



Investigating the Relationship Between Intelligent Automation and Supply Chain Resilience Based on the Role of Integration Capability

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Abstract

This study was conducted to investigate the relationship between intelligent automation and supply chain resilience based on the role of integration capability and supply chain transparency. The statistical population included managers and experts employed in large industries in Iran. The research questionnaire was distributed among 384 members of the statistical population selected as the sample, and the completed questionnaires were collected. The data gathered through the questionnaires were analyzed using SPSS version 24 and AMOS version 24 software through structural equation modeling. The results indicated that intelligent automation has a positive and significant effect on supply chain resilience. Supply chain integration plays a positive mediating role in the relationship between intelligent automation and supply chain resilience. Supply chain transparency also plays a positive mediating role in the relationship between intelligent automation and supply chain resilience.

Keywords: *Intelligent automation, supply chain resilience, integration capability.*

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1. Introduction

Supply chains have long been recognized as one of the most critical pillars of organizational competitiveness and sustainability in dynamic business environments. In recent decades, the expansion of globalization, increasing market complexity, rapid technological advancements, and the growing interdependence among supply chain members have fundamentally transformed the nature and structure of supply chain management. Modern supply chains are no longer limited to the simple flow of materials and products; rather, they encompass integrated networks of information, finance, technology, and knowledge that must respond rapidly and intelligently to environmental changes and disruptions. The occurrence of severe global crises, particularly the COVID-19 pandemic, exposed the vulnerability of traditional supply chain systems and demonstrated that many organizations lacked sufficient preparedness to manage unexpected disruptions [1].

Consequently, concepts such as supply chain resilience, agility, viability, and intelligent transformation have become central concerns in both academic and managerial domains. Among these concepts, supply chain resilience has attracted considerable attention because it reflects the ability of supply chains to resist disruptions, adapt to environmental uncertainty, recover from crises, and maintain operational continuity under turbulent conditions [2]. The growing complexity of operational environments has also increased the need for advanced technological solutions capable of improving coordination, enhancing decision-making quality, and enabling rapid responses to environmental changes. Accordingly, organizations are increasingly investing in digital transformation initiatives and intelligent technologies to improve the resilience and sustainability of their supply chain systems.

Intelligent automation has emerged as one of the most influential technological developments associated with digital transformation and Industry 4.0. Unlike traditional



automation systems, intelligent automation combines artificial intelligence, machine learning, robotic process automation, big data analytics, and intelligent decision-support systems to perform complex tasks with minimal human intervention [3]. The integration of artificial intelligence with automation technologies enables organizations to enhance operational accuracy, increase productivity, reduce human error, and improve process adaptability in uncertain environments [4]. Intelligent automation not only facilitates operational efficiency but also provides organizations with predictive and analytical capabilities that strengthen strategic decision-making and organizational responsiveness. Ghosh described the future of organizations as simultaneously automated and intelligent, emphasizing that competitiveness increasingly depends on the capacity to integrate intelligence into automated systems [5]. In supply chain contexts, intelligent automation can optimize procurement activities, inventory management, logistics operations, forecasting systems, and supplier coordination, thereby improving the overall responsiveness and flexibility of supply chain networks [6]. Furthermore, intelligent automation enables organizations to process real-time data, identify emerging risks, and proactively respond to disruptions before they escalate into severe operational crises. This capability is particularly important in volatile environments characterized by uncertainty, fluctuating demand, geopolitical instability, and unexpected disruptions.

Recent studies have increasingly emphasized the strategic role of intelligent automation in improving supply chain performance and resilience. Mubarik and Maciukaite-Zviniene argued that technology alone is insufficient for achieving sustainable organizational resilience unless it is integrated with broader organizational and strategic capabilities [7]. Their findings demonstrated that intelligent automation significantly contributes to supply chain resilience when supported by complementary organizational mechanisms and strategic alignment. Similarly, Mubarik and colleagues highlighted the importance of organizational readiness, strategic orientation, and knowledge advancement in maximizing the benefits of intelligent automation initiatives [8]. Yamin and colleagues also emphasized that artificial intelligence and strategic human resource management collectively strengthen supply chain agility and resilience by enabling faster adaptation to changing market conditions [9]. In humanitarian and digital supply chain environments, researchers have found that the adoption of intelligent technologies is frequently constrained by

technological, organizational, and informational barriers [10]. Nevertheless, organizations that successfully integrate intelligent technologies into their operational processes are more likely to achieve superior resilience and adaptability. Salhab and colleagues demonstrated that artificial intelligence applications improve inventory decisions and quality management in digitally integrated supply chains [11]. Similarly, Sadeghi Moghadam and colleagues emphasized the transformative potential of advanced technologies in enhancing the capabilities of humanitarian supply chains in Iran [12]. These findings collectively indicate that intelligent automation is becoming an essential driver of sustainable and resilient supply chain systems.

Despite the growing adoption of intelligent automation technologies, the successful realization of their benefits largely depends on organizational and structural capabilities within the supply chain network. One of the most important capabilities in this regard is supply chain integration. Supply chain integration refers to the strategic coordination and synchronization of processes, information flows, resources, and decision-making activities among supply chain partners. Integrated supply chains facilitate collaboration, communication, and alignment among internal departments and external stakeholders, thereby reducing inefficiencies and improving operational responsiveness. The role of integration becomes increasingly important in digitalized environments where intelligent technologies rely heavily on interconnected systems and seamless information exchange. Ghasemi Hamedani and colleagues argued that the evolution of supply chain management toward intelligent systems requires a high level of technological and informational integration among organizational units and supply chain actors [13]. Without sufficient integration capability, organizations may fail to effectively utilize intelligent automation technologies because fragmented systems and disconnected processes hinder the flow of information and coordinated decision-making. Supply chain integration also enhances visibility and collaborative problem-solving, which are essential for maintaining resilience during disruptions. Organizations with integrated supply chains are generally more capable of detecting operational risks, sharing critical information rapidly, and implementing coordinated responses to crises. Consequently, supply chain integration may function as a mediating mechanism through which intelligent automation enhances supply chain resilience.

Another important dimension associated with intelligent automation and supply chain resilience is supply chain

transparency. Transparency refers to the visibility, accessibility, and accuracy of information throughout the supply chain network. In contemporary digital supply chains, transparency has become essential for effective monitoring, coordination, and risk management. Intelligent automation technologies facilitate transparency by enabling real-time data collection, automated reporting systems, predictive analytics, and digital communication platforms. Enhanced transparency improves organizational awareness regarding operational conditions, supplier activities, inventory levels, logistics processes, and potential risks across the supply chain network. Jin and colleagues emphasized that organizational readiness and resilience are closely associated with the availability of timely and accurate information that enables proactive responses to crises and uncertainties [14]. Transparent supply chains enable organizations to identify vulnerabilities earlier, improve decision quality, and strengthen stakeholder trust. Moreover, transparency contributes to operational flexibility because organizations can respond more rapidly to environmental changes when information flows efficiently across the network. Ivanov argued that viable and resilient supply chain systems require not only operational continuity but also adaptive information systems capable of supporting rapid recovery and transformation under uncertain conditions [15]. In this context, intelligent automation can significantly improve supply chain transparency by automating information-sharing processes, enhancing analytical capabilities, and reducing delays in data transmission. Therefore, supply chain transparency may also serve as a critical mediating mechanism linking intelligent automation to supply chain resilience.

Although prior studies have investigated intelligent automation, artificial intelligence, and supply chain resilience separately, limited research has comprehensively examined the simultaneous mediating roles of supply chain integration and supply chain transparency in the relationship between intelligent automation and supply chain resilience, particularly in the context of large industries in developing economies such as Iran. Existing research has primarily focused either on technological adoption or on general organizational performance outcomes, while less attention has been devoted to the structural and informational mechanisms through which intelligent automation contributes to resilience. Furthermore, the increasing complexity of supply chains in emerging economies necessitates context-specific investigations that account for technological infrastructure limitations, organizational

readiness, and managerial capabilities. Intelligent automation projects often fail because organizations lack the integration capability, transparency mechanisms, or strategic alignment necessary for successful implementation [16, 17]. Therefore, understanding how intelligent automation interacts with integration capability and transparency to improve supply chain resilience can provide valuable theoretical and practical insights for managers, policymakers, and researchers. Given the strategic importance of resilient supply chains in today's uncertain business environment, this study aims to investigate the relationship between intelligent automation and supply chain resilience based on the mediating roles of supply chain integration and supply chain transparency among managers and experts working in large industries in Iran.

2. Methodology

The present study is categorized as an applied research project in terms of its objective, as its findings can be utilized to improve decision-making processes and enhance organizational performance. In terms of implementation method, this study was conducted as a survey research, and from the perspective of data analysis, it was performed within the framework of correlational research based on Structural Equation Modeling (SEM). In correlational studies, the primary objective is to investigate and analyze the relationships among the variables of the model. In structural equation modeling, data are organized in the form of covariance or correlation matrices, and a set of regression equations is developed to explain the relationships among constructs.

To collect data related to the theoretical foundations and research background, a library-based method was employed, and sources such as scientific articles, books, databases, and valid reports were reviewed. In the field section, a questionnaire was used to gather the data required for testing the hypotheses, and it was distributed among respondents through a survey and face-to-face approach. The statistical population of the study consisted of managers and experts employed in large industries in Iran, whose exact number was unknown. Therefore, based on the Morgan table, the sample size was determined to be 384 individuals. To ensure an adequate response rate, 390 questionnaires were distributed, and ultimately, 384 completed and analyzable questionnaires were collected.

The primary instrument for data collection was a standardized questionnaire developed based on the study by

Mubarak and Masiukaitė-Zvinienė (2026). The questionnaire was designed using a five-point Likert scale ranging from “strongly disagree” to “strongly agree” and consisted of two sections. The first section addressed demographic variables such as age, gender, work experience, and educational level, while the second section included 22 items related to the main constructs of the study.

To assess the reliability of the instrument, Cronbach’s alpha coefficient was calculated using SPSS software. The results indicated that all alpha coefficients exceeded the minimum acceptable threshold of 0.70. Therefore, it can be concluded that the questionnaire possessed acceptable and reliable validity and reliability. Table 1 presents the Cronbach’s alpha results for the study variables.

Table 1. Reliability Results of the Questionnaire

Questionnaire Construct	Items	Cronbach’s Alpha
Intelligent Automation	1–9	0.952
Supply Chain Integration	10–13	0.865
Supply Chain Transparency	14–16	0.811
Supply Chain Resilience	17–22	0.905
Total Questionnaire	1–22	0.960

3. Findings and Results

The present study utilized both descriptive and inferential statistics to analyze the data collected from the statistical sample. In the first stage, using SPSS software, the study variables were described and summarized through tables and

appropriate statistical indicators such as frequency, mean, standard deviation, and other related indices. In the second stage, to test the hypotheses and generalize the sample findings to the statistical population, the Structural Equation Modeling (SEM) approach was employed using AMOS version 24 software. Table 2 presents the descriptive statistics of the research variables.

Table 2. Descriptive Statistics of the Research Variables

Variable	Mean	Standard Deviation	Skewness	Kurtosis	Maximum	Minimum	N
Intelligent Automation	3.425	0.542	-0.235	0.475	5.00	1.00	384
Supply Chain Integration	3.324	0.625	-0.425	-0.311	5.00	1.00	384
Supply Chain Transparency	3.225	0.465	0.335	0.525	5.00	1.00	384
Supply Chain Resilience	3.445	0.611	0.155	0.145	5.00	1.00	384

Considering that the skewness and kurtosis values of all variables fall within the range of -2 to +2, it can be concluded that the research data follow a normal distribution. Accordingly, parametric statistical techniques were employed to test the research hypotheses. The conceptual model of the study was explained in the previous sections. Prior to implementing the structural model, it was necessary to examine whether the 22 observed items in the questionnaire (the main research questions) appropriately and significantly reflected the four principal dimensions of

the study, namely intelligent automation, supply chain integration, supply chain transparency, and supply chain resilience. For this purpose, the overall fit of the measurement model was evaluated using Confirmatory Factor Analysis (CFA). The following figure illustrates the measurement model of the study, in which the observed and latent variables are identified by their principal labels. Furthermore, the final measurement model, along with the implemented modifications, is presented in the subsequent figure.

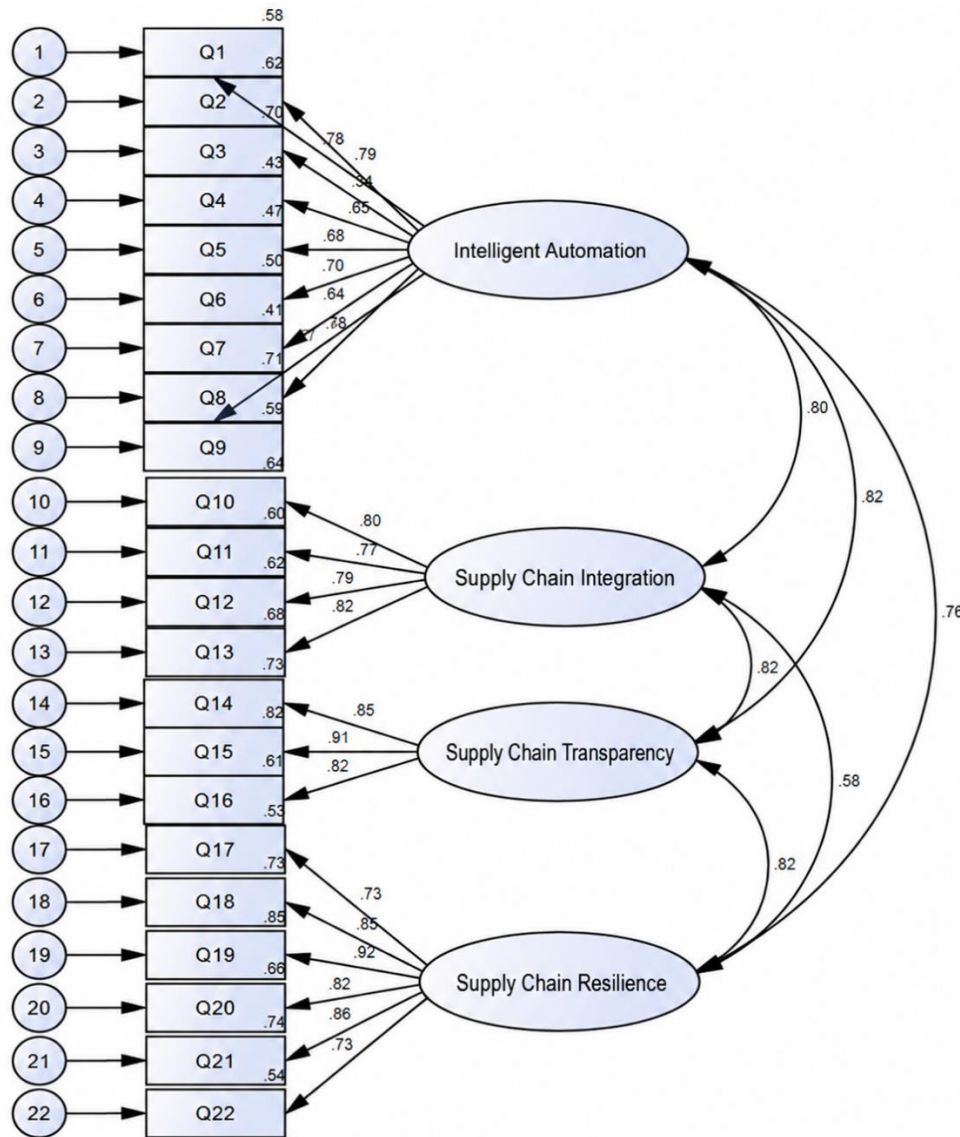


Figure 1. Factor Analysis Model with Standardized Coefficients

Before testing the hypotheses, it is necessary to ensure the validity and precision of the measurement models of the research variables in order to subsequently examine the

structural relationships. For this purpose, model fit indices were utilized, as presented in Table 3.

Table 3. Model Fit Indices

Fit Indices	CMIN/df	GFI	IFI	TLI	CFI	NFI	RMSEA
Main Model	3.335	0.975	0.962	0.945	0.970	0.960	0.007
Acceptable Level	1-5	>0.90	>0.90	>0.90	>0.90	>0.90	<0.05

As shown in the above table, all indices fall within the desirable range. Therefore, the adequacy of the confirmatory factor analysis model in fitting the collected data is confirmed. In this section, the structural model of the study

was fitted to evaluate the alignment of the model fit. The analysis model of the first hypothesis in the standardized mode is presented in Figure 3.

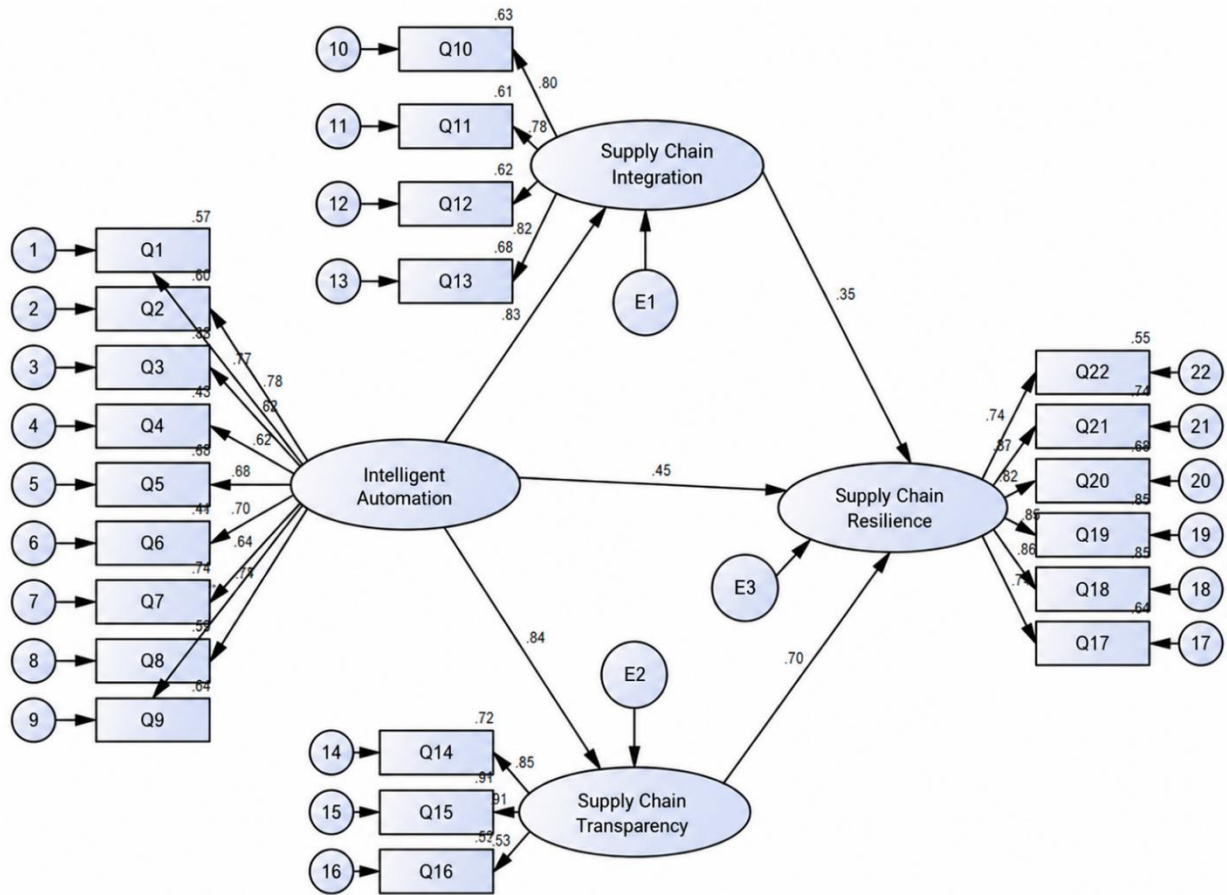


Figure 2. First Hypothesis Model in Standardized Mode

Table 4. Results of the Research Hypotheses

Path Analysis	Standardized Coefficient	Standard Error	t-Statistic	p-value
Intelligent Automation → Supply Chain Integration	0.740	0.051	14.489	0.000
Intelligent Automation → Supply Chain Transparency	0.842	0.059	14.851	0.000
Intelligent Automation → Supply Chain Resilience	0.451	0.094	4.249	0.000
Supply Chain Transparency → Supply Chain Resilience	0.696	0.073	8.158	0.000
Supply Chain Integration → Supply Chain Resilience	0.346	0.076	4.529	0.000

Based on the data presented in the table, intelligent automation has a positive and significant effect on supply chain resilience (path coefficient = 0.451, $t = 4.249$, $p < 0.05$). Given that the t-statistic is greater than 1.96, this hypothesis is confirmed. This finding indicates that the implementation of intelligent automation technologies directly enhances the organization’s ability to cope with disruptions and restore stable conditions within the supply chain. According to the table, intelligent automation also has a positive effect on integration (0.740), and integration serves as a prerequisite or facilitating factor for performance improvement. To examine the mediating role, the Sobel test was employed, in which the Z-value is calculated based on

the product of the coefficients of the direct paths involved in the mediating relationship. Given the significance of both paths (intelligent automation to integration with $t = 14.489$ and the probable effect of integration on resilience), the Sobel test results with a value of $Z > 1.96$ and $p < 0.05$ confirm the mediating role of “supply chain integration” in the relationship between intelligent automation and supply chain resilience. This means that intelligent automation exerts part of its effect on resilience through facilitating integration among supply chain components.

The path analysis further demonstrates that intelligent automation has a strong and positive effect on transparency (0.842, $t = 14.851$), while transparency also has a direct and

significant effect on supply chain resilience (0.696, $t = 8.158$). By applying the Sobel test to examine this mediating path, the obtained Z -value indicated statistical significance ($Z > 1.96$, $p < 0.05$). Therefore, the mediating role of “supply chain transparency” in the relationship between intelligent automation and supply chain resilience is confirmed. This result suggests that enhancing information transparency through intelligent automation provides a critical foundation for increasing supply chain resilience.

4. Discussion and Conclusion

The findings of the present study demonstrated that intelligent automation has a positive and significant effect on supply chain resilience among large industries in Iran. Furthermore, the results confirmed that supply chain integration and supply chain transparency both play positive mediating roles in the relationship between intelligent automation and supply chain resilience. These findings indicate that organizations capable of effectively implementing intelligent automation technologies are more likely to enhance their ability to withstand disruptions, adapt to uncertain conditions, and recover from operational crises. The results also suggest that intelligent automation contributes to resilience not only directly, but also indirectly through strengthening integration among supply chain components and improving the transparency of information flows across the supply chain network. The direct positive relationship between intelligent automation and supply chain resilience is theoretically meaningful because intelligent automation technologies provide organizations with advanced analytical capabilities, real-time monitoring systems, predictive insights, and automated operational processes that increase flexibility and responsiveness during periods of uncertainty. Modern supply chains operate in highly dynamic environments characterized by frequent disruptions, fluctuating demand patterns, geopolitical instability, and rapid technological changes. Under such conditions, organizations require intelligent systems capable of processing large volumes of information rapidly and supporting adaptive decision-making processes. Intelligent automation technologies facilitate this capability by minimizing human error, accelerating operational procedures, and improving the accuracy of forecasting and risk assessment processes. Therefore, organizations adopting intelligent automation are more capable of maintaining operational continuity and restoring stable conditions when disruptions occur.

The positive impact of intelligent automation on supply chain resilience identified in this study is consistent with the findings of previous research emphasizing the strategic importance of intelligent technologies in strengthening organizational adaptability and operational continuity. Mubarik and Maciukaite-Zviniene argued that intelligent automation significantly enhances supply chain resilience when it is aligned with organizational capabilities and strategic readiness [7]. Their study demonstrated that organizations relying on intelligent automation technologies are more capable of identifying operational risks, responding proactively to disruptions, and sustaining competitive performance under uncertain conditions. Similarly, Yamin and colleagues found that artificial intelligence technologies significantly improve supply chain agility and resilience by enabling organizations to react rapidly to environmental changes and unexpected disruptions [9]. The present findings also align with the arguments presented by Ivanov, who emphasized that resilient and viable supply chain systems require adaptive technologies capable of supporting rapid recovery and operational continuity during crises [15]. During major global disruptions such as the COVID-19 pandemic, organizations with advanced technological infrastructures demonstrated superior resilience compared to organizations relying on traditional and fragmented operational systems. Choi and colleagues similarly emphasized that digital transformation and intelligent technologies have become essential components of resilient supply chain systems in post-pandemic business environments [1]. The current findings therefore reinforce the growing consensus that intelligent automation represents a strategic necessity rather than merely a technological option for modern supply chain management.

Another important finding of the study was the significant mediating role of supply chain integration in the relationship between intelligent automation and supply chain resilience. The results suggest that intelligent automation enhances resilience partly by improving coordination, collaboration, and synchronization among supply chain members and organizational units. Supply chain integration facilitates the seamless exchange of information, resources, and operational activities among internal departments and external partners, thereby reducing inefficiencies and strengthening collective responsiveness to disruptions. Intelligent automation technologies rely heavily on integrated systems because automation processes require interconnected databases, synchronized workflows, and collaborative communication channels to function

effectively. Consequently, organizations with higher integration capability are more likely to maximize the benefits of intelligent automation technologies. The findings indicate that intelligent automation strengthens integration by enabling faster communication, improving data accessibility, and supporting coordinated decision-making across the supply chain network. In turn, enhanced integration improves resilience because organizations become more capable of identifying vulnerabilities, sharing critical information, and implementing coordinated responses during crises. This result is theoretically important because it demonstrates that technological capabilities alone are insufficient for achieving resilience unless they are embedded within integrated organizational structures and collaborative supply chain relationships.

The mediating role of supply chain integration identified in this study is consistent with prior literature emphasizing the interdependence between technological adoption and organizational integration. Ghasemi Hamedani and colleagues explained that the evolution of supply chain management toward intelligence requires substantial integration among organizational units, technological systems, and supply chain actors [13]. Their findings suggested that fragmented and poorly coordinated systems significantly limit the effectiveness of intelligent technologies. Likewise, Mubarik and colleagues emphasized that organizational and strategic factors play critical roles in advancing intelligent automation and maximizing its operational benefits [8]. The present findings support this perspective by demonstrating that intelligent automation exerts a stronger influence on resilience when supported by integrated supply chain structures. Josyula and colleagues also argued that intelligent automation projects frequently encounter implementation challenges because organizations lack adequate integration mechanisms and agile coordination systems [16]. Without integration, organizations may struggle to utilize automation technologies effectively because disconnected operational processes create delays, inefficiencies, and communication barriers. The current findings further align with the work of Lacity and Willcocks, who highlighted that organizations become strategically successful with intelligent automation when automation initiatives are embedded within coordinated organizational systems and collaborative operational frameworks [17]. Therefore, the results of the present study confirm that supply chain integration serves as a critical organizational mechanism through which

intelligent automation contributes to long-term resilience and operational sustainability.

The findings also revealed that supply chain transparency has a positive and significant mediating role in the relationship between intelligent automation and supply chain resilience. This result suggests that intelligent automation enhances resilience by improving the visibility, accessibility, and quality of information across supply chain activities. Supply chain transparency enables organizations to monitor operational conditions more accurately, identify disruptions more rapidly, and make informed decisions under uncertain circumstances. Intelligent automation technologies significantly improve transparency because they facilitate real-time data collection, automated reporting systems, predictive analytics, and digital communication processes. As organizations gain greater visibility into inventory levels, supplier activities, logistics operations, and customer demand patterns, they become more capable of managing uncertainty and responding effectively to disruptions. The positive relationship between transparency and resilience observed in this study indicates that transparent information systems are essential for adaptive and resilient supply chain management. Organizations with transparent supply chains can detect operational problems earlier, coordinate responses more effectively, and minimize the negative consequences of disruptions. In contrast, limited transparency often creates informational delays, decision-making inefficiencies, and increased vulnerability during crises. The findings therefore demonstrate that transparency functions as a critical informational capability that strengthens the effectiveness of intelligent automation technologies in improving resilience.

The mediating effect of supply chain transparency identified in this study is supported by several previous studies addressing the importance of information visibility and digital technologies in modern supply chain systems. Jin and colleagues emphasized that organizational readiness and resilience depend heavily on access to timely, accurate, and transparent information that supports proactive crisis management and rapid decision-making [14]. Similarly, Ng and colleagues highlighted that intelligent automation technologies enable organizations to enhance operational visibility and improve information-processing capabilities across complex operational environments [3]. The findings of the present study also align with the work of Salhab and colleagues, who demonstrated that artificial intelligence technologies improve inventory management, operational coordination, and quality-related decision-making within

digital supply chains [11]. Furthermore, Hatampour emphasized that artificial intelligence technologies contribute significantly to procurement management and supply chain management through improved data processing and analytical capabilities [6]. These technological capabilities directly support transparency by enabling organizations to access real-time operational information and detect risks more effectively. The current findings are also consistent with the arguments of Pettit and colleagues, who identified visibility and adaptability as key dimensions of resilient supply chains [2]. Transparency strengthens these dimensions because organizations with greater informational visibility are more capable of adapting rapidly to environmental changes and maintaining operational continuity under uncertain conditions.

Another notable implication of the present findings is that intelligent automation should not be viewed solely as a technical investment, but rather as a multidimensional organizational transformation requiring strategic alignment, integration capability, and transparency-oriented infrastructures. The findings demonstrate that organizations cannot achieve meaningful resilience improvements merely by introducing isolated automation technologies. Instead, intelligent automation must be integrated into broader organizational systems that support collaboration, information sharing, and coordinated operational processes. This perspective aligns with the growing literature emphasizing that digital transformation success depends not only on technological sophistication but also on organizational readiness and managerial capability [8]. The present findings therefore contribute to the theoretical understanding of supply chain resilience by illustrating the interconnected roles of technology, organizational integration, and informational transparency. The study also extends previous research by empirically examining these relationships within the context of large industries in Iran, where organizations increasingly face environmental uncertainty, economic instability, and technological transformation pressures. The findings indicate that intelligent automation can provide substantial resilience advantages for organizations operating in emerging economies, particularly when supported by integrated and transparent supply chain systems. Consequently, managers should prioritize the development of collaborative infrastructures, digital communication systems, and integrated information platforms alongside investments in automation technologies.

The study additionally contributes to the broader discussion regarding the future of intelligent supply chain management. As organizations continue to confront increasing uncertainty and global disruptions, traditional operational models are becoming inadequate for maintaining competitiveness and sustainability. Intelligent automation offers organizations the opportunity to transition from reactive operational models toward predictive and adaptive supply chain systems capable of continuous learning and dynamic response. The findings of this study suggest that resilience is increasingly dependent on technological intelligence combined with organizational coordination and transparency. This observation is consistent with the view presented by Ghosh, who argued that the future of organizations will be simultaneously automated and intelligent [5]. Similarly, Jha and colleagues emphasized that combining artificial intelligence with robotic process automation creates more flexible, adaptive, and intelligent operational systems capable of managing complex environments [4]. Therefore, the findings of the present study reinforce the argument that intelligent automation should be considered a strategic capability for achieving sustainable supply chain resilience in highly volatile business environments.

One limitation of the present study relates to its cross-sectional research design, which restricts the ability to examine causal relationships and long-term changes in organizational behavior over time. In addition, the study focused exclusively on managers and experts working in large industries in Iran, which may limit the generalizability of the findings to smaller organizations or industries operating in different economic and cultural contexts. Another limitation concerns the use of self-reported questionnaire data, which may increase the possibility of response bias and subjective interpretation by participants. Furthermore, the study examined only two mediating variables, namely supply chain integration and supply chain transparency, while other organizational, technological, and environmental factors may also influence the relationship between intelligent automation and supply chain resilience.

Future studies are encouraged to employ longitudinal research designs in order to examine the dynamic effects of intelligent automation on supply chain resilience over extended periods of time. Researchers may also investigate additional mediating or moderating variables such as organizational culture, digital maturity, leadership style, knowledge management capability, technological readiness, and environmental uncertainty. Comparative studies across

different industries and countries may provide deeper insights into contextual differences influencing intelligent automation adoption and resilience outcomes. Future research could also utilize mixed-method approaches by combining quantitative analysis with qualitative interviews or case studies to gain a more comprehensive understanding of implementation challenges and strategic success factors associated with intelligent automation in supply chain systems.

From a practical perspective, organizational managers should prioritize investments in intelligent automation technologies that support real-time information processing, predictive analytics, and adaptive operational decision-making. However, technological investment alone is insufficient; organizations must simultaneously strengthen supply chain integration by improving collaboration among departments, suppliers, and strategic partners. Managers should also develop transparent information-sharing mechanisms and digital communication platforms that enable rapid visibility across supply chain operations. Training programs aimed at enhancing employees' technological competencies and digital readiness can further improve the effectiveness of intelligent automation initiatives. Policymakers and industrial decision-makers should additionally support digital infrastructure development and encourage organizations to adopt integrated and transparent supply chain management systems capable of enhancing resilience under uncertain and disruptive conditions.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

References

- [1] T. Y. Choi, D. S. Rogers, and B. Vakil, "Coronavirus pandemic and supply chain implications: A research agenda," *International Journal of Operations & Production Management*, vol. 40, no. 10, pp. 1-18, 2020.
- [2] T. J. Pettit, J. Fiksel, and K. L. Croxton, "Ensuring supply chain resilience," *Journal of Business Logistics*, vol. 31, no. 1, pp. 1-21, 2010.
- [3] K. K. Ng, C. H. Chen, C. K. Lee, J. R. Jiao, and Z. X. Yang, "A systematic literature review on intelligent automation," *Advanced Engineering Informatics*, vol. 47, p. 101246, 2021.
- [4] N. Jha, D. Prashar, and A. Nagpal, "Combining artificial intelligence with robotic process automation," in *Deep Learning and Big Data for Intelligent Transportation*, K. R. Ahmed and A. E. Hassanien Eds. Cham: Springer, 2021, pp. 245-264.
- [5] S. Ghosh, "The future is both automated and intelligent," *Forbes Technology Council*, 2021. [Online]. Available: <https://www.forbes.com>.
- [6] H. Hatampour, "Identifying artificial intelligence factors for improving procurement management and supply chain management," in *Thirteenth International Conference on Industrial Engineering, Productivity, and Quality*, Tehran, 2024.
- [7] M. Mubarik and S. Maciukaite-Zviniene, "Technology or innovation alone is not enough: A SEM-fsQCA based study on intelligent automation driven supply chain resilience," *Journal of Innovation & Knowledge*, vol. 13, p. 100930, 2026.
- [8] M. Mubarik, S. Maciukaite-Zviniene, M. F. Mubarak, M. Ghobakhloo, and A. Pilkova, "Strategic and organisational factors for advancing knowledge in intelligent automation," *Journal of Innovation & Knowledge*, vol. 10, no. 2, p. 100675, 2025.
- [9] M. A. Yamin, S. D. Almuteri, K. J. Bogari, and A. K. Ashi, "The influence of strategic human resource management and artificial intelligence in determining supply chain agility and supply chain resilience," *Sustainability*, vol. 16, no. 7, p. 2688, 2024.
- [10] G. Kabra, A. Ramesh, V. Jain, and P. Akhtar, "Barriers to information and digital technology adoption in humanitarian supply chain management: A fuzzy AHP approach," *Journal of Enterprise Information Management*, vol. 36, no. 2, pp. 505-527, 2023.
- [11] H. Salhab, M. Allahham, I. Abu-ElSondos, R. Frangieh, A. Alkhwaldi, and B. Ali, "Inventory competition, artificial intelligence, and quality improvement decisions in supply chains with digital marketing," *Uncertain Supply Chain Management*, vol. 11, no. 4, pp. 1915-1924, 2023.
- [12] M. R. Sadeghi Moghadam, R. Nouferesti, and A. Farahani, "Analysis of the capability-attractiveness of transformative technologies in Iran's humanitarian supply chain," *Industrial Management*, vol. 14, no. 4, pp. 565-594, 2022.
- [13] I. Ghasemi Hamedani, M. Bashkhouh Ajirlou, H. Rahimi Kalvar, and N. Seifollahi Anar, "Explaining the evolution trends of supply chain management toward intelligence: A study based on a scientometric approach," *Defense Foresight*, vol. 8, no. 31, pp. 119-155, 2023.
- [14] Y. Jin, W. T. Coombs, Y. Wang, T. G. van der Meer, and B. N. Shivers, "Readiness: A keystone concept beyond

- organizational crisis preparedness and resilience," *Journal of Contingencies and Crisis Management*, vol. 32, no. 1, p. e12546, 2024.
- [15] D. Ivanov, *Viability of Supply Chain Systems*. Cham: Springer Nature, 2020.
- [16] S. S. Josyula, M. Suresh, and R. Raghu Raman, "How to make intelligent automation projects agile?," *International Journal of Organizational Analysis*, vol. 30, no. 2, pp. 1-20, 2021.
- [17] M. Lacity and L. Willcocks, "Becoming strategic with intelligent automation," *MIS Quarterly Executive*, vol. 20, no. 2, pp. 1-14, 2021.