

Assessing the Impact of Global Supply Chain Disruptions on China's New Energy Vehicle Industry: A Quantitative Analysis of Resilience Strategies

Yuefei Long^{1*}, Chanakiat Samarnbutra²

^{1,2}Rangsit University, Thailand

*Corresponding Author: Yuefei Long

Email: longyuefei1995@gmail.com

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ABSTRACT:

Frequent global supply chain disruptions have challenged the operational stability of China's new energy vehicle (NEV) industry, requiring firms to strengthen supply chain resilience. Grounded in dynamic capabilities theory and the resource-based view, this study examines the effects of three resilience strategies—supplier diversification, localized production, and smart supply chain management—on operational and market performance. Using survey data from 243 managers in China's NEV industry, structural equation modeling (SEM) was employed to test direct and indirect relationships among variables. The findings indicate that all three strategies significantly improve market sales, competitive advantage, and operational efficiency indirectly through operational performance during supply chain disruptions. Smart supply chain management demonstrates the strongest effect on operational performance ($\beta = 0.312$, $p < 0.001$), followed by supplier diversification ($\beta = 0.284$, $p < 0.001$) and localized production ($\beta = 0.244$, $p = 0.002$). Operational performance fully mediates the relationship between resilience strategies and market performance, with bootstrap bias-corrected 95% confidence intervals excluding zero. The results underscore digitalized supply chain management as the most effective strategy for enhancing resilience in China's NEV industry and offer practical implications for resource allocation and industrial policy development..

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Keywords: supply chain resilience; new energy vehicle; supplier diversification; smart supply chain management; operational performance.

INTRODUCTION

The global supply chain landscape has experienced unprecedented turbulence in recent years. The COVID-19 pandemic, semiconductor shortages, raw material price volatility, and geopolitical conflicts have exposed the structural fragility of globalized production networks (Finck & Tillmann, 2023; Ivanov, 2021). China's new energy vehicle (NEV) industry—the world's largest in both production and sales—is particularly vulnerable to these disruptions. Despite its global leadership in battery manufacturing and vehicle assembly, the sector remains heavily dependent on imported critical minerals and advanced components. Over 60% of cobalt originates from the Democratic Republic of Congo, and more than 80% of nickel is sourced from Indonesia (Gulley, 2024). Lithium, essential for battery production, is subject to acute supply risks, as China's domestic mining output accounts for less than 20% of its processing needs (Zhang & Zhang, 2025). Meanwhile, the 2020–2022 semiconductor shortage caused delivery delays of four to six months for major Chinese NEV manufacturers such as NIO and XPeng (Ali et al., 2022). These dependencies create structural vulnerabilities that directly threaten production continuity and market competitiveness.

Despite the growing recognition of supply chain resilience (SCR) as a strategic imperative, significant gaps persist in the systematic understanding of how firms can effectively build it. First, a conceptual gap exists: prior research has tended to treat SCR as a monolithic construct,

failing to disaggregate distinct strategies—such as supplier diversification, localization, and digitalization—and examine their potentially differential effects on performance. Second, a theoretical gap remains: few studies have integrated SCR with established strategic management theories such as the resource-based view (RBV) and dynamic capabilities theory (DCT), leaving the mechanisms through which resilience translates into competitive advantage underexplored. Third, an empirical gap is evident: quantitative, survey-based evidence on the effectiveness of resilience strategies within the specific context of China's NEV industry is scarce, with most existing research relying on case studies or conceptual frameworks (Huang et al., 2024; Zhou et al., 2024).

RESEARCH OBJECTIVES

1. To identify and analyze the key impacts of global supply chain disruptions on China's new energy vehicle (NEV) industry.
2. To examine how different supply chain resilience strategies—namely supplier diversification, localization, and smart supply chain management—help mitigate the identified disruptions in the context of China's NEV industry.
3. To evaluate the relative effectiveness of supplier diversification, localization, and smart supply chain management in improving operational stability and financial performance, and to determine the mediating role of operational performance in these relationships.

Theoretical Framework and Hypotheses

Theoretical Framework: Resources, Capabilities, and Process

This study integrates two complementary theoretical perspectives—the resource-based view (RBV) and dynamic capabilities theory (DCT)—to explain how supply chain resilience strategies translate into market performance. The RBV posits that firms achieve sustained competitive advantage by possessing resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991; Channuwong et al., 2026). From this perspective, supplier diversification and localized production can be understood as structural resources: diversification builds redundancy by creating multiple sourcing options that buffer against supplier-side shocks, while localization enhances control by shortening physical distances and reducing exposure to international logistics disruptions. However, the RBV alone cannot explain how these resources are activated under turbulent conditions. DCT addresses this limitation by emphasizing a firm's capacity to integrate, build, and reconfigure resources in response to rapidly changing environments (Teece et al., 1997; Kenikasahmanworakhun et al., 2025). Within this framework, supply chain resilience is conceptualized as a dynamic capability comprising three micro-foundations: sensing (identifying and anticipating potential disruptions), seizing (mobilizing resources and executing contingency plans), and transforming (reconfiguring supply chain structures based on lessons learned). Smart supply chain management, enabled by digital technologies such as IoT, AI, and big data analytics, embodies these three micro-foundations by providing real-time visibility, predictive intelligence, and coordinated response capabilities.

Crucially, neither resources nor capabilities generate competitive advantage in a vacuum. This study posits that operational performance during disruptions serves as the critical mediating process that converts resilience potential into realized market outcomes. A firm may possess a diversified supplier base, localized production facilities, and advanced digital systems, but unless these resources and capabilities are effectively deployed through operational execution during an actual crisis—swiftly switching to backup suppliers, reconfiguring production schedules, and maintaining output levels—their market value remains latent. This integrated framework—resources $\times$ capabilities $\rightarrow$ operational process $\rightarrow$ market performance—provides the theoretical foundation for the hypothesized model depicted in Figure 1.

Resilience Strategies and Operational Performance

Supplier diversification refers to the practice of utilizing multiple sources for critical components to reduce dependency on any single supplier and mitigate supply-side risk (Bode & Wagner, 2015; Sutthadaanantaphokin et al., 2025). This strategy primarily builds redundancy, a core dimension of resilience, by creating structural buffers that can absorb the shock of a supplier failure. When a primary supplier is disabled by a natural disaster, trade restriction, or production outage, orders can be swiftly reallocated to backup suppliers in unaffected areas, thereby preserving production continuity. Empirically, Bode and Wagner (2015) found that firms with structurally diversified supplier bases experienced fewer and less severe production disruptions. In the NEV context, the semiconductor shortage demonstrated the vulnerability inherent in single-sourcing

arrangements, as manufacturers with multi-sourced chip suppliers sustained higher production continuity than their single-sourced counterparts (Ali et al., 2022; Bangbon et al., 2023). Therefore, this study proposed the following hypotheses:

H1: Supplier diversification positively affects operational performance during supply chain disruptions.

H2: Localized production positively affects operational performance during supply chain disruptions.

H3: Smart supply chain management positively affects operational performance during supply chain disruptions.

H4: Operational performance during disruptions positively affects market performance (market sales, competitive advantage, and operational efficiency).

H5: Operational performance during disruptions mediates the relationship between supplier diversification and market performance.

H6: Operational performance during disruptions mediates the relationship between localized production and market performance.

H7: Operational performance during disruptions mediates the relationship between smart supply chain management and market performance.

Based on the literature review and research hypotheses, the following conceptual frame work was proposed (Figure 1).

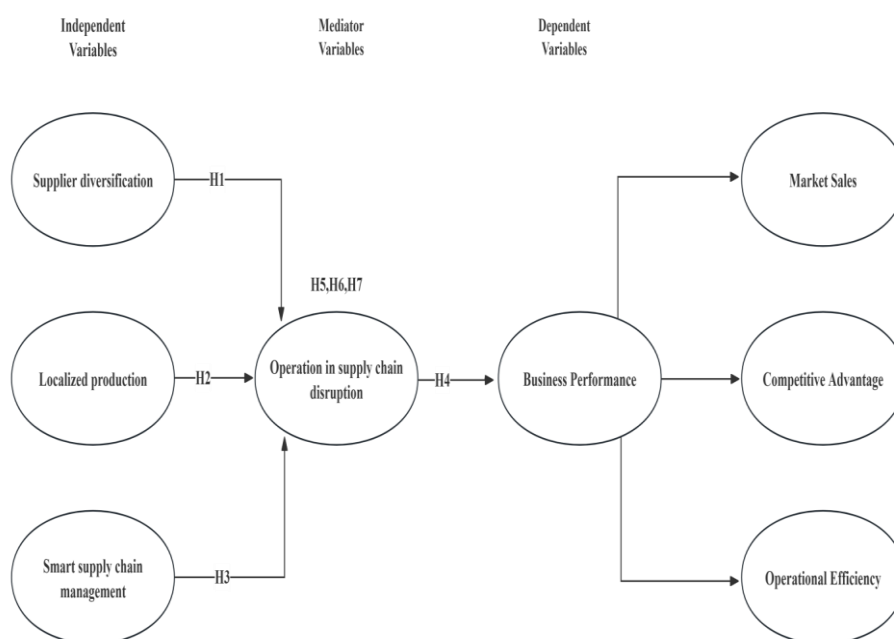


Figure 1: Conceptual Model

METHODOLOGY

Data were collected from 243 valid responses obtained from mid- and senior-level managers in China's NEV industry using purposive and snowball sampling. Established five-point Likert

scales were employed to measure all constructs, and SEM with AMOS 28 was used for hypothesis testing. The measurement model demonstrated satisfactory reliability and validity, with factor loadings above 0.70, CR values above 0.84, and

AVE values above 0.50. Model fit indices indicated a good fit ($\chi^2/df = 1.52$, CFI = 0.946, TLI = 0.937, RMSEA = 0.046, SRMR = 0.042). Harman's single-factor test (31.47%) confirmed that common method bias was not a significant concern.

RESEARCH RESULTS

Hypothesis Testing on the structural model demonstrated good fit: $\chi^2/df = 1.51$, CFI = 0.945, TLI = 0.938, RMSEA = 0.046, SRMR = 0.043. All seven hypotheses were supported.

Table 1 presents the direct effect results. Smart supply chain management exhibited the strongest

effect on operational performance during disruptions ($\beta = 0.312$, $p < 0.001$), supporting H3. Supplier diversification ($\beta = 0.284$, $p < 0.001$, H1) and localized production ($\beta = 0.244$, $p = 0.002$, H2) also demonstrated significant positive effects. The three strategies jointly explained 32.8% of the variance in operational performance ($R^2 = 0.328$). Operational performance significantly predicted all three market performance dimensions: market sales ($\beta = 0.526$, $p < 0.001$), operational efficiency ($\beta = 0.514$, $p < 0.001$), and competitive advantage ($\beta = 0.487$, $p < 0.001$), supporting H4a–H4c.

Table 1. Standardized Path Coefficients of the Structural Model for Direct Effects

Hypothesis	Path	Standardized β	p-value	Result
H1	SD $\rightarrow$ OPD	0.284	< 0.001	Supported
H2	LOC $\rightarrow$ OPD	0.244	0.002	Supported
H3	SSCM $\rightarrow$ OPD	0.312	< 0.001	Supported
H4a	OPD $\rightarrow$ MS	0.526	< 0.001	Supported
H4b	OPD $\rightarrow$ CA	0.487	< 0.001	Supported
H4c	OPD $\rightarrow$ OE	0.514	< 0.001	Supported

Note: SD = Supplier Diversification; LOC = Localized Production; SSCM = Smart Supply Chain Management; OPD = Operational Performance during Disruptions; MS = Market Sales; CA = Competitive Advantage; OE = Operational Efficiency. $R^2(OPD) = 0.328$; $R^2(MS) = 0.277$; $R^2(CA) = 0.237$; $R^2(OE) = 0.264$.

Table 2 presents the bootstrap mediation results based on 5,000 resamples. All indirect effects were statistically significant, with bias-corrected 95% confidence intervals excluding zero. Smart supply chain management yielded the strongest indirect

effects ($\beta = 0.152$ – 0.164 , $p = 0.001$), followed by supplier diversification ($\beta = 0.138$ – 0.149 , $p < 0.01$) and localized production ($\beta = 0.119$ – 0.128 , $p < 0.01$), supporting H5–H7.

Table 2. Standardized Path Coefficients of the Structural Model for Indirect Effects

Hypotheses	Indirect Path	Indirect Effect (β)	BC 95% CI	p-value	Result
H5a	SD $\rightarrow$ OPD $\rightarrow$ MS	0.149	[0.068, 0.249]	0.002	Supported
H5b	SD $\rightarrow$ OPD $\rightarrow$ CA	0.138	[0.062, 0.233]	0.003	Supported
H5c	SD $\rightarrow$ OPD $\rightarrow$ OE	0.146	[0.067, 0.244]	0.002	Supported
H6a	LOC $\rightarrow$ OPD $\rightarrow$ MS	0.128	[0.051, 0.221]	0.004	Supported
H6b	LOC $\rightarrow$ OPD $\rightarrow$ CA	0.119	[0.046, 0.208]	0.005	Supported
H6c	LOC $\rightarrow$ OPD $\rightarrow$ OE	0.125	[0.050, 0.217]	0.004	Supported
H7a	SSCM $\rightarrow$ OPD $\rightarrow$ MS	0.164	[0.083, 0.266]	0.001	Supported
H7b	SSCM $\rightarrow$ OPD $\rightarrow$ CA	0.152	[0.076, 0.248]	0.001	Supported
H7c	SSCM $\rightarrow$ OPD $\rightarrow$ OE	0.160	[0.080, 0.261]	0.001	Supported

Note: BC 95% CI = Bias-Corrected 95% Confidence Interval. Mediation is significant when the 95% CI does not include zero. 5,000 bootstrap samples. See Table 1 for abbreviations. All indirect effects represent full mediation. A clear hierarchy emerged across both direct and indirect effects: H3 (SSCM) > H1 (SD) > H2 (LOC). This confirms smart supply chain management as the most powerful resilience strategy in China's NEV industry.

DISCUSSION

The results indicate that smart supply chain management (SSCM) has the strongest positive effect on operational performance, highlighting the importance of dynamic capabilities in enabling firms to sense, respond to, and adapt during

disruptions. Supplier diversification also significantly improves operational performance by reducing dependence on critical suppliers and enhancing supply flexibility. Localized production contributes positively to resilience, although its impact is comparatively smaller due to trade-offs

associated with geographic concentration and resource constraints.

A key contribution of this study is the confirmation that operational performance fully mediates the relationships between resilience strategies and market performance. This finding suggests that resilience investments do not directly translate into market advantages; rather, their value is realized through effective operational execution during disruption events. By integrating Resource-Based View (RBV) and Dynamic Capabilities Theory (DCT), the study demonstrates that superior market outcomes emerge from the combination of strategic resources, adaptive capabilities, and strong operational performance.

CONCLUSION

This study contributes to the supply chain resilience literature by distinguishing resilience into three strategic dimensions and demonstrating their different impacts on performance. By integrating Resource-Based View (RBV) and Dynamic

Capabilities Theory (DCT), it provides a comprehensive framework linking resilience strategies, operational performance, and market outcomes. Empirical evidence from China's NEV industry further strengthens understanding of resilience in an important emerging sector.

The findings suggest that smart supply chain management should be prioritized as the most effective resilience strategy, followed by supplier diversification and localized production. Managers should therefore focus on digital technologies, visibility, and predictive capabilities while adopting targeted diversification and selective localization. For policymakers, investment in digital infrastructure and collaborative supply chain platforms can enhance resilience across the industry ecosystem. Despite its contributions, the study is limited by its cross-sectional design and industry-specific sample. Future research should employ longitudinal and cross-country studies to validate and extend these findings.

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