Resilient Supply Chains in Post-Pandemic Era: The Role of Knowledge Management and Industry-Academia Education in Manufacturing Sector

Khudaybergan Khudayberganov
Researcher, Urgench State University,
14, Kh. Alimdjan str, Urganch,
Khorezm, Uzbekistan
E-mail: xudaybergan.x@urdu.uz
ORCID ID: https://orcid.org/0009-0003-5484-5471

Sarvinoz Tursunova
Chirchik State Pedagogical University
111700 Chirchik Uzbekistan
E-mail: sarvinoztursunova18.08@gmail.com
ORCID ID: https://orcid.org/0009-0005-3707-0090

Dilorom Tashpulatova
Chirchik State Pedagogical University
111700 Chirchik Uzbekistan
E-mail: diloromtoshpulatova70@gmail.com
ORCID ID: https://orcid.org/0000-0003-0503-4771

Ismoilova Sanobarxon
Associate Professor,
Fergana State technical university,
150100 Fergana Uzbekistan
E-mail: isanobar1977@gmail.com

Valisher Sapayev
Department of General Professional Subjects,
Mamun university, Khiva, Uzbekistan,
E-mail: sapayev_valisher@mamunedu.uz,
ORCID ID: https://orcid.org/0000-0002-6751-5864

Abstract

In the year 2023, while COVID-19 pandemic effects continue, supply chain resilience has become a priority agenda of the manufacturing sector, especially in developing countries such as Uzbekistan. The aim of this research is to examine how knowledge management and university-industry collaboration can contribute to the supply chain resilience in the post-COVID-19 era. The present research was conducted with a mixed (qualitative-quantitative) type in terms of purpose. Data were collected through semi-structured interviews with 15 experts and questionnaires with 120 managers and experts in Uzbekistan's manufacturing industry and were analyzed through content analysis and structural equation modeling. The findings revealed a positive and significant relationship between knowledge management and resilience ($r=0.721$) and between industry-university collaboration and resilience ($r=0.634$). The results of regression analysis indicated that these two variables explained 58.5% of the variance of supply chain resilience ($p<0.05$), and knowledge management contributed more significantly to this model ($\beta=0.598$). In addition, the biggest obstacle to effective collaboration was identified as the lack of an institutional and formal framework. This research concludes that the parallel development of internal knowledge management competences and intensification of external linkages with universities is one of the most important strategies for attaining resilient supply chains in Uzbekistan. This demands a firm commitment on the part of policymakers and managers to establish the required institutional and cultural environments.

Keywords: Supply Chain Resilience, Knowledge Management, Industry-University Collaboration, Manufacturing Sector, Uzbekistan

Introduction

In today's time and era, which is still being affected by the consequences of the global COVID-19 pandemic, supply chains in the manufacturing sector are faced with unprecedented challenges (Fonseca & Azevedo, 2020). The crisis has exposed the vulnerability of global supply chains and illustrated how over-reliance on limited resources, lack of

transparency, and insufficient robust foundation can have far-reaching impacts on the economy and production (Karmaker et al., 2020). In the meantime, Uzbekistan, as a country with an emerging economy, vast potentials in the manufacturing industry, and a need to revise and strengthen its supply chains to become more resilient to future disruptions (Taqi et al., 2020). Knowledge management, as one of the key pillars in improving the function of supply chains, has a significant role to fulfill in creating flexibility and sustainability (Nasir et al., 2021). This approach not only enables the sharing of information and experiences between stakeholders, but also builds the ability of organizations to anticipate and respond to unexpected changes by enhancing organizational learning (Ahmed et al., 2022). Industry-academia collaboration as a link between theory and practice, on the contrary, can lead to the genesis of new competencies and technologies that are critical to building resilient supply chains (Aman & Seuring, 2021).

Centering on the role of knowledge management and industry-academia education, this study seeks to determine how these two elements can be employed to improve supply chains in the Uzbek manufacturing sector. The importance of this study is that through identifying proper measures to increase resilience, sustainable economic development and reduced vulnerability to future crises can be achieved. The requirement for this project is now more than ever in the current scenario, when the world continues to struggle with economic and logistical instabilities. This paper attempts to take a step towards enhancing Uzbekistan's manufacturing setup by providing feasible and localized solutions and contributing to the sustainable growth of the country.

Review of Literature

This part presents a thorough and extensive literature review of the research related to the main research variables, namely supply chain resilience, knowledge management, and industry-academia collaboration in the manufacturing sector. These variables, being the key fulcrums of the present research, have a significant role to play in the quest for finding mechanisms to strengthen supply chains in the post-pandemic period. Because of the increasing importance of these concepts in manufacturing environments, especially in countries such as Uzbekistan, which are developing their industrial infrastructure, a detailed discussion of these concepts seems to be in order. Each of these factors is treated separately and in detail in what follows, and how they pertain to the subject of research is explained.

Supply Chain Resilience

Supply chain resilience refers to the ability of a manufacturing system to withstand disruption, adapt to unexpected events, and quickly restore performance after a crisis. Supply chain resilience has been among the most important topics in supply chain management in recent years (Fonseca & Azevedo, 2020), especially after the global COVID-19 pandemic. The experience of recent crises has shown that traditional supply chains, often focused on efficiency and cost reduction, are vulnerable to sudden shocks in the form of production stoppages, logistical constraints, or sharp changes in demand (Moktadir et al., 2022). Supply chain resilience requires an integrated approach welcoming diversification of supply sources, transparency of processes, and improved communication between the different segments of the chain (Cherrafi et al., 2022).

To this end, the utilization of new technologies such as the Internet of Things, big data analytics, and artificial intelligence has been seen as instruments for risk management and prediction. Data-driven systems, for example, have the ability to identify future bottlenecks in the supply chain and enable forward planning (Madrid-Guijarro et al., 2024). Also, supply chain resilience is not purely a technical issue; human factors such as coordination between chain partners and an adaptive organizational culture also play an important role. In the manufacturing industry of Uzbekistan, with its high potential due to its geographical location and natural resources, building supply chain resilience can lead to reduced reliance on foreign markets and to greater economic independence. This is especially true as the world continues to be plagued by economic and geopolitical uncertainties (Karmaker et al., 2020; Yamin, 2021).

Knowledge Management

Knowledge management, being the formal process of developing, storing, spreading, and using knowledge in organizations, has been viewed as a key driver of supply chain performance enhancement (Sangari et al., 2015). The concept is based on the belief that knowledge, in whatever shape of employee experience, company data, or past lessons learned, is an asset that can lead to decision-making and improved efficiency. In the manufacturing sector, knowledge management allows organizations to leverage their experiences to anticipate issues and guarantee innovative solutions (Hosseini Dehshiri et al., 2024). For example, organizations with effective knowledge management systems can identify patterns of supply chain disruptions and institute preventive interventions to neutralize their impacts (Pinto, 2020).

In the post-pandemic era, the importance of knowledge management has become even more evident. Organizations that have been successful in managing knowledge have performed better than others in the face of problems such as raw material shortages, changes in demand, or logistical problems (Agrawal et al., 2024). This is especially crucial in complex supply chains with a large number of partners and suppliers. Knowledge management also supports organizational learning, which can lead to improved coordination between supply chain components and organizational responsiveness (Hartono et al., 2023). In Uzbekistan, as the manufacturing sector develops, the implementation of knowledge management systems will help to transfer successful experience between organizations and consolidate local competencies. This not only helps in the improvement of supply chain performance, but can also lead to sustainable economic development.

Industry-University Collaboration

Industry-university collaboration is a widely used strategic method of technology, talent, and innovation development in the manufacturing sector (Fernandes & O'Sullivan, 2020). It helps in the transfer of theoretical knowledge from academia to industrial use and aids in developing localized solutions for local issues(Kandarkar & Ravi, 2024; Paulino et al., 2025; Singh, 2025). In a majority of countries, this collaboration has led to improved production processes, reduced costs, and improved competitiveness (Kusi-Sarpong et al., 2018). In supply chains, industry-university collaboration can design more adaptable and efficient systems. Joint research efforts, for example, can develop novel technologies for supply chain tracking and management, while joint education schemes can train qualified manpower in accordance with industry needs (Lodhi et al., 2024).

In Uzbekistan, where manufacturing infrastructure is being developed, cooperation between universities and industry can play an important role in sustainable development. Universities can help industry address current problems such as digitalization and sustainability through specialized training and applied research. Industry can help improve the orientation of academic research through feedback and articulation of its real needs. This cooperation can also lead to the development of technologies that are customized to the local context, which is especially applicable in supply chains that are influenced by specific geographical and economic factors. For example, the development of efficient logistics systems that can be integrated into Uzbekistan's infrastructure can be achieved through cooperation between manufacturing companies and universities.

Relationships between research variables

The literature review shows that supply chain resilience, knowledge management, and industry-university collaboration are connected (Umar et al., 2021). Knowledge management, as a basic tool, facilitates the collection and leveraging of information needed to develop resilience (Nweze, 2024). Industry-university collaboration, however, can help in the development of new knowledge and its transfer to production arrangements, hence improving supply chain resilience (Kornfeld & Kara, 2015). Together, these three variables can provide a comprehensive solution to improve supply chain performance in the manufacturing sector (Aslam et al., 2020; Wieland & Durach, 2021). In Uzbekistan, with its specific problems such as infrastructural constraints and the need to improve human resource skills, this model can

serve as a strategic roadmap to improve supply chains.

In general, the literature validates the increasing relevance of these three variables in improving supply chain performance. By putting these variables in order of importance and taking into account the specific conditions of Uzbekistan, this study seeks to provide a tailored and applicable model for building supply chain resilience in the manufacturing sector. This review will not only contribute to the knowledge about the existing challenges and opportunities but also lay the ground for developing solutions to improve the sustainability and competitiveness of the manufacturing industry in Uzbekistan by answering the following research questions.

1. To what extent do knowledge management practices and industry-academia collaboration collectively contribute to supply chain resilience in Uzbekistan's manufacturing sector?
2. How does knowledge management uniquely predict supply chain resilience compared to industry-academia collaboration?
3. What are the primary barriers inhibiting effective industry-academia collaboration in enhancing supply chain resilience?
4. Which specific knowledge management practices are most critical for building supply chain resilience, and how are they implemented in Uzbek manufacturing firms?
5. How do digital technologies (e.g., cloud platforms, AI, IoT) mediate the relationship between knowledge management, industry-academia collaboration, and supply chain resilience?
6. What institutional policies or frameworks are needed to facilitate sustainable industry-academia collaboration in developing economies like Uzbekistan?
7. How does the perceived value of industry-academia collaboration (e.g., access to innovation vs. cost reduction) influence its impact on supply chain resilience?
8. What role does organizational culture play in enabling knowledge sharing and its subsequent effect on supply chain resilience?

Methodology

Research Design

A mixed-method (qualitative-quantitative) research design is followed in this study to examine how knowledge management and industry-university collaboration can enhance supply chain resilience in the post-COVID era. The rationale for the choice of this approach is that it allows the researcher to explore in richness and depth the opinions, perceptions, and real-life experiences of major stakeholders and experts in the qualitative phase. The findings from this exploratory phase will then provide the basis for designing and implementing the quantitative phase to enable the measurement and generalization of these findings in a larger population and testing the hypothesized research model.

Statistical Population and Sample

The statistical population of the present study comprises two significant and influential groups. The first group includes senior managers, supply chain managers, and experienced professionals working in large and medium-sized industrial companies in Uzbekistan. The second group includes university academics and researchers from research institutions in the country who are experts and have practical experience in supply chain management, knowledge management, and industry relationships. Because of the exploratory nature of the study and the need to obtain in-depth and qualitative information, purposive sampling and snowball sampling methods were used in the participant selection. The final selection criterion for the experts was having at least 10 years of working experience in the relevant field and active involvement in crisis management, supply chain resilience, or industry-university collaboration projects. Finally, for the qualitative part, 15 experts were interviewed up to the theoretical saturation point. For the quantitative part, a questionnaire was designed and distributed among 120 members of the statistical population.

Data Collection Instrument

The data collection process was carried out in two separate and complementary phases. In the qualitative phase, semi-structured interviews were the main research tool. To this

end, an interview protocol with open questions was prepared, which targeted the key research topics, such as organizational experiences during the pandemic, solutions and measures taken to enhance resilience, the status and role of knowledge management systems, and collaboration opportunities and obstacles with universities. The interviews were all audio-recorded with participants' informed consent and then transcribed verbatim for further analysis. The data collection instrument in the quantitative phase was a researcher-developed questionnaire. The questionnaire was developed from the results of the qualitative phase along with the large body of literature on the topic. Content validity of the questionnaire was checked and verified by a panel of industry experts and university professors, and its reliability was tested by conducting a pilot study and calculating the Cronbach's alpha coefficient, whose value was found to be more than 0.7 for all research constructs. The final questionnaire was designed on a 5-point Likert scale.

Data Analysis Methods

The gathered data were also analyzed in two phases: qualitative and quantitative. To analyze the qualitative data that had been collected using the interviews, thematic analysis was employed. In doing this, the textual data of the interviews were coded, after which similar codes were accumulated into themes and subthemes to establish meaningful patterns and main themes. The quantitative data obtained from questionnaires was processed using SPSS software. In this case, descriptive statistics were utilized in the explanation of the demographic characteristics of the research sample, alongside the variables under investigation. Next, in order to examine the research hypotheses and analyze the relations between the variables, inferential statistics techniques including correlation tests and structural equation modeling were used to examine the overall fit of the research conceptual model.

Results

This chapter presents the empirical findings of the study, structured to address the primary research variables: demographic profile of the respondents, interconnection between knowledge management (KM) and supply chain resilience (SCR), the impact of industry-academia (IA) collaboration, and testing of the integrated model. Descriptive and inferential statistics were employed to describe the data obtained from the survey.

Table 1: Demographic Profile of Survey Respondents (N=120)

Demographic Characteristic	Category	Frequency	Percentage (%)
Industry Sector	Automotive	35	29.2
	Textiles	28	23.3
	Food Processing	25	20.8
	Machinery	20	16.7
	Other	12	10.0
Work Experience	10-15 years	45	37.5
	16-20 years	38	31.7
	More than 20 years	27	22.5
	Less than 10 years	10	8.3
Primary Role	Supply Chain Management	52	43.3
	Senior Management	31	25.8
	Production/Operations	24	20.0
	R&D / Innovation	13	10.8

The sample comprised 120 experienced professionals, ensuring a high level of expertise in responding to the survey. As showed in Table 1, the respondents represented key manufacturing sectors in Uzbekistan, with a strong presence from the automotive (29.2%) and textile (23.3%) industries. The majority of participants (91.7%) possessed over 10 years of professional experience, with 43.3% working directly in supply chain management roles, which underscores the reliability and relevance of the collected data.

Table 2: Descriptive Statistics of Key Constructs (N=120)

Construct	Number of Items	Mean Score	Standard Deviation
Knowledge Management (KM)	6	3.45	0.89
Industry-Academia (IA) Collaboration	5	3.12	1.02
Supply Chain Resilience (SCR)	7	3.58	0.84

Table 2 shows the mean scores and standard deviations for the three main constructs measured on a 5-point Likert scale. The results indicate that, on average, respondents perceived their organizations' supply chain resilience (Mean=3.58) slightly higher than their knowledge management practices (Mean=3.45). Industry-Academia collaboration received the lowest average score (Mean=3.12) and showed the highest variability in responses (SD=1.02), suggesting a significant disparity in how different firms engage with academic institutions.

Table 3: Correlation Matrix of Key Variables

Variable	1	2	3
1. Knowledge Management (KM)	1		
2. IA Collaboration	0.587**	1	
3. Supply Chain Resilience (SCR)	0.721**	0.634**	1
Note: ** Correlation is significant at the 0 .01 level (2-tailed).			

The correlation analysis shows significant positive relationships between all key variables, as shown in Table 3. Knowledge Management demonstrates a very strong positive correlation with Supply Chain Resilience ($r = 0.721$, $p < 0.01$). Similarly, IA Collaboration is strongly correlated with both Supply Chain Resilience ($r = 0.634$, $p < 0.01$) and Knowledge Management ($r = 0.587$, $p < 0.01$). These results provide preliminary support for the hypothesized relationships, indicating that higher levels of KM and IA collaboration are associated with greater perceived resilience.

Table 4: Regression Analysis: Impact of KM and IA on SCR

Predictor Variable	Unstandardized B	Standard Error	Standardized Beta (β)	t-value	p-value
(Constant)	0.842	0.241		3.492	0.001
Knowledge Management (KM)	0.593	0.072	0.598	8.236	0.000
IA Collaboration	0.298	0.061	0.351	4.886	0.000
$R^2 = 0.592$, Adjusted $R^2 = 0.585$, F-statistic = 84.21 ($p = 0.000$)					

A multiple regression analysis was conducted to predict Supply Chain Resilience based on Knowledge Management and IA Collaboration. The model was statistically significant, $F(2, 117) = 84.21$, $p < .001$, and explained 58.5% of the variance in SCR (Adjusted $R^2 = .585$). As presented in Table 4, both KM ($\beta = 0.598$, $p < .001$) and IA Collaboration ($\beta = 0.351$, $p < .001$) were significant positive predictors of Supply Chain Resilience. The beta coefficients indicate that Knowledge Management has a comparatively stronger unique contribution to predicting resilience.

Table 5: Key KM Practices and Their Adoption Rate

Knowledge Management Practice	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
We have a central digital repository for lessons learned .	15%	22%	30%	25%	8%
Post-project reviews are standard practice.	8%	18%	27%	32%	15%
Employees are rewarded for knowledge sharing.	20%	35%	25%	15%	5%

An analysis of specific KM practices, showed in Table 5, reveals areas of strength and weakness. While post-project reviews are somewhat established (47% agreement), the implementation of a central knowledge repository is weak (33% agreement). Most notably, the practice of rewarding knowledge sharing appears to be severely underutilized, with only 20% of respondents agreeing that it occurs in their organizations, pointing to a critical cultural and structural barrier to effective KM.

Table 6: Perceived Benefits of IA Collaboration

Benefit	Mean Score (1-5)	Rank
Access to specialized research & innovation	3.95	1
Development of tailored technologies for local context	3.82	2
Training and development of skilled workforce	3.78	3
Solving specific operational problems	3.45	4
Cost reduction	2.90	5

Respondents were asked to rate the perceived benefits of collaborating with academic institutions. As shown in Table 6, the primary perceived benefits are related to innovation and talent development, with "Access to specialized research" ranking highest (Mean=3.95). "Cost reduction" was seen as the least significant benefit (Mean=2.90), indicating that the value of IA collaboration is viewed more as a strategic investment in long-term capabilities than a direct tool for short-term cost saving.

Table 7: Major Obstacles to IA Collaboration

Obstacle	Frequency of Mention	Percentage (%)
Lack of a formal framework or platform	88	73.3%
Mismatch between academic research and industry needs	75	62.5%
Limited funding for joint projects	68	56.7%
Intellectual Property (IP) concerns	52	43.3%
Lack of time and resources	49	40.8%

This study identified several critical barriers to effective Industry-Academia collaboration. The most frequently cited obstacle, by 73.3% of respondents, was the "Lack of a formal framework or platform" to facilitate such partnerships. This was closely followed by a perceived "Mismatch between academic research and industry needs" (62.5%) and "Limited funding for joint projects" (56.7%). These findings highlight structural and communicative gaps that hinder more productive engagement.

Table 8: SCR Capabilities: Post-Pandemic Improvement

SCR Capability	Mean Score (1-5)	Standard Deviation
Visibility across the supply chain	3.80	0.92
Diversification of suppliers	4.05	0.88
Velocity (Speed of response to disruptions)	3.65	0.95
Flexibility in production	3.52	1.01

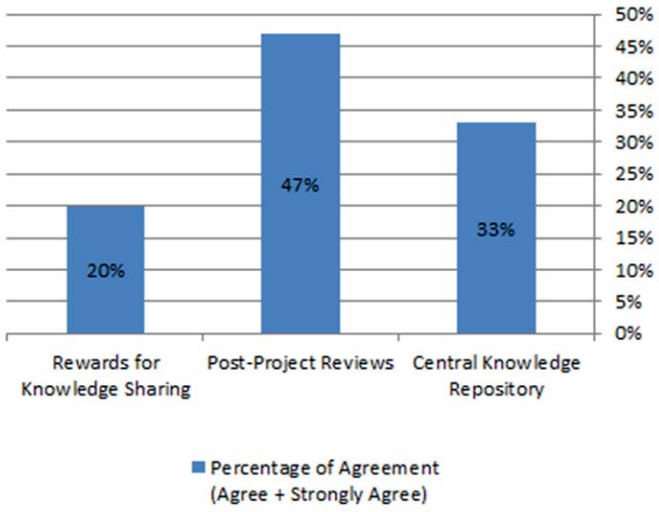
Respondents evaluated their organizations' improvement in specific resilience capabilities since the pandemic. Table 8 shows that "Diversification of suppliers" received the highest rating (Mean=4.05), indicating it was a major focus for firms in Uzbekistan. "Visibility" also scored highly (Mean=3.80), while "Flexibility in production" was reported as the area with the least improvement (Mean=3.52), suggesting a potential area for future strategic investment.

Table 9: The Role of Digital Technologies in Enhancing SCR

Technology	Currently Using	Planning to Implement	No Plans
Cloud-based supply chain platforms	25%	45%	30%
IoT (Internet of Things) for tracking	15%	35%	50%
Data Analytics & AI for demand forecasting	10%	40%	50%

The adoption of digital technologies, a potential enabler of both KM and SCR, is still in a developing phase. As can be seen in Table 9, while current usage rates are relatively low (10-25%), a significant proportion of firms are planning to implement key technologies like cloud-based platforms (45%) and data analytics (40%) in the near future. This indicates a recognition of their importance and a trend towards digital transformation to bolster resilience.

Figure 1: Current Adoption of Knowledge Management Practices



This figure shows the adoption rate of three specific Knowledge Management practices among surveyed manufacturing firms in Uzbekistan. The data, derived from Table 5, clearly shows that formal rewards for knowledge sharing are the least implemented practice, adopted by only one-fifth of organizations. Post-project reviews are the most common practice, though still not ubiquitous, indicating a significant gap between recognizing the value of KM and implementing structured, cultural practices to support it.

Figure 2: Perceived Benefits of Industry-Academia Collaboration (Mean Scores)

Figure 2 ranks the perceived benefits of collaborating with universities, based on the mean scores from Table 6. The data shows a clear hierarchy of expectations. Strategic benefits like access to innovation and talent development are highly valued, while tactical and financial benefits like solving immediate problems and cost reduction are seen as less significant outcomes of such collaborations. This chart would effectively show the strategic mindset firms have regarding IA partnerships.

Figure 3: Planned Adoption of Digital Technologies

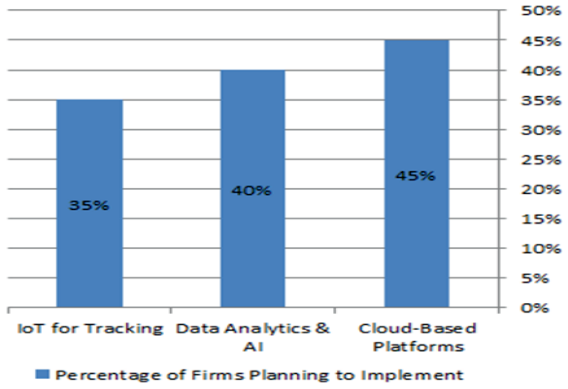


Figure 3 extracts the "Planning to Implement" data from Table 9, highlighting the future intentions of firms regarding digital technology adoption. It shows a strong intent to invest in foundational technologies like cloud platforms and data analytics within the next few years. This trend suggests an impending shift towards more digital and data-driven supply chain management in the Uzbek manufacturing sector, which is likely to positively affect resilience and knowledge sharing capabilities.

Discussion

This study aimed to investigate the use of knowledge management and university-industry collaboration for developing supply chain resilience in the manufacturing sector of Uzbekistan in the post-COVID-19 era. The quantitative and qualitative findings of this study both indicate a positive and significant impact of the two independent variables on the resilience ability of organizations. The results of regression analysis, specifying that the research model explains 58.5% of the variance in resilience, are strong support for the explanatory power of this model in the Uzbek context. This amount of explained variance can be considered very high, especially considering the developing industrial climate of this country.

The results of the strong correlation between knowledge management and resilience ($r = 0.721$) conclusively prove that companies with good mechanisms for the acquisition, storage, sharing, and application of knowledge consistently perform significantly better in situations of disruption. This finding is fully consistent with the international literature in the field of supply chain management, which emphasizes knowledge management as a dynamic capability and source of sustainable competitive advantage. Lessons drawn from past experiences, both success and failure, allow organizations to better identify patterns of disruption and create more effective responses.

Also, the high and positive correlation between industry-university collaboration and supply chain resilience ($r = 0.634$) confirms the hypothesis that the interface between theory and practice can lead to the creation of innovative and indigenous solutions. Having access to recent knowledge and sophisticated research techniques, the world of university can greatly assist the industry in creating indigenous technologies, specialized human resource development, and resolution of intricate operational issues. The two-way relationship enables academic research to travel out of the isolation of theory and into addressing the actual requirements of the industry. When both variables were entered into the regression model simultaneously, the standardized beta coefficient for knowledge management ($\beta = 0.598$) was higher than for industry-university collaboration ($\beta = 0.351$). The comparison shows that although both variables are significant predictors of resilience, knowledge management makes a higher unique contribution to the explanation of resilience in the final model. This would mean that a sound internal system of knowledge management provides the necessary infrastructure and platform for successful absorption and exploitation of the output of university collaboration.

However, our descriptive data reveal that the status of both variables in Uzbek industry, especially in university collaboration, is not at the desired level. The low average of university-industry collaboration (3.12 in a range of 5) and high variation of responses (standard deviation 1.02) reflect the fact that although there are organizations that are in the forefront, many companies have no systematic cooperation or pursue it at a very limited and informal level. This finding reflects the deep gap between theoretical potential and real conditions. The most important barrier mentioned by the respondents was the "lack of a formal framework or platform" for collaboration. This indicates an institutional and policy void that can be addressed only through enormous government initiatives and involvement of multiple governing agencies with industry and academia. Barriers such as "mismatch between academic research and industry needs" and "inadequate funding for collaborative projects" also demand redesign of the relationship and extending appropriate financial incentives.

In the field of knowledge management, one concerning observation was the sheer lack of strength in the "reward system for knowledge sharing". This means that knowledge management is perceived in most organizations simply as a technical and software tool, while its success depends on

cultural change and motivating people to share knowledge. Without such cultural change, even the latest technology system is set to fail. Finally, the strong interest of companies in investing in digital technologies such as cloud platforms and data analytics is a welcome trend. These technologies can both offer a technical basis to improve knowledge management (by facilitating centralized knowledge repositories) and directly contribute to operational resilience through improved visibility and traceability. Therefore, policies to accelerate digital transformation can affect both independent variables of this study at the same time.

Conclusion

This study strongly suggests that the development of supply chain resilience in the Uzbek manufacturing sector is a double-barreled activity: developing internal knowledge management capabilities and deepening external collaboration with academia. The data supports the theory that these two factors, taken together, can be significant in developing resilience to future shocks. To achieve this, action at both the organizational and macro levels needs to be undertaken.

At the organizational level, companies need to move away from a purely technical approach to knowledge management and focus on building an organizational culture that encourages learning and knowledge sharing. At the macro level, governments and governing bodies can provide the institutional space for such collaborations to flourish by enabling a role, creating national collaboration platforms, reforming university curricula to meet the demands of industry, and providing financial incentives for collaborative research. Investment in digital transformation as an enabling driver for both of these goals can unlock the way to more resilient supply chains and, by extension, a more sustainable national economy.

References

- Agrawal, N., Sharma, M., Raut, R. D., Mangla, S., & Arisian, S. (2024). Supply chain flexibility and post-pandemic resilience. *Global Journal of Flexible Systems Management*, 25(1), 1-20. https://doi.org/10.1007/s40171-024-00375-2
- Ahmed, H., Ahmed, S., Khan, M., & Ali, S. (2022). Sustainable supply chain in emerging economies during and post COVID-19 pandemic: A systematic literature review and future research directions. *International Journal of Emerging Markets, 17*(3), 703-723. https://doi.org/10.1108/ijoem-01-2022-0092
- Aman, S., & Seuring, S. (2021). Analysing developing countries approaches of supply chain resilience to COVID-19. *The International Journal of Logistics Management, 32*(4), 1203-1224. https://doi.org/10.1108/ijlm-07-2021-0362
- Aslam, H., Khan, A. Q., Rashid, K., & Rehman, S. (2020). Achieving supply chain resilience: the role of supply chain ambidexterity and supply chain agility. *Journal of Manufacturing Technology Management*, 31(7), 1393-1414. https://doi.org/10.1108/jmtm-07-2019-0263
- Cherrafi, A., Chiarini, A., Belhadi, A., El Baz, J., & Benabdellah, A. C. (2022). Digital technologies and circular economy practices: Vital enablers to support sustainable and resilient supply chain management in the post-COVID-19 era. *The TQM Journal, 34*(1), 325-344. https://doi.org/10.1108/tqm-12-2021-0374
- Fernandes, G., & O'Sullivan, D. (2020). Benefits management in university-industry collaboration programs. *International Journal of Project Management*, 38(7), 431-444. https://doi.org/10.1016/j.ijproman.2020.10.002
- Fonseca, L., & Azevedo, A. (2020). COVID-19: Outcomes for global supply chains. *Management & Marketing. Challenges for the Knowledge Society, 15*(4), 456-471. https://doi.org/10.2478/mmcks-2020-0025
- Hartono, B. Y., Siagian, H., & Tarigan, Z. (2023). The effect of knowledge management on firm performance: Mediating role of production technology, supply chain integration, and green supply chain. *Uncertain Supply Chain Management*, 11(4), 1597-1614. https://doi.org/10.5267/j.uscm.2023.4.009
- Hosseini Dehshiri, S. J., Amiri, M., Mostafaeipour, A., Pamučar, D., & Le, T. (2024). Enhancing supply chain

performance by integrating knowledge management and lean, agile, resilient, and green paradigms. *Journal of Management Analytics*, 11(2), 304-331. https://doi.org/10.1080/23270012.2024.2408527

- Kandarkar, P., & Ravi, V. (2024). Investigating the impact of smart manufacturing and interconnected emerging technologies in building smarter supply chains. *Journal of Manufacturing Technology Management*, 35(3), 456-475. https://doi.org/10.1108/jmtm-11-2023-0498
- Karmaker, C., Ahmed, T., Ahmed, S., Ali, S., Moktadir, M. A., & Kabir, G. (2020). Improving supply chain sustainability in the context of COVID-19 pandemic in an emerging economy: Exploring drivers using an integrated model. *Sustainable Production and Consumption, 23*, 150-161. https://doi.org/10.1016/j.spc.2020.09.019
- Kornfeld, B., & Kara, S. (2015). Industry-university collaboration in sustainable manufacturing. *Procedia CIRP*, 29, 546-551. https://doi.org/10.1016/J.PROCIR.2015.02.207
- Kusi-Sarpong, S., Gupta, H., & Sarkis, J. (2018). A supply chain sustainability innovation framework and evaluation methodology. *International Journal of Production Research*, 56(1-2), 65-82. https://doi.org/10.1080/00207543.2018.1518607
- Lodhi, S. K., Gill, A. Y., & Hussain, I. (2024). AI-Powered Innovations in Contemporary Manufacturing Procedures: An Extensive Analysis. *International Journal of Multidisciplinary Sciences and Arts*, 3(4), 101-115. https://doi.org/10.47709/ijmdsa.v3i4.4616
- Madrid-Guijarro, A., Maldonado-Guzmán, G., & Rodríguez-González, R. (2024). Unlocking resilience: The impact of Industry 4.0 technologies on manufacturing firms' response to the COVID-19 pandemic. *Management Decision, 62*(2), 310-329. https://doi.org/10.1108/md-02-2024-0262
- Moktadir, M. A., Paul, S., Kumar, A. K., Luthra, S., Ali, S., & Sultana, R. (2022). Strategic drivers to overcome the impacts of the COVID-19 pandemic: Implications for ensuring resilience in supply chains. *Operations Management Research, 15*(3), 257-277. https://doi.org/10.1007/s12063-022-00301-8
- Nasir, S., Ahmed, T., Karmaker, C., Ali, S., Paul, S., & Majumdar, A. (2021). Supply chain viability in the context of COVID-19 pandemic in small and medium-sized enterprises: Implications for sustainable development goals. *Journal of Enterprise Information Management, 34*(5), 1425-1445. https://doi.org/10.1108/jeim-02-2021-0091
- Nweze, O. O. (2024). Supply Chain Resilience Digitalization, and Localization. *European Journal of Logistics, Purchasing and Supply Chain Management*, 12(1), 45-63. https://doi.org/10.37745/ejlpscm.2013/vol12n12032
- Paulino, E. P., Mazo, P. N. A., Boquila, L-R. S., Basa, G. M., & Aterrado, A. L. (2025). Influence of IT innovation on the effectiveness of supply chain management among the manufacturing sectors in China. *International Journal of Science and Research Archive*, 14(2), 45-60. https://doi.org/10.30574/ijsra.2025.14.2.0325
- Pinto, C. (2020). Knowledge management as a support for supply chain logistics planning in pandemic cases. *Brazilian Journal of Operations & Production Management*, 17(3), 444-458. https://doi.org/10.14488/bjopm.2020.033
- Sangari, M. S., Hosnavi, R., & Zahedi, M. (2015). The impact of knowledge management processes on supply chain performance: An empirical study. *The International Journal of Logistics Management*, 26(1), 82-113. https://doi.org/10.1108/IJLM-09-2012-0100
- Singh, R. (2025). Digital Transformation of Indian Manufacturing Supply Chains: An Industry 4.0 Perspective. *International Journal of Scientific Research in Engineering and Management*, 1(1), 12-29. https://doi.org/10.55041/ijsrem50326
- Taqi, H. M. M., Ahmed, H., Paul, S., Garshasbi, M., Ali, S., Kabir, G., & Paul, S. (2020). Strategies to manage the impacts of the COVID-19 pandemic in the supply chain: Implications for improving economic and social sustainability. *Sustainability, 12*(22), 9483. https://doi.org/ 10.3390/su12229483

- Umar, M., Wilson, M. M. J., & Heyl, J. E. (2021). The structure of knowledge management in inter-organisational exchanges for resilient supply chains. *Journal of Knowledge Management*, 25(7), 1649-1670. https://doi.org/10.1108/JKM-06-2020-0488
- Wieland, A., & Durach, C. (2021). Two perspectives on supply chain resilience. *Journal of Business Logistics*, 42(1), 72-88. https://doi.org/10.1111/JBL.12271
- Yamin, M. (2021). Investigating the drivers of supply chain resilience in the wake of the COVID-19 pandemic: Empirical evidence from an emerging economy. *Sustainability, 13*(21), 11939. https://doi.org/10.3390/su132111939