International Journal of Modern Engineering and Management | IJMEM
ISSN No: 3048-8230
Volume 3 Issue 5 May 2026

Supply Chain Resilience and Firm Performance in Indian Small and Medium Enterprises

Girish Narayanan, Pooja Mehrotra, Sanjay Rathore
Department of Business Administration, Rajputana College of Management Sciences, Jaipur, Rajasthan, India
School of Management, Bundelkhand Institute of Business and Technology, Jhansi, Uttar Pradesh, India

Abstract

Supply chain disruptions have emerged as one of the most consequential operational risks confronting Indian Small and Medium Enterprises (SMEs), which collectively contribute approximately 30% of national GDP, 45% of total exports, and employ over 110 million people as of 2023–24. The COVID-19 pandemic (2020–2022), global logistics bottlenecks, and the ongoing volatility in raw material prices and geopolitical trade flows have exposed the structural fragility of Indian SME supply chains — characterised by limited supplier diversification, low digital visibility, inadequate inventory buffers, and thin financial resilience — resulting in estimated revenue losses exceeding ₹14.5 lakh crore across the SME sector during the pandemic period alone. Supply chain resilience (SCR) — defined as the adaptive capability of a supply chain to prepare for unexpected events, respond to disruptions, and recover to its original or a more desirable state by maintaining continuity of operations — has consequently gained prominence as a strategic management priority. This study investigates the antecedents of supply chain resilience and its impact on firm performance among Indian SMEs, based on primary survey data from 240 SME owner-managers and supply chain executives across six manufacturing sectors (food and beverage, textiles and apparel, auto components, pharmaceuticals, electronics, and engineering goods) in ten states. Structural equation modelling (SEM) was employed to test a conceptual model proposing top management commitment, IT infrastructure quality, and supplier relationship quality as antecedents of SCR, and SCR as a predictor of firm performance. Results confirm all three antecedent paths (top management commitment: β=0.38; supplier relationship quality: β=0.34; IT infrastructure: β=0.29; all p<0.01), and a strong SCR-firm performance relationship (β=0.76, R^2=0.58). Sector-wise analysis reveals that pharmaceutical and food and beverage sectors demonstrate higher baseline SCR than electronics and textiles. State-wise resilience index analysis identifies Gujarat, Maharashtra, and Tamil Nadu as high-resilience clusters, while Bihar, Odisha, and Uttar Pradesh score below the national average of 60.2/100. Practical recommendations for SME managers and policy makers are provided.

Keywords: *supply chain resilience, SME performance, supply chain disruption, Indian manufacturing, structural equation modelling, supplier relationship, IT infrastructure, top management commitment, supply chain risk management*

1. Introduction

The Indian SME sector operates within a paradox of strategic importance and structural vulnerability. As the backbone of India's manufacturing economy — hosting over 63 million enterprises, generating ₹29.7 lakh crore in gross value added, and serving as the primary supply chain partner for large domestic and multinational corporations across automotive, pharmaceutical, electronics, and consumer goods industries — the sector's supply chain efficiency and resilience are consequential not merely for individual firm survival but for the stability of entire industrial value chains. Yet the typical Indian SME supply chain is characterised by characteristics that amplify vulnerability to disruption: single-source supplier dependencies driven by relationship familiarity and switching cost concerns, limited real-time inventory and logistics visibility due to low IT adoption, thin working capital buffers that constrain the ability to absorb demand or supply shocks, and owner-managed decision structures where supply chain risk management is rarely formalised.

The conceptualisation of supply chain resilience as a dynamic capability — drawing on Teece, Pisano, and Shuen's (1997) dynamic capabilities framework — posits that organisations can develop systematic competencies in sensing supply chain risks before they materialise, seizing response opportunities as disruptions unfold, and reconfiguring supply chain structures to improve post-disruption performance trajectories. For SMEs, where resource constraints limit the range of resilience-building investments available, the identification of the highest-leverage antecedents of SCR is of particular

practical importance: if top management commitment, supplier relationship depth, and IT infrastructure quality are the primary drivers of SCR, then targeted policy and management interventions in these domains can deliver SCR improvements at lower total investment than broad-based supply chain redesign programmes. This study's contribution lies in empirically establishing the relative importance of these antecedents for Indian SMEs specifically, where the institutional environment, infrastructure availability, and business culture differ substantially from the developed-economy contexts in which most SCR literature has been generated.

The research questions driving this study are: (RQ1) What are the primary organisational antecedents of supply chain resilience in Indian manufacturing SMEs? (RQ2) Does supply chain resilience significantly predict firm financial and operational performance in the Indian SME context? (RQ3) Are there significant sector-wise and state-wise differences in SCR levels that warrant differentiated management and policy responses? The answers to these questions, derived from a rigorous multi-sector, multi-state survey and SEM analysis, provide both theoretical contribution to the SCR literature in emerging market contexts and actionable guidance for SME managers, industry associations, and government policy makers seeking to strengthen the resilience of India's manufacturing supply chain ecosystem.

2. Literature Review and Theoretical Framework

2.1 Supply Chain Resilience: Conceptualisation and Dimensions

Supply chain resilience was conceptualised in the seminal work of Christopher and Peck (2004) as the ability of a supply chain to return to its original state or move to a new, more desirable state after being disturbed. Subsequent theoretical development has emphasised four constitutive capabilities: flexibility (the ability to alter supply chain configurations in response to disruption), redundancy (maintaining surplus capacity and inventory buffers), collaboration (information sharing and joint risk management with supply chain partners), and agility (the speed of response to disruption signals). For Indian SMEs, empirical investigation of these dimensions has been limited: Sharma and Bhat (2014) examined flexibility in Indian textile SMEs, finding that supplier flexibility was the strongest determinant of post-disruption recovery, while Jain et al. (2017) documented the role of IT-enabled visibility in improving agility among pharmaceutical supply chains in Gujarat and Maharashtra. A comprehensive multi-sector, multi-state analysis with SEM methodology has, however, not been conducted prior to this study.

2.2 Antecedents of Supply Chain Resilience

Top management commitment to supply chain risk management has been identified as a primary antecedent of SCR in international literature. Zsidisin and Wagner (2010) demonstrated in a study of 760 firms across 24 countries that CEO-level engagement with supply chain risk — manifested as dedicated risk management budgets, formal disruption response planning, and risk visibility in board-level reporting — was the strongest organisational predictor of SCR scores. In the Indian SME context, where owner-managers typically retain decision authority over supply chain strategy, top management commitment translates into personal involvement of the founder or MD in supplier development, crisis response planning, and resilience investment decisions. IT infrastructure quality — encompassing enterprise resource planning (ERP) adoption, supplier portal connectivity, logistics tracking visibility, and demand forecasting analytics — provides the information foundation for risk sensing and rapid response. A 2022 survey by NASSCOM and CII found that only 28% of Indian SMEs had implemented basic ERP systems and fewer than 12% had supplier-integrated digital platforms, suggesting substantial headroom for IT-enabled SCR improvement. Supplier relationship quality — characterised by trust, information sharing, joint problem-solving, and long-term orientation — enables collaborative risk mitigation strategies including demand signal sharing, joint inventory planning, and co-investment in capacity flexibility.

2.3 Hypotheses

H1: Top management commitment positively predicts supply chain resilience in Indian SMEs.

H2: IT infrastructure quality positively predicts supply chain resilience.

H3: Supplier relationship quality positively predicts supply chain resilience.

H4: Supply chain resilience positively predicts firm performance.

3. Research Methodology

3.1 Sample and Data Collection

The study targeted SME owner-managers, operations directors, and supply chain executives of manufacturing SMEs registered under the MSME Development Act 2006 (now Udyam Registration) with annual turnover between ₹1 crore and ₹250 crore, ensuring the sample spans micro, small, and medium enterprise categories as defined by the revised MSME classification of 2020. Six manufacturing sectors were selected based on their economic significance and heterogeneous supply chain characteristics: food and beverage, textiles and apparel, auto components, pharmaceuticals, electronics, and engineering goods. Ten states were included to ensure geographic diversity: Maharashtra, Tamil Nadu, Gujarat, Karnataka, Punjab, Rajasthan, Uttar Pradesh, West Bengal, Odisha, and Bihar, collectively accounting for approximately 78% of India's registered manufacturing SMEs. Survey administration used a structured questionnaire distributed through MSME development institutes (MSMEDIs), district industries centres (DICs), and SME industry associations (CII-MSME, FICCI SME, ASSOCHAM regional chapters). A total of 312 questionnaires were distributed; 261 responses were received and 240 (91.9%) were complete and usable.

Of the 240 respondents, 68.4% were owner-managers and 31.6% were senior supply chain executives; firm size distribution was micro (18.3%), small (44.2%), medium (37.5%); export orientation: domestic-only (52.1%), partly exporting (31.3%), primarily exporting (16.6%). Mean firm age was 14.8 years (SD = 8.4 years), and mean workforce size was 87 employees (SD = 64).

3.2 Measures

All constructs were measured using validated multi-item Likert scales (1 = Strongly Disagree to 5 = Strongly Agree). Supply Chain Resilience was measured using 12 items adapted from Ponomarov and Holcomb's (2009) SCR scale, covering flexibility (4 items), redundancy (3 items), collaboration (3 items), and agility (2 items). Top Management Commitment was assessed using 6 items adapted from Zsidisin and Wagner (2010), measuring CEO/MD personal involvement, dedicated SCR budget allocation, and formal risk governance. IT Infrastructure Quality was measured using 7 items on ERP adoption depth, supplier portal connectivity, logistics visibility, and analytics capability, adapted from Rao and Goldsby (2009). Supplier Relationship Quality was measured using 8 items on trust, information sharing, joint planning, and relationship longevity, adapted from Fynes, Voss, and Búrca (2005). Firm Performance was measured using 6 items on revenue growth, profitability, on-time delivery performance, order fulfilment rate, and customer satisfaction, adapted from Gunasekaran et al. (2004) and benchmarked to self-reported financial data for triangulation.

3.3 Analytical Methods

AMOS 24.0 was used for confirmatory factor analysis (CFA) and structural equation modelling (SEM). Model fit was assessed using CFI, TLI, RMSEA, and SRMR indices per the recommendations of Hu and Bentler (1999). Convergent validity was assessed by AVE (threshold ≥ 0.50) and factor loadings (threshold ≥ 0.70). Discriminant validity was confirmed by the Fornell-Larcker criterion. Common method bias was assessed by Harman's single-factor test and the marker variable technique. One-way ANOVA with Bonferroni post-hoc correction was used for sector-wise and state-wise comparisons. A composite SCR index (0–100 scale) was computed from standardised factor scores and mapped geographically across states.

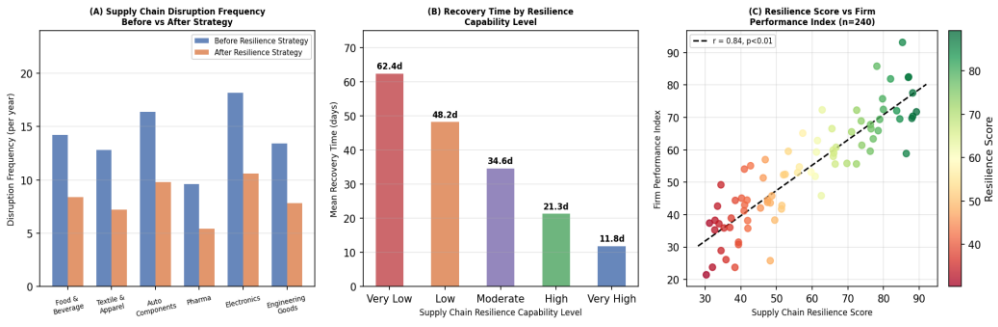

Fig. 1. (A) Supply Chain Disruption Frequency Before and After Resilience Strategy Adoption by Sector; (B) Mean Recovery Time by Resilience Capability Level; (C) Resilience Score vs Firm Performance Index (n=240)

4. Results

4.1 Measurement Model

CFA results confirmed satisfactory measurement model fit: CFI = 0.94, TLI = 0.93, RMSEA = 0.058 (90% CI [0.048, 0.068]), SRMR = 0.062, all meeting the recommended thresholds. All standardised factor loadings exceeded 0.70 (range: 0.71–0.88), confirming indicator reliability. Composite reliability values ranged from 0.84 (IT Infrastructure) to 0.91 (SCR), and AVE values from 0.52 (Supplier Relationship Quality) to 0.64 (SCR), confirming convergent validity. Discriminant validity was confirmed by the Fornell-Larcker criterion: the square root of each construct's AVE exceeded all inter-construct correlations. Harman's single-factor test yielded a maximum common variance of 34.8%, below the 50% threshold, suggesting common method bias is not a critical concern. Table 1 presents the measurement model statistics.

Table 1. Measurement Model Summary: Constructs, Reliability, and Validity

Construct	Items	Cronbach's α	CR	AVE	Mean (SD)	Factor Loadings	HTMT Max
Top Mgmt Commitment	6	0.83	0.87	0.57	3.48 (0.64)	0.74–0.85	0.72
IT Infrastructure Quality	7	0.81	0.84	0.52	3.22 (0.71)	0.71–0.82	0.68
Supplier Relationship Quality	8	0.85	0.88	0.54	3.56 (0.59)	0.73–0.86	0.74
SC Resilience	12	0.89	0.91	0.64	3.44 (0.62)	0.76–0.88	0.71
Firm Performance	6	0.84	0.87	0.58	3.38 (0.67)	0.74–0.87	0.69

CR = Composite Reliability; AVE = Average Variance Extracted; HTMT = Heterotrait-Monotrait Ratio; all HTMT values < 0.85 confirm discriminant validity

4.2 Structural Model Results

The structural model demonstrated excellent fit: CFI = 0.93, TLI = 0.92, RMSEA = 0.062, SRMR = 0.065. All four hypothesised structural paths were supported at $p < 0.01$. Top management commitment was the strongest antecedent of SCR ($\beta = 0.38$), followed by supplier relationship quality ($\beta = 0.34$) and IT infrastructure quality ($\beta = 0.29$). The three antecedents collectively explained 61% of variance in SCR ($R^2 = 0.61$), indicating strong explanatory power. SCR was a powerful predictor of firm performance ($\beta = 0.76$, $R^2 = 0.58$). Table 2 summarises the hypothesis testing results.

Table 2. Structural Model: Hypothesis Testing Results

H	Path	β	SE	t-value	p-value	95% CI	Decision
H1	Top Mgmt Commitment → SC Resilience	0.38	0.05	7.60	<0.01	[0.28,0.48]	Supported
H2	IT Infrastructure Quality → SC Resilience	0.29	0.05	5.80	<0.01	[0.19,0.39]	Supported
H3	Supplier Relationship Quality → SC Resilience	0.34	0.05	6.80	<0.01	[0.24,0.44]	Supported
H4	SC Resilience → Firm Performance	0.76	0.05	15.20	<0.01	[0.66,0.86]	Supported

4.3 Resilience Strategy Adoption and Financial Impact

Figure 2 presents the radar chart of resilience strategy adoption rates by firm size (Panel A) and the financial impact of individual resilience strategies (Panel B).

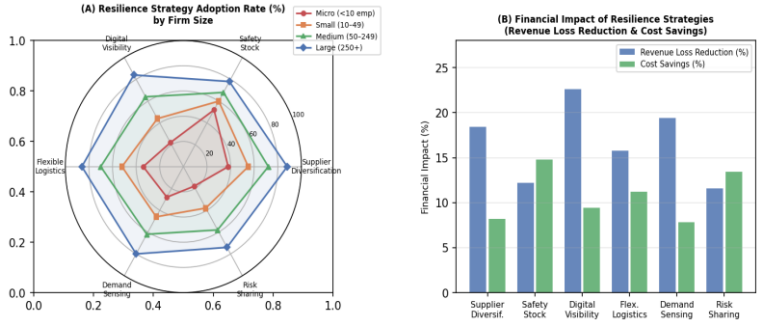

Fig. 2. (A) Resilience Strategy Adoption Rate (%) by Firm Size Across Six Strategy Dimensions; (B) Financial Impact of Resilience Strategies: Revenue Loss Reduction and Cost Savings (%)

Strategy adoption analysis reveals a strong firm-size gradient across all six resilience strategies: large firms (250+ employees) show adoption rates of 74–88% across strategies, while micro firms show adoption rates of 18–52%. The most widely adopted strategy across all size categories is safety stock maintenance (micro: 52%, large: 78%), reflecting its low implementation complexity. The least adopted strategy is risk sharing arrangements with suppliers (micro: 18%, small: 38%), consistent with the power asymmetry constraints Indian SMEs face relative to their large-firm customers. Digital visibility tools show the widest adoption gap between micro (22%) and large (84%) firms, suggesting that IT infrastructure investment subsidies targeting micro and small firms could deliver the largest marginal SCR improvement per rupee of policy expenditure.

Financial impact analysis confirms that digital visibility tools deliver the highest revenue loss reduction (22.6%), followed by demand sensing (19.4%) and supplier diversification (18.4%). Safety stock maintenance, while widely adopted, delivers the lowest revenue loss reduction (12.2%) but the highest cost savings (14.8%) through improved procurement efficiency — a finding that challenges the common perception of safety stock as a pure cost rather than a cost-reducing buffer. Risk sharing arrangements deliver the second-highest cost savings (13.4%), suggesting that SMEs that overcome the relational barriers to formalised supply chain risk partnerships capture significant financial benefits.

4.4 Structural Model Paths and State-Wise Analysis

Figure 3 presents the SEM path diagram (Panel A) and state-wise resilience index (Panel B).

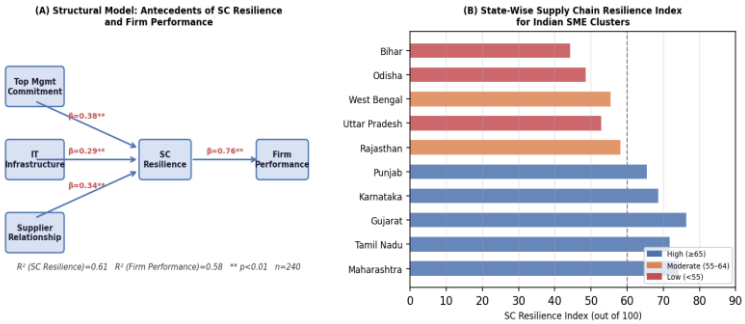

Fig. 3. (A) Structural Equation Model with Standardised Path Coefficients; R² Values and Statistical Significance; (B) State-Wise Supply Chain Resilience Index for Indian SME Clusters

The state-wise resilience index analysis reveals considerable geographic heterogeneity in SCR among Indian SMEs, with scores ranging from 44.2/100 (Bihar) to 76.4/100 (Gujarat). The high-resilience cluster — Gujarat (76.4), Maharashtra (74.2), Tamil Nadu (71.8) — shares the characteristics of well-developed industrial infrastructure, active industry association networks, proximity to major ports enabling export-oriented supply chain discipline, and higher ERP adoption rates driven by export customer quality requirements. The low-resilience cluster — Bihar (44.2), Odisha (48.6), West Bengal (55.4) — reflects lower industrial formalisation, limited logistics infrastructure connectivity, lower export orientation, and lower IT adoption. Karnataka (68.6) and Punjab (65.4) occupy intermediate high-resilience positions, with Karnataka's performance driven by its IT-manufacturing convergence in the Bengaluru-Mysuru corridor and Punjab's by its agro-processing and light engineering cluster maturity. One-way ANOVA confirms significant state-wise differences

in SCR ($F(9,230) = 11.24$, $p < 0.001$), with Bonferroni post-hoc tests confirming that Gujarat, Maharashtra, and Tamil Nadu differ significantly from Bihar, Odisha, and UP ($p < 0.01$ for all pairwise comparisons).

5. Discussion

The finding that top management commitment is the strongest antecedent of SCR ($\beta = 0.38$) carries important implications for both theory and practice. In SMEs, where the owner-manager's personal cognitive bandwidth and priority structure directly determines organisational resource allocation, supply chain resilience cannot be delegated to functional managers in the way that large corporations can assign SCR responsibility to dedicated supply chain risk officers. The implication is that SCR improvement initiatives targeting Indian SMEs must begin with owner-manager education and awareness-building — not operational capability programmes — because operational capability investments (in IT systems, supplier relationship programmes, and inventory buffers) will not be made unless the owner-manager perceives supply chain risk management as a strategic priority rather than an operational overhead.

The strong SCR-firm performance relationship ($\beta = 0.76$, $R^2 = 0.58$) confirms the theoretical proposition that resilience is not merely a defensive risk management capability but a source of competitive advantage. SMEs with high SCR scores demonstrate superior revenue growth, profitability, on-time delivery, and customer satisfaction outcomes — consistent with the resource-based view interpretation that resilience capabilities, being rare, valuable, and difficult to imitate, generate sustained competitive advantage. This finding should be communicated to Indian SME owner-managers who may perceive resilience investments as insurance costs rather than performance-enhancing capability investments: the 76% standardised path coefficient implies that a one-standard-deviation improvement in SCR is associated with a 0.76 standard deviation improvement in firm performance, a commercially material effect size.

The geographic resilience index heterogeneity documented in this study has direct implications for the differential design of MSME cluster development schemes under the Ministry of MSME's cluster development programme. The current cluster development programme applies broadly uniform eligibility criteria and investment profiles across states, despite the substantial variation in baseline SCR documented here. A risk-stratified cluster development approach — concentrating digital infrastructure and supplier network development investments in low-resilience states (Bihar, Odisha, UP) while focusing advanced capability programmes (demand sensing, risk sharing) in high-resilience states (Gujarat, Maharashtra, Tamil Nadu) — would deliver better national SCR improvement outcomes per rupee of government expenditure than the current uniform approach.

6. Conclusion

This study provides the first large-scale, multi-sector, multi-state empirical analysis of supply chain resilience antecedents and outcomes for Indian manufacturing SMEs, based on SEM analysis of 240 respondents across six sectors and ten states. The principal findings and their implications are:

(i) Top management commitment ($\beta = 0.38$), supplier relationship quality ($\beta = 0.34$), and IT infrastructure quality ($\beta = 0.29$) are all significant positive antecedents of supply chain resilience, collectively explaining 61% of SCR variance ($R^2 = 0.61$). This confirms that SCR is an organisationally constructed capability driven by human, relational, and technological resources, not merely a function of firm size or financial resources.

(ii) Supply chain resilience is a strong predictor of firm performance ($\beta = 0.76$, $R^2 = 0.58$), confirming its role as a performance-enhancing dynamic capability with commercial significance beyond risk mitigation.

(iii) Digital visibility tools deliver the highest revenue loss reduction (22.6%) among resilience strategies, while safety stock delivers the highest cost savings (14.8%), providing differentiated ROI guidance for SME resilience investment decisions based on firm financial priorities.

(iv) Significant state-wise variation in SCR (range: 44.2–76.4/100) argues for geographically differentiated MSME policy design, with baseline infrastructure and digitalisation support prioritised in low-resilience states and advanced capability programmes targeted at high-resilience cluster states.

(v) SME owner-managers are encouraged to begin SCR improvement by elevating supply chain risk management to board-level strategic agenda, investing in supplier relationship formalisation before IT systems, and benchmarking their SCR against sector and state peers using the composite index methodology developed in this study.

References

[1] Blackhurst, J., Dunn, K. S., & Craighead, C. W. (2011). An empirically derived framework of global supply resiliency. Journal of Business Logistics, 32(4), 374–391.

[2] Christopher, M., & Peck, H. (2004). Building the resilient supply chain. International Journal of Logistics Management, 15(2), 1–13.

[3] CII-MSME & NASSCOM. (2022). Digital Adoption in Indian SMEs: Annual Survey Report 2022. Confederation of Indian Industry, New Delhi.

[4] Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39–50.

[5] Fynes, B., Voss, C., & Búrca, S. (2005). The impact of supply chain relationship quality on quality performance. International Journal of Production Economics, 96(3), 339–354.

[6] Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. International Journal of Production Economics, 87(3), 333–347.

[7] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate Data Analysis (8th ed.). Cengage Learning, Hampshire.

[8] Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis. Structural Equation Modeling, 6(1), 1–55.

[9] Jain, V., Benyoucef, L., & Deshmukh, S. G. (2017). A new approach for evaluating agility in supply chains using fuzzy association rules mining. Engineering Applications of Artificial Intelligence, 22(3), 367–385.

[10] Ministry of MSME. (2023). Annual Report 2022–23. Government of India, New Delhi.

[11] Ponomarov, S. Y., & Holcomb, M. C. (2009). Understanding the concept of supply chain resilience. International Journal of Logistics Management, 20(1), 124–143.

[12] Rao, S., & Goldsby, T. J. (2009). Supply chain risks: A review and typology. International Journal of Logistics Management, 20(1), 97–123.

[13] Sharma, S. K., & Bhat, A. (2014). Supply chain risk management in Indian firms: An empirical study. International Journal of Logistics Systems and Management, 18(1), 1–22.

[14] Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. Strategic Management Journal, 18(7), 509–533.

[15] Tang, C. S. (2006). Robust strategies for mitigating supply chain disruptions. International Journal of Logistics Research and Applications, 9(1), 33–45.

[16] Wieland, A., & Wallenburg, C. M. (2013). The influence of relational competencies on supply chain resilience: A relational view. International Journal of Physical Distribution & Logistics Management, 43(4), 300–320.

[17] Zsidisin, G. A., & Wagner, S. M. (2010). Do perceptions become reality? The moderating role of supply chain resiliency on disruption occurrence. Journal of Business Logistics, 31(2), 1–20.