chain flexibility enables firms to expand operational options, absorb disruptions, and maintain service continuity (Asare et al., 2023). Flexibility is particularly critical in industries exposed to frequent environmental shocks, where rapid adaptation is required to preserve supply chain continuity and ensure organizational survival. Research examining leagile strategies—a hybrid of lean and agile paradigms—reveals that strategic partnerships and flexible production processes significantly enhance competitive advantage in turbulent markets (Oyombe et al., 2023). Together, these findings validate the growing consensus that strategic flexibility is indispensable for organizations seeking to remain robust in the face of severe and unpredictable disruptions.

Another important factor influencing supply chain resilience is supply chain diversification, a strategy increasingly adopted by organizations seeking to mitigate the risks associated with uncertainty and supply dependency. Recent contributions show that diversification strategies, supported by AI-based predictive modeling, reduce vulnerability, enhance resilience, and expand firms' strategic options for procurement, logistics, and distribution (Zhou et al., 2024). Complementary studies on hybrid supply chain channel pricing demonstrate that consumer behavior and market uncertainty require firms to adopt flexible

pricing and distribution models to maintain competitiveness (Zhang et al., 2023). These insights reveal that diversification and flexibility are interconnected strategic dimensions that enable firms to withstand volatility while enhancing supply chain integration and performance.

The dynamics of information sharing also play a central role in enhancing supply chain resilience and innovation. Knowledge sharing has been shown to positively influence organizational innovation capabilities, fostering a culture of continuous improvement and operational effectiveness (Lin, 2019). When firms are able to effectively share production information—whether internally or across organizational boundaries—they can reduce lead times, synchronize production flows, and enhance operational efficiency (Huang et al., 2021). Studies on problem taxonomy in information sharing emphasize that well-organized information structures help streamline communication among supply chain partners, thereby improving decision-making and minimizing misunderstandings (Chandra et al., 2019). Furthermore, research on online value networks underscores that information sharing and interorganizational connectivity enhance operational flexibility and create a more cohesive supply chain ecosystem (Barlow & Li, 2020). These insights collectively reinforce that effective information sharing serves as the foundation for achieving supply chain integration, strategic collaboration, and sustainable competitive advantage.

In recent years, the importance of resilience has intensified due to heightened global uncertainty and major disruptions. Literature on health tourism supply chains demonstrates that resilience models significantly contribute to enhancing the operational stability of service networks, especially in crisis-prone environments (Marvi, 2023). Notably, digital transformation initiatives under Industry 4.0 have been identified as powerful enablers of supply chain resilience, offering organizations digital tools and strategic frameworks for addressing disruptions, optimizing response strategies, and building adaptive capacity (Ghobakhloo et al., 2025). Reviews of digital transformation highlight that organizations must adopt long-term resilience strategies to mitigate risks from external shocks while maintaining supply chain integration and performance.

Within this broader context, strategic management accounting (SMA) has gained renewed attention as a tool for supporting sustainable supply chain management. SMA facilitates informed strategic decision-making by integrating external orientation, performance metrics, and forward-looking analytical capabilities. Recent research

demonstrates that SMA significantly supports sustainable supply chain practices, particularly in manufacturing sectors where long-term resource planning is essential (Seyed Nejad Fahim, 2024). Other work shows that strategic management accounting strengthens strategic supply chain orientation by integrating financial insights with operational strategies, thereby improving both internal and external alignment (Pramono et al., 2023). Collectively, these findings highlight the necessity of combining accounting-based strategic tools with operational capabilities to achieve sustainable and flexible supply chain systems.

As organizations confront growing environmental uncertainty, scholars have increasingly argued that supply chain integration must be paired with robust strategic capabilities to ensure enduring performance. The literature asserts that supply chain integration improves coordination, reduces redundancy, and enhances overall performance by promoting collaboration and operational harmony (Zhou & Benton, 2020). Recent contributions emphasize that integrated supply chains equipped with advanced analytics and strategic flexibility are better positioned to respond to disruptions and maintain service continuity (Tari, 2022). Moreover, investigations into the impact of blockchain adoption and knowledge sharing indicate that integrated digital platforms significantly enhance supply chain performance by improving traceability, relationship management, and information flow (Tari, 2022). These findings reinforce the idea that supply chain performance depends not only on integration practices but also on the presence of strategic flexibility and digital capability.

Given these extensive theoretical and empirical foundations, the present study seeks to extend the scholarly understanding of how environmental disruptions—in particular, the consequences of COVID-19—affect supply chain integration and performance, while also investigating the mediating role of strategic flexibility in shaping these relationships in the context of Iranian airlines. The aim of this study is to examine the impact of COVID-19 consequences on supply chain integration and supply chain performance with the mediating role of strategic flexibility.

2 Methods and Materials

This study can be classified as an applied research project in terms of its objective and as a descriptive–correlational research in terms of data-collection method, because in this investigation, the researcher examines the relationships among the variables of the model.

The statistical population consists of employees of airline companies in Tehran, totaling 3,400 individuals. The sampling method was purposive. The sample size was calculated using Cochran's formula, resulting in a sample of 240 participants.

$$n = ((1.96^2 \times .5 \times .5) / .05^2) / (1 + 1/3400 ((1.96^2 \times .5 \times .5) / .05^2 - 1)) = 240$$

Reliability refers to the stability and internal consistency of a measurement scale. To establish the reliability of the questionnaire, a preliminary Likert-scale questionnaire was distributed among 30 respondents, and using SPSS software, Cronbach's alpha was calculated for each set of items related to each research variable; the results are presented in the following table. These coefficients must exceed 0.70. In structural equation modeling, in addition to Cronbach's alpha, other indices are also used, which are examined at the end of the statistical analysis. The alpha values for all dimensions are above 0.70; therefore, it is concluded that all dimensions of the questionnaire possess good reliability based on Cronbach's alpha testing.

Data analysis was conducted using SPSS and PLS statistical software at two levels: descriptive and inferential statistics. Descriptive and inferential statistics were employed to examine the research hypotheses within the population. At the descriptive level, indicators such as mean, standard deviation, frequency, and percentage frequency were used to summarize the demographic characteristics of the variables. In the second stage, at the inferential level, structural equation modeling based on path analysis using SPSS and PLS software was employed to test the statistical hypotheses. It should be noted that all hypotheses were evaluated based on the results obtained from the model test.

3 Findings and Results

Table 1 presents the research hypotheses, path coefficients, significance values, and conclusions.

Table 1

Results of Research Hypotheses

Hypothesis	Description	Path Coefficient	Significance	Result
First Sub-Hypothesis	COVID-19 consequences have a significant effect on integration in Iranian airlines.	0.456	10.100	Hypothesis Accepted
Second Sub-Hypothesis	COVID-19 consequences have a significant effect on supply chain performance in Iranian airlines.	0.325	10.222	Hypothesis Accepted
Third Sub-Hypothesis	COVID-19 consequences have a significant effect on strategic flexibilities in Iranian airlines.	0.258	7.455	Hypothesis Accepted
Fourth Sub-Hypothesis	Strategic flexibilities have a significant effect on integration in Iranian airlines.	0.459	8.200	Hypothesis Accepted
Fifth Sub-Hypothesis	Strategic flexibilities have a significant effect on supply chain performance in Iranian airlines.	0.369	12.123	Hypothesis Accepted

To examine the mediating hypothesis, the Sobel test was used.

Table 2

Model Fit Indices

Fit Result	Desired Value	Observed Value	Fit Index
Acceptable	< 0.09	0.09	SRMR
Acceptable	> 0.90	0.96	NIF
Acceptable	Close to zero	0.30	RMS
Acceptable	> 0.95	0.07	d-G
Acceptable	> 0.95	0.03	d-ULS
Acceptable	> 0.70	0.90	CR
Acceptable	> 0.50	0.90	AVE
Acceptable	> 0.15	0.39	Q ²

Based on the table, comparing the desired and observed values indicates that the research model has a good fit. Additionally, the t-values for each path from independent to

dependent variables exceed 1.97 ($p < .05$), confirming the overall research hypothesis.

Table 3

Mediating Variable Analysis

Mediating Variables	Mediating Effect	Upper Bootstrap Level	Lower Bootstrap Level	Hypothesis Evaluation
The consequences of COVID-19 have a significant effect on supply chain integration through the mediating role of strategic flexibilities in Iranian airlines.	0.39	0.55	0.30	Hypothesis Confirmed
The consequences of COVID-19 have a significant effect on supply chain performance through the mediating role of strategic flexibilities in Iranian airlines.	0.44	0.49	0.39	Hypothesis Confirmed

According to the Sobel test, the indirect effects of the mediating variables at the 5% level are 0.39 and 0.44, respectively, and their confidence intervals are noticeably above zero. This indicates that the mediating variables have significant and influential effects within the regression model.

The R^2 value is calculated for latent endogenous variables. This test shows how much the exogenous

variables collectively predict the behavior of the dependent variable; that is, R^2 indicates how much of the variance of an endogenous variable is explained. Chen et al. (2001) state that an R^2 value below 0.19 indicates weak prediction, above 0.33 indicates moderate prediction, and above 0.67 indicates strong prediction.

Table 4*Results of R² Test*

Variables	R ² Value
COVID-19 Consequences	0.768
Supply Chain Integration	0.789
Supply Chain Performance	0.857
Organizational Strategic Flexibilities	0.809

Another name for the structural model quality test is Q-square (Q²). Structural model quality refers to the extent to which the model explains the variance of endogenous variables. Chen et al. (2001) state that values of 0.02 indicate weak quality, 0.15 moderate quality, and 0.35 strong quality.

For this purpose, the table of cross-validated redundancy (CV-Red) is used. However, this index alone is not sufficient for a final judgment; the final assessment of structural model quality lies in the last test, the Global Fit Index (GFI).

Table 5*Structural Model Quality Results*

Variables	Cross-Validated Redundancy
COVID-19 Consequences	0.568
Supply Chain Integration	0.503
Supply Chain Performance	0.434
Organizational Strategic Flexibilities	0.515

The GOF test determines the overall quality of measurement and structural models. To calculate this, the square root of the product of average communality and average R² is taken:

$$\text{GOF} = \sqrt{(\text{communality} \times R^2)} = \sqrt{(.651 \times .782)} = .713$$

Chen et al. (2001) argue that if the value is 0.02, the overall model is weak; if 0.15, the model is moderate; and if 0.35, the model is strong. Given the value of 0.713, it can be concluded that the overall model possesses high and strong quality.

4 Discussion and Conclusion

The purpose of this study was to investigate the effect of COVID-19 consequences on supply chain integration and supply chain performance, considering the mediating role of strategic flexibility in Iranian airlines. The findings demonstrated that COVID-19 significantly influences both supply chain integration and supply chain performance, while strategic flexibility plays a meaningful mediating role in strengthening these relationships. These results align with a large body of contemporary literature highlighting the vulnerability of supply chains during disruptions and the corresponding role of flexible, information-driven strategies in sustaining operational continuity. The significant positive

effect of COVID-19 consequences on supply chain integration suggests that crisis conditions stimulate a shift toward deeper interorganizational collaboration, enhanced information sharing, and tighter coordination. This is consistent with the argument that disruptions increase the strategic value of integrated communication systems, as firms under uncertainty tend to rely more heavily on timely, accurate, and comprehensive information exchange (Li & Lin, 2021). Moreover, earlier studies stressed that effective information-sharing mechanisms are essential for maintaining supply chain stability and mitigating complexity during environmental turbulence (Sun & Yen, 2021), which corresponds with our findings indicating that integration becomes a critical response strategy in crisis contexts.

The significant effect of COVID-19 consequences on supply chain performance also reflects broader research asserting that disruptions reshape operational priorities and accelerate the adoption of performance-enhancing practices. Prior work demonstrated that large-scale disruptions force firms to refine their coordination processes, upgrade information systems, and adopt innovative methods to maintain overall performance (Huang et al., 2021). This study confirms these insights within the airline industry by

showing that despite the challenges imposed by COVID-19, companies increasingly focus on strengthening their supply chain performance through improved communication, operational realignment, and collaborative planning. Similarly, earlier contributions argued that the ability to effectively manage information flow directly influences operational outcomes in periods of disruption, as timely information reduces uncertainty and enhances decision-making (Chandra et al., 2019). The present findings reinforce this perspective by demonstrating that supply chain performance improves when firms adopt integrated strategies that minimize delays, enhance resource allocation, and increase responsiveness.

The results further indicate that COVID-19 consequences significantly influence strategic flexibility within Iranian airlines. This is consistent with studies showing that environmental turbulence forces organizations to rapidly adjust their strategies, reconfigure capabilities, and increase adaptability (Masadeh et al., 2023). COVID-19 intensified global uncertainties and supply instability, compelling airlines to deploy flexible strategies in areas such as procurement, logistics coordination, fleet management, and supplier partnerships. Supporting evidence from recent literature shows that firms facing uncertainty often adopt flexible planning, invest in digital tools, and diversify supply sources to minimize vulnerability (Zhou et al., 2024). The current study confirms that such strategic adjustments have become essential in the airline sector, where operational realities changed drastically due to pandemic-induced restrictions and fluctuating demand.

The significant relationship between strategic flexibility and supply chain integration in the results aligns with earlier research demonstrating that flexible organizations are more capable of fostering collaborative partnerships, enhancing communication channels, and responding effectively to supplier or customer changes (Asare et al., 2023). Strategic flexibility enhances an organization's ability to modify resource allocations, restructure processes, and engage in rapid problem-solving, which in turn strengthens integration across the supply chain. The current findings provide empirical support for this theoretical argument, showing that strategic flexibility is not only a desirable capability but a necessary one for achieving a fully integrated supply chain in turbulent environments. Prior studies also highlight that flexible firms can more easily adopt new digital platforms that support integration, such as blockchain or AI-enabled systems, further supporting the association found here

(Shafiei Alavi & Estakhrian Haghighi, 2021; Varkiani Pour & Sarhadi, 2024).

Furthermore, the significant effect of strategic flexibility on supply chain performance is aligned with the central premise that flexibility enables organizations to adapt quickly to disruptions, which directly boosts performance. Earlier studies concluded that flexibility strengthens competitive advantage by enhancing the ability to modify operations, increase responsiveness, and implement timely mitigation strategies (Oyombe et al., 2023). This aligns with the findings of the present research, which indicate that strategic flexibility empowers airlines to better navigate resource shortages, fluctuating regulations, and sudden changes in passenger and cargo demand. Additional evidence shows that flexibility in planning, sourcing, and logistics decision-making plays a critical role in enhancing organizational performance during crises (Masadeh et al., 2023). Therefore, strategic flexibility serves as a core mechanism through which firms achieve resilience and strengthen overall supply chain capabilities.

The mediating role of strategic flexibility observed in this study is particularly noteworthy. The Sobel test confirmed that strategic flexibility significantly mediates the relationship between COVID-19 consequences and both supply chain integration and performance. This finding is consistent with research emphasizing that flexibility acts as a bridge connecting disruption-induced pressures with organizational responses that drive resilience and efficiency (Mitchell & Kovach, 2018). Scholars argue that flexibility allows organizations to translate crisis conditions into opportunities for reconfiguration, learning, and modernization, which in turn foster deeper integration and improved performance. The present findings reinforce this conceptual view by showing that the more COVID-19 impacts the external environment, the more organizations rely on strategic flexibility to sustain integration and performance.

This mediating relationship is also supported by studies in sustainable supply chain management, which emphasize the role of strategic management accounting (SMA) in enhancing learning, adaptation, and strategic responsiveness (Seyed Nejad Fahim, 2024). SMA concepts intersect with strategic flexibility by supporting long-term planning and real-time adjustment, which ultimately lead to more integrated and high-performing supply chains. Meanwhile, studies on hybrid channel strategies and consumer behavior further highlight the need for organizations to remain flexible in operational and pricing decisions, especially

when managing uncertainty across multiple supply pathways (Zhang et al., 2023). The findings of this study confirm that such flexibilities are instrumental in short-term adaptation and long-term strategy during global disruptions.

The significant model fit indices (SRMR, NIF, RMS, AVE, CR, Q^2) and strong R^2 values support the validity of the proposed relationships by showing that the model effectively explains variance in supply chain integration, performance, and strategic flexibility. These results support findings from structural equation modeling studies in logistics and supply chain domains that emphasize the usefulness of integrated and flexible constructs in predicting performance outcomes (Tari, 2022; Zahedi & Naghdi Khanehchah, 2020). The strong R^2 values in particular suggest that the variables used in this study—COVID-19 consequences, integration, flexibility, and performance—offer a comprehensive explanation for operational and strategic changes within airline supply chains. The high GOF value (0.713) confirms the overall quality and robustness of the structural model, aligning with research that emphasizes the importance of multidimensional evaluation in supply chain analysis (Ghobakhloo et al., 2025).

Overall, the discussion of results reveals clear alignment between the current study and global scholarship emphasizing the interconnected roles of integration, flexibility, and information sharing in enhancing supply chain resilience during crises. The findings validate the argument that uncertainty—whether caused by pandemics, technological disruptions, economic instability, or environmental shifts—inevitably restructures supply chain priorities. The literature consistently supports the notion that organizations with higher levels of flexibility, integrated information systems, stronger partnerships, and digitally enabled processes outperform those lacking such capabilities (Barlow & Li, 2020; Madlberger, 2021). Through integration and flexibility, firms are better equipped to absorb shocks, maintain alignment, and optimize performance. The results of this study confirm that Iranian airlines, despite facing severe operational disruptions due to COVID-19, were able to shift toward strategic practices that strengthen both integration and performance. This suggests that supply chain resilience is achievable when firms cultivate dynamic capabilities, invest in digital transformation, and embrace a culture of knowledge sharing and collaborative learning (Lin, 2019; Mohammad Salahi, 2021). Ultimately, the findings reinforce a critical theme within contemporary supply chain research: resilience and

performance are not outcomes of stability, but rather the result of adaptability, integration, and strategic flexibility during conditions of uncertainty.

The results of this investigation provide strong evidence that COVID-19 consequences have reshaped supply chain strategies within Iranian airlines, forcing organizations to adopt more flexible, integrated, and technology-driven approaches. These findings contribute to ongoing academic discourse by confirming that strategic flexibility is both a mitigating mechanism and a pathway for enhancing supply chain performance under crisis conditions. By positioning flexibility as a mediator, the study advances theoretical understanding of how disruptions translate into strategic change, offering implications for both supply chain management theory and managerial practice.

Although the study provides valuable insights into the relationships among COVID-19 consequences, supply chain integration, strategic flexibility, and performance, it is subject to several limitations. The research is geographically limited to airline companies located in Tehran, which may restrict the generalizability of findings to airlines in other regions or countries with different organizational structures, technological capabilities, or regulatory environments. Additionally, the study relies on self-reported data collected through questionnaires, which may introduce subjective biases or inaccuracies due to respondents' perceptions. The cross-sectional nature of the data collection prevents an assessment of changes over time, meaning that causal inferences should be interpreted cautiously. Finally, although structural equation modeling offers robust analytical power, the model may not fully capture all contextual or external variables that influence supply chain resilience during crises.

Future research should consider expanding the sample to include airlines from multiple provinces or international airline organizations to enhance external validity. Longitudinal studies would be beneficial for capturing how strategic flexibility and supply chain performance evolve throughout different phases of a disruption. Researchers may also explore additional mediating or moderating variables such as digital maturity, organizational culture, leadership effectiveness, or environmental sustainability practices. Comparative studies between industries heavily affected by crises—such as healthcare, tourism, or logistics—could further clarify sector-specific dynamics. Finally, mixed-methods approaches combining quantitative modeling with qualitative interviews may provide deeper insights into managerial decision-making, adaptation processes, and the

mechanisms through which flexibility and integration shape organizational outcomes.

Managers should prioritize strengthening strategic flexibility by investing in scenario planning, rapid reconfiguration capabilities, and workforce agility. Implementing digital tools that support real-time information sharing and decision-making can significantly enhance integration and improve supply chain performance during crises. Organizations should also focus on diversifying supply sources, establishing strong partnerships, and creating collaborative information-sharing environments. Continuous monitoring of supply chain risks, coupled with the development of resilience strategies, can help firms anticipate disruptions and respond more effectively. Finally, training programs and organizational learning initiatives should be emphasized to ensure that employees can adapt to evolving operational demands and contribute to building a more flexible and integrated supply chain infrastructure.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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