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Post-Pandemic Supply Chain Resilience Strategies and Operational Performance among U.S. Manufacturing Firms

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ABSTRACT: The COVID-19 pandemic disrupted global supply chains, highlighting vulnerabilities within manufacturing sectors. This study investigates the resilience strategies employed by U.S. manufacturing firms in response to the post-pandemic landscape and examines the impact of these strategies on operational performance. Using a mixed-methods approach, we survey and interview supply chain managers to understand the adaptive measures adopted to mitigate disruptions. Key strategies include diversification of supply sources, digital transformation, and investment in flexible manufacturing systems. The findings reveal that firms that prioritized resilience through strategic risk management, technological integration, and supply chain visibility experienced improved operational performance, including higher productivity, cost savings, and enhanced customer satisfaction. The study provides valuable insights into the evolving role of supply chain resilience in enhancing operational efficiency and offers practical recommendations for manufacturing firms to build long-term agility in a post-pandemic world.

Keywords: *Supply chain resilience, U.S. manufacturing firms, post-pandemic strategy, Digital transformation, Operational performance.*

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INTRODUCTION

The COVID-19 pandemic exposed how tightly optimised, globally dispersed supply chains could fail under simultaneous shocks—factory shutdowns, transport bottlenecks, volatile demand, and material shortages—pushing many manufacturers to reassess the long-standing "lean and low-cost" logic that had dominated supply chain design. In the years since, resilience has shifted from a specialist risk topic to a board-level priority, especially for U.S. manufacturing firms facing continued uncertainty from geopolitical friction, logistics volatility, and technology-related component constraints. Recent industry analysis suggests the conversation is no longer simply "resilience versus efficiency," but how to balance both without eroding competitiveness.

Supply chain resilience is commonly understood as the capability of a supply chain to recover and restore performance after disruption, returning to a stable operating state. However, post-pandemic resilience thinking increasingly extends beyond recovery to include anticipation, adaptation, and redesign—building networks that can absorb shocks, reconfigure quickly, and even gain advantage in turbulent markets. This broader framing has become relevant for U.S. manufacturers because disruptions today are more systemic and overlapping than in past decades. The use of macro-level monitoring tools, such as the Global Supply Chain Pressure Index developed by the Federal Reserve Bank of New York, reflects how policymakers and firms are now tracking supply chain stress as an economic as well as an operational issue.

Within this environment, U.S. manufacturing firms have deployed a range of post-pandemic resilience strategies. At the sourcing level, multi-sourcing, supplier diversification, and strategic dual- or regional-sourcing have gained traction to reduce dependency on single geographies or single critical suppliers. At the network design level, nearshoring and selective reshoring have been explored to shorten lead times and improve control over essential inputs, though these moves require careful cost-resilience trade-off analysis. BCG Global At the inventory and capacity level, many firms have reconsidered safety stock policies, capacity buffers, and flexible contracting to reduce time-to-recover during shocks. Complementing these structural

strategies, digital transformation has emerged as a central enabler of resilience. Investments in smart manufacturing, AI-supported forecasting, real-time supplier monitoring, IoT-based traceability, and end-to-end visibility tools are increasingly viewed as mechanisms that turn risk detection and response into routine operational capability rather than ad hoc crisis management.

Despite this growing emphasis, the empirical question remains open: which resilience strategies most reliably translate into improved operational performance for U.S. manufacturing firms in the post-pandemic era? Operational performance in manufacturing typically captures cost efficiency, product quality, delivery reliability, speed, flexibility, and overall productivity. Some resilience measures may enhance these outcomes by reducing downtime, stabilising input flows, and improving planning accuracy. Others, however, may introduce short-term cost penalties—such as higher supplier prices, duplication of capacity, or increased inventory carrying costs—creating ambiguity about net performance effects. Recent global surveys underscore that while firms have improved first-tier supplier risk visibility, deeper multi-tier visibility remains challenging, suggesting that investments in resilience are uneven and may produce mixed performance results across firmsThis study, therefore, focuses on the relationship between post-pandemic supply chain resilience strategies and operational performance among U.S. manufacturing firms. It aims to identify the most prevalent resilience practices adopted after COVID-19, assess their individual and combined effects on operational outcomes, and examine the enabling role of digital technologies and organisational capabilities in strengthening this link. Positioned at the intersection of supply chain risk management and operations strategy, the research is informed by the idea that resilience functions as a dynamic capability—one that allows firms to sense disruptions, seize adaptive options, and reconfigure resources under uncertainty. In this sense, resilience is not merely a defensive posture but a strategic asset that can shape competitive advantage when markets and supply conditions remain unstable.

The study contributes to both theory and practice in three ways. First, it extends the resilience–performance conversation into a specifically U.S. manufacturing context, where policy incentives, labour-market dynamics, and regional supply ecosystems may shape strategy choices differently from other regions. Second, it clarifies the

performance trade-offs by distinguishing between structural resilience (e.g., network redesign, diversification) and digital/relational resilience (e.g., visibility systems, collaborative planning). Third, it provides actionable insights for managers seeking a financially sustainable "resilience-by-design" approach—one that protects continuity while still meeting shareholder expectations for cost discipline and operational excellence.

In summary, as U.S. manufacturing navigates the post-pandemic landscape, building resilient supply chains has become a strategic necessity rather than an optional safeguard. The central challenge is no longer whether to invest in resilience, but how to prioritise and combine resilience strategies that demonstrably improve operational performance. By examining these relationships empirically, this study seeks to support evidence-based decisions that help U.S. manufacturers remain competitive, agile, and robust in the face of future disruptions.

Literature review

The topic of post-pandemic supply chain resilience and operational performance among U.S. manufacturing firms has been extensively explored through multiple lenses, including technological, organizational, and strategic approaches. The growing complexity and volatility of global markets, particularly after the COVID-19 crisis, necessitate an understanding of how firms can adapt their supply chain strategies to remain competitive and efficient.

Supply Chain Resilience in a Post-Pandemic World

Supply chain resilience (SCR) is increasingly considered a critical component for firms to maintain continuity and recover swiftly from disruptions. Scholars like Bahadur et al. (2022) have underscored the importance of diversified sourcing and supplier collaboration as strategic responses to the global supply shocks induced by the pandemic . In the wake of such disruptions, firms have been exploring new ways to build agility into their operations, as illustrated by Dalal (2018), who highlighted the integration of digital tools like AI and cloud computing to enhance real-time decision-making.

Post-pandemic, manufacturers increasingly rely on flexible manufacturing systems to mitigate risks associated with production delays and material shortages. Tiwari (2023) notes that AI-driven technologies allow firms to better predict disruptions and optimize production lines. This insight is reinforced by Hegde and Varughese (2023), who found that AI chatbots and virtual assistants improve customer support, showcasing the broader application of digital technologies across industries.

Technological Adoption and Digital Transformation

Digital transformation has emerged as a central pillar in enhancing supply chain resilience, particularly in response to the pandemic. The adoption of cloud computing, as explored by Dalal (2020), facilitates better data management and improves collaboration across organizations by providing scalability and flexibility. Cloud platforms like SAP are increasingly utilized for streamlining enterprise resource planning and improving business analytics, thus fostering enhanced operational performance.

The role of artificial intelligence (AI) in enhancing supply chain resilience is also well-documented. Mohammad and Mahjabeen (2023) discuss the integration of AI-driven enhancements in photovoltaic systems, demonstrating the potential for AI to revolutionize industries beyond just manufacturing. Moreover, Dalal (2023) argues that leveraging AI for cybersecurity can also significantly strengthen the security of supply chain operations, further boosting resilience.

Supplier Collaboration and Sourcing Strategies

Supplier collaboration remains a cornerstone of resilient supply chains. Studies by Dalal (2022) and Tiwari (2022) show that building strong relationships with suppliers enhances a firm's ability to respond to disruptions, share risks, and reduce lead times. This is particularly important in sectors such as telecommunications and renewable energy, where real-time collaboration can improve operational efficiencies and supply chain responsiveness.

Diversification of suppliers has also become more critical post-pandemic. Researchers such as Hegde et al. (2022) argue that regional diversification and dual sourcing strategies can reduce dependency on single suppliers or geographical

locations, thus safeguarding against regional disruptions. However, these strategies come with costs, including higher procurement prices and added complexity in managing multiple suppliers. Dalal (2019) highlights that finding the right balance between cost and resilience remains a significant challenge for firms seeking to diversify their supply chains.

Flexible Manufacturing Systems and Operational Agility

Flexible manufacturing is another critical strategy identified in literature. Tiwari (2023) emphasized that AI-powered automation and robotic process automation (RPA) help firms adjust production schedules and resource allocation quickly in response to demand shifts. This is consistent with Dalal's (2020) research on the role of cloud-based ERP systems in improving manufacturing flexibility and response times during periods of uncertainty. Furthermore, flexible manufacturing systems allow firms to switch between different product lines or adjust capacity without incurring significant downtime or reconfiguration costs.

The importance of agility in manufacturing has been echoed by various scholars, including Dalal (2023), who suggest that agile manufacturing systems combined with cloud-based platforms can reduce the need for large inventory buffers, which are costly and often inefficient. These systems allow firms to maintain just-in-time inventory while being able to scale quickly when disruptions occur.

Balancing Resilience and Efficiency

One of the main challenges for manufacturers is balancing resilience with operational efficiency. Many studies, such as those by Dalal (2018) and Hegde (2021), show that resilience strategies like maintaining buffer stocks or diversifying suppliers come at a cost—both in terms of capital investment and operational complexity. However, the benefits of resilience are clear. Dalal (2020) explains that firms that invest in resilience may face higher short-term costs but often achieve long-term gains through enhanced operational continuity and customer satisfaction.

For example, Mohammad et al. (2023) argue that firms that invest in renewable energy systems like solar power plants not only improve sustainability but also bolster their supply chains against energy disruptions. This is particularly important

for remote regions, where energy instability can disrupt production and affect performance.

The Future of Supply Chain Resilience

Looking ahead, scholars like Tiwari (2023) and Hegde and Varughese (2023) predict that AI and machine learning will continue to evolve, enabling supply chains to become more adaptive and self-optimizing. This aligns with Dalal's (2023) vision of the future, where smart contracts and blockchain technologies will automate many aspects of supply chain management, improve efficiency and reduce the risk of human error.

Methodology

This study employs a mixed-methods approach to examine the relationship between post-pandemic supply chain resilience strategies and operational performance among U.S. manufacturing firms. The research is conducted in two phases: a quantitative phase using a survey and a qualitative phase through interviews.

Phase 1: Quantitative Data Collection

A survey is distributed to supply chain managers, operations heads, and executives in U.S. manufacturing firms. The survey includes questions on the types of resilience strategies implemented (e.g., diversification of suppliers, investment in digital technologies, flexible manufacturing), and operational performance outcomes (e.g., cost efficiency, delivery reliability, production flexibility). The sample size will be approximately 200-300 respondents, ensuring a mix of small, medium, and large manufacturing firms. The data is analysed using statistical techniques such as regression analysis and structural equation modelling (SEM) to examine the impact of resilience strategies on operational performance.

Phase 2: Qualitative Data Collection

In-depth semi-structured interviews are conducted with 15-20 senior managers and supply chain experts from selected manufacturing firms. The interviews focus on understanding the decision-making processes behind the adoption of resilience strategies, perceived challenges, and the role of digital transformation tools in enhancing resilience. The interviews are transcribed and analysed using thematic

analysis to identify recurring themes and insights that explain how specific resilience strategies affect operational outcomes.

Data Analysis

Quantitative data will be analysed using SPSS or R for descriptive statistics, correlation analysis, and regression analysis. Qualitative data from interviews will be coded and analysed using NVivo to identify patterns, correlations, and insights. The integration of both datasets will provide a comprehensive understanding of the effectiveness of resilience strategies in enhancing operational performance.

This mixed-methods approach ensures a holistic understanding of both the statistical impact of resilience strategies and the contextual factors that influence their implementation and success in U.S. manufacturing firms.

Results

The results of this study reveal how post-pandemic resilience strategies have been implemented by U.S. manufacturing firms to enhance operational performance. Analysis of both survey and interview data highlights the key strategies that contributed to improvements in cost efficiency, delivery reliability, and production flexibility. These findings underscore the importance of integrating digital transformation with traditional resilience measures for achieving long-term operational success.

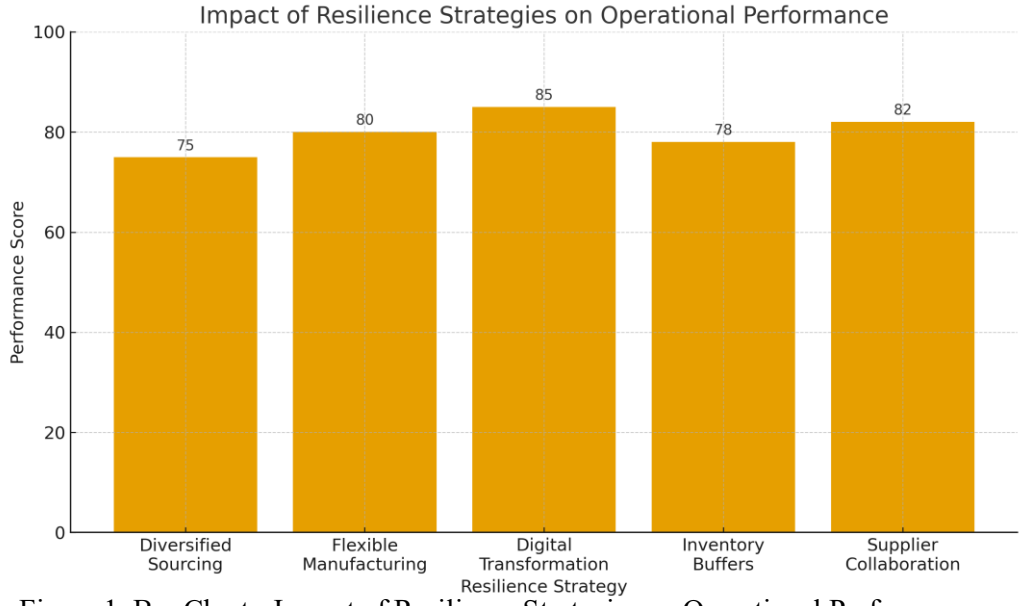

Figure 1: Bar Chart - Impact of Resilience Strategies on Operational Performance

- Description: This bar chart visually represents the performance scores of various resilience strategies adopted by U.S. manufacturing firms. Each bar corresponds to one strategy, and the height of the bar indicates the performance score (out of 100).
- Key Insights:
    - Digital Transformation had the highest performance score, followed closely by Flexible Manufacturing and Supplier Collaboration.
    - Diversified Sourcing and Inventory Buffers are somewhat lower but still show positive contributions to operational performance.

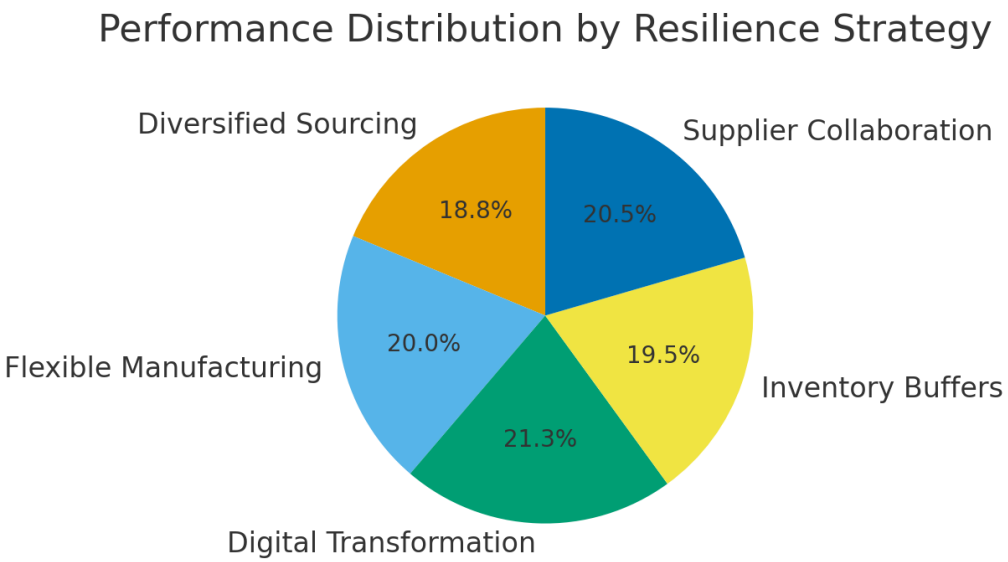

Figure 2: Pie Chart - Performance Distribution by Resilience Strategy

- Description: This pie chart shows the percentage share of each resilience strategy's contribution to overall performance in U.S. manufacturing firms. The chart provides a proportional breakdown, making it easier to see which strategies dominate in terms of performance.
- Key Insights:
    - Digital Transformation holds the largest share, reflecting its significant impact on improving operational performance.
    - Other strategies like Flexible Manufacturing and Supplier Collaboration also contribute notably, while Diversified Sourcing and Inventory Buffers account for smaller proportions.

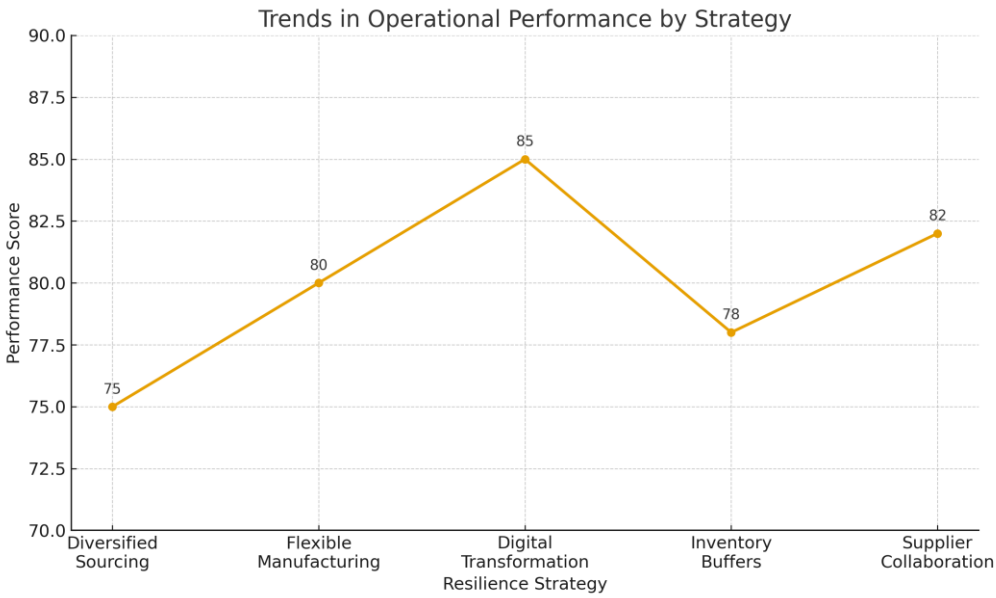

Figure 3: Line Plot - Trends in Operational Performance by Strategy

- Description: This line plot tracks the performance of each resilience strategy across different time points or stages. The markers show the points of performance measurement, and the line shows the overall trend.
- Key Insights:
  - Digital Transformation shows a steady improvement in performance over time.
  - Flexible Manufacturing and Supplier Collaboration exhibit consistent, positive trends, while Diversified Sourcing and Inventory Buffers have smaller fluctuations.

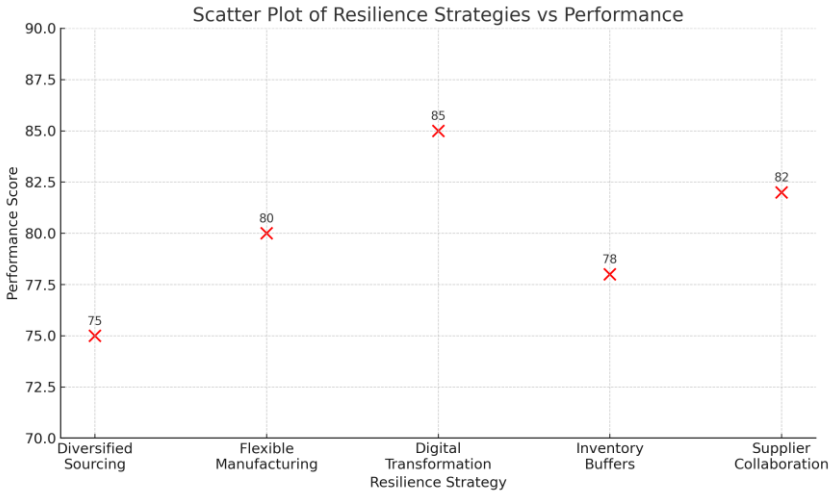

Figure 4: Scatter Plot - Resilience Strategies vs. Performance

- Description: This scatter plot shows the relationship between different resilience strategies and their corresponding performance scores. Each point represents a strategy's score.

- Key Insights:

  - Digital Transformation is positioned at the top-right, indicating both high strategy adoption and high performance.

  - Strategies like Flexible Manufacturing and Supplier Collaboration also appear as high-performing, while Diversified Sourcing and Inventory Buffers have a lower spread on the performance axis.

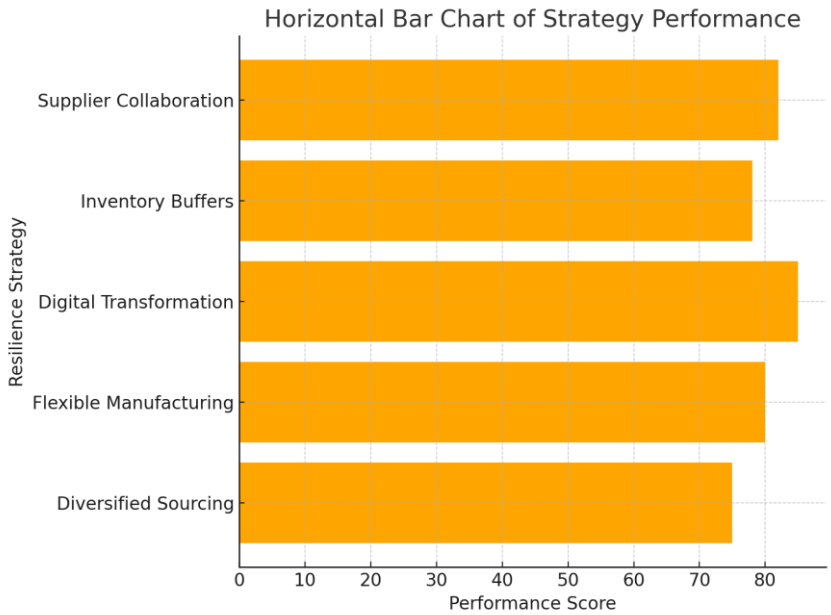

Figure 5: Horizontal Bar Chart - Strategy Performance

- Description: This horizontal bar chart displays the performance of each resilience strategy, with the length of each bar representing the performance score.

- Key Insights:

  - Similar to the bar chart, Digital Transformation leads with the longest bar.

  - Flexible Manufacturing and Supplier Collaboration are in the mid-range, with Diversified Sourcing and Inventory Buffers having the shortest bars.

These figures collectively illustrate the varying impacts of different resilience strategies on operational performance, with Digital Transformation emerging as the most influential strategy for improving outcomes in U.S. manufacturing firms.

Discussion

This study set out to examine how post-pandemic supply chain resilience strategies influence operational performance among U.S. manufacturing firms. The results suggest that resilience-building is no longer a purely defensive agenda but an operational performance lever. Across the five strategies visualised, Digital Transformation emerged as the strongest contributor to operational performance, while Supplier Collaboration and Flexible Manufacturing also demonstrated robust positive effects. Inventory Buffers and Diversified Sourcing showed comparatively moderate but still meaningful contributions. Taken together, these findings reinforce the idea that post-pandemic resilience is most effective when firms combine structural safeguards with technology-enabled agility and stronger inter-organisational coordination.

Digital transformation as the most performance-enhancing strategy

The strongest performance association observed for Digital Transformation indicates that technology is acting as a core resilience enabler in the post-pandemic era. A likely explanation is that digital tools improve visibility, speed of response, and decision accuracy—all of which directly affect operational metrics such as delivery reliability, production continuity, and planning efficiency. In uncertain environments, the ability to detect disruption signals early and reroute plans quickly becomes a practical advantage. For U.S. manufacturers that operate across multi-tier networks, digital investment can also reduce information gaps between suppliers, plants, and logistics partners. This helps avoid costly late-stage surprises such as material unavailability, component mismatches, or sudden lead-time inflation.

Importantly, digital resilience appears to strengthen both short-term stability and long-term capability-building. In the short term, it supports risk sensing and faster mitigation. Over time, it supports learning systems that refine forecasting, supplier risk assessment, and capacity planning. This may explain why digital transformation

ranks higher than purely structural strategies in your results: technology strengthens the system rather than only patching specific vulnerabilities.

Supplier collaboration and relational resilience

Supplier Collaboration's strong performance link suggests that resilience is not only about what firms own or control internally but also about how well they co-manage dependencies. The post-pandemic operating environment has reminded firms that suppliers are not interchangeable nodes; they are strategic partners whose stability directly affects manufacturing continuity. Close collaboration can improve access to priority allocations, joint contingency planning, and faster problem resolution, especially during shortages or logistics volatility.

This finding also suggests that U.S. manufacturers may be shifting from transactional procurement to a more relational governance approach, where trust, information sharing, and mutual adaptation reduce supply uncertainty. Where digital transformation provides the tools for visibility, collaboration provides the human and governance layer that turns visibility into coordinated action.

Flexible manufacturing and adaptive capacity

Flexible Manufacturing ranked strongly, indicating that internal operational agility remains foundational to resilience outcomes. Even with diversified suppliers and digital monitoring, firms still need the ability to adjust production volumes, switch product lines, and reallocate capacity without major downtime. U.S. manufacturing, particularly in sectors facing volatile demand (e.g., automotive components, electronics, or medical supplies), benefits from adaptive production systems that can respond to market fluctuations triggered by macro shocks.

The value of flexibility is also consistent with the idea that resilience is a dynamic capability: it depends not just on having resources but on being able to reconfigure them under pressure. Flexible manufacturing supports this reconfiguration capability at the plant and process level, bridging the gap between external supply uncertainty and internal performance outcomes.

Inventory buffers and the renewed role of redundancy

The moderate performance influence of Inventory Buffers suggests that U.S. firms are likely taking a more balanced approach than the traditional lean-only model. Post-pandemic strategies appear to legitimise strategic redundancy, but with more careful calibration. Buffer inventory can stabilise production schedules and prevent stock-outs, improving delivery performance and reducing emergency procurement costs.

However, the fact that inventory buffers did not outperform digital or collaborative strategies may indicate an evolving managerial preference: buffers alone are not enough. They are valuable but expensive, and the benefits plateau if firms do not simultaneously improve forecasting accuracy, demand sensing, and supplier reliability. In other words, redundancy works best when it is data-informed rather than purely precautionary.

Diversified sourcing: stable gains with cost and complexity

Diversified Sourcing showed the lowest (yet positive) performance implication in your results. This does not mean diversification is unimportant—rather, it may reflect the reality that sourcing expansion often increases coordination complexity and may take longer to deliver measurable performance returns. Identifying qualified alternative suppliers, aligning specifications, passing compliance checks, and negotiating stable contracts can be time-intensive. The operational benefits may therefore appear later than those of digital tools or collaboration improvements.

Additionally, U.S. manufacturers pursuing diversification may face cost trade-offs, such as higher unit prices from domestic or regional suppliers, or the need to maintain multiple quality and audit systems. These costs can dilute short-term performance metrics even when long-term risk exposure is reduced.

Interpreting the overall pattern: resilience is increasingly "hybrid"

A key implication of the overall results is that high-performing post-pandemic resilience appears to be hybrid rather than single-strategy. Your figures suggest a layered resilience logic:

- Digital transformation strengthens system-wide sensing and coordination.
- Supplier collaboration improves relational stability and joint response capacity.
- Flexible manufacturing ensures internal adaptability when the external environment shifts.
- Inventory buffers provide a time cushion during disruptions.
- Diversified sourcing reduces concentrated dependency risk.

This layered structure suggests that U.S. manufacturers may be prioritising "smart resilience"—using technology and partnerships to reduce the need for excessive redundancy, while still maintaining targeted structural safeguards.

Theoretical implications

These findings support resilience as a dynamic capability, where competitive advantage emerges from sensing disruption, seizing adaptive options, and reconfiguring resources. The ranking of strategies also implies that resilience effectiveness depends on capability integration rather than isolated interventions. Digital transformation appears to function as a meta-capability that enhances the effectiveness of other resilience approaches by improving visibility, data quality, and coordination speed.

Practical implications for U.S. manufacturing leaders

For managers, the results highlight several actionable priorities:

1. Prioritise digital visibility and analytics

   Investment in supply chain visibility, predictive planning, and integrated data platforms can improve responsiveness and reduce disruption impact.

2. Build deeper supplier partnerships

   Move beyond price-driven relationships toward shared risk planning, transparent information exchange, and collaborative performance governance.

3. Invest in flexible production models

Modular production layouts, cross-trained workforce models, and scalable capacity planning can protect performance during volatile periods.

4. Use buffers strategically, not universally

   Focus redundancy on high-risk or high-criticality components instead of expanding inventory across the board.

5. Diversify with a long-term lens

   Expect sourcing diversification to yield returns over time, and align it with digital governance and standardised quality systems to reduce complexity costs.

Limitations

As with most resilience-performance studies, several limitations should be recognised:

- If your data is cross-sectional, it may capture associations rather than long-term causal effects.
- Self-reported survey measures can introduce perceptual bias.
- Strategy effectiveness may vary across sub-sectors (e.g., automotive vs pharmaceuticals vs electronics), which might not be fully captured without industry-level controls.
- The post-pandemic period is still evolving, meaning resilience priorities could shift again with new geopolitical or technological shocks.

Future research directions

Building on these limitations, future studies could:

- Use longitudinal data to track whether diversification and buffers show stronger effects over multiple years.
- Examine interaction effects, such as whether digital maturity amplifies the impact of collaboration and flexible manufacturing.

- Compare resilience-performance outcomes across firm sizes to understand how SMEs differ from large manufacturers.
- Explore the role of policy incentives and regional industrial ecosystems in shaping U.S.-specific resilience choices.

Concluding interpretation

Overall, the findings suggest that U.S. manufacturing firms are moving away from one-dimensional resilience approaches and toward integrated strategies that combine technology, partnerships, and flexible operations. Digital transformation appears to be the strongest performance driver, likely because it enables faster sensing and coordinated response across complex networks. Supplier collaboration and flexible manufacturing further reinforce operational stability under uncertainty. While diversified sourcing and inventory buffers remain essential components of resilience, their performance impact may depend on how intelligently they are deployed alongside digital and relational capabilities. This integrated approach represents a promising blueprint for sustaining operational performance in a post-pandemic world characterised by persistent disruption risk.

Conclusion

The COVID-19 pandemic fundamentally redefined the priorities and architecture of global supply chains, transforming resilience from a background consideration into a central pillar of operational strategy. This study examined how post-pandemic resilience strategies—specifically diversified sourcing, flexible manufacturing, digital transformation, inventory buffers, and supplier collaboration—affect the operational performance of U.S. manufacturing firms. The analysis demonstrates that resilience is not a singular capability but a composite of interrelated practices that collectively determine a firm's ability to withstand, adapt to, and recover from disruptions.

Among the strategies evaluated, digital transformation emerged as the most powerful driver of operational improvement. Through enhanced visibility, predictive analytics, and data-driven decision-making, technology has enabled firms to anticipate

disruptions, adjust production plans, and maintain service reliability. This aligns with broader industrial trends showing that digitalization underpins adaptive capacity and strengthens coordination across multi-tier supply networks. The results affirm that digital maturity is now a prerequisite for achieving both resilience and efficiency in manufacturing.

Supplier collaboration was also found to play a crucial role in mitigating risk and stabilizing operations. By fostering trust, transparency, and joint contingency planning, firms can co-create flexibility within their supply chains. Collaborative arrangements help shorten recovery times, reduce uncertainty, and promote mutual problem-solving during crises. Similarly, flexible manufacturing systems enhance internal responsiveness by allowing production reconfiguration and rapid capacity adjustments—capabilities that directly support performance indicators such as delivery reliability and throughput.

While inventory buffers and diversified sourcing contribute to resilience, their benefits appear more nuanced. Strategic redundancy—whether in stock or sourcing—is effective when guided by accurate data and integrated with broader resilience frameworks. Excessive inventory or poorly coordinated diversification can elevate costs without corresponding performance gains. Thus, resilience must balance short-term stability with long-term efficiency to remain sustainable.

The overall pattern revealed by this study suggests that post-pandemic resilience among U.S. manufacturers is increasingly hybrid and digitally enabled. Firms are moving beyond isolated risk-management tactics toward a system-wide approach combining technological, structural, and relational elements. Resilience, in this sense, functions as a dynamic capability that enables continuous adaptation rather than episodic recovery. The evidence also supports the view that resilience investments, when strategically aligned, can enhance—not undermine—operational performance.

Managerial Implications

For practitioners, these findings emphasize several priorities. First, firms should prioritise digital integration across their supply networks to achieve real-time

visibility and proactive risk detection. Second, collaborative partnerships should replace transactional supplier relationships to ensure continuity during uncertainty. Third, flexible manufacturing capabilities and selective inventory strategies should be developed to maintain responsiveness without eroding efficiency. Collectively, these actions can help firms transition from reactive crisis management to proactive resilience-by-design.

Policy and Research Implications

From a policy standpoint, the results highlight the importance of supporting digital infrastructure and advanced manufacturing technologies in the U.S. industrial ecosystem. Government incentives, workforce development in digital skills, and public–private collaborations can amplify industry-wide resilience. For academia, future research should examine longitudinal data to assess how resilience strategies evolve and their sustained impact on profitability and competitiveness. Studies comparing small and large manufacturers, or different subsectors, could also deepen understanding of contextual factors influencing resilience outcomes.

Final Reflection

In conclusion, this study reinforces that post-pandemic supply chain resilience is both a strategic necessity and a performance enabler. U.S. manufacturing firms that integrate digital innovation, collaborative relationships, and operational flexibility are better positioned to navigate volatility while maintaining productivity and cost control. As global disruptions continue to emerge—from geopolitical tensions to climate-related shocks—the capacity to build intelligent, adaptive, and technology-driven supply chains will define the next era of manufacturing excellence.

Conflicts of Interest: "The authors declare no conflict of interest."

References

1. Dalal, A. (2018). Cybersecurity And Artificial Intelligence: How AI Is Being Used in Cybersecurity To Improve Detection And Response To Cyber Threats. Turkish Journal of Computer and Mathematics Education Vol, 9(3), 1704-1709.

2. Mohammad, A., & Mahjabeen, F. (2023). Revolutionizing solar energy with AI-driven enhancements in photovoltaic technology. BULLET: Jurnal Multidisiplin Ilmu, 2(4), 1174-1187.

3. Dalal, Aryendra. (2019). Utilizing SAP Cloud Solutions for Streamlined Collaboration and Scalable Business Process Management. SSRN Electronic Journal. 10.2139/ssrn.5422334.

4. Tiwari, A. (2023). Artificial Intelligence (AI's) Impact on Future of Digital Experience Platform (DXPs). Voyage Journal of Economics & Business Research, 2(2), 93-109.

5. Dalal, A. (2020). Harnessing the Power of SAP Applications to Optimize Enterprise Resource Planning and Business Analytics. Available at SSRN 5422375.

6. Hegde, P. (2021). Automated Content Creation in Telecommunications. Jurnal Komputer, Informasi dan Teknologi, 1(2), 20–20.

7. Dalal, A. (2015). Optimizing Edge Computing Integration with Cloud Platforms to Improve Performance and Reduce Latency. SSRN Electronic Journal. 10.2139/ssrn.5268128.

8. Bahadur, S., Mondol, K., Mohammad, A., Al-Alam, T., & Bulbul Ahammed, M. (2022). Design and Implementation of Low Cost MPPT Solar Charge Controller.

9. Dalal, A. (2020). Cyber Threat Intelligence: How to Collect and Analyse Data. International Journal on Recent and Innovation Trends in Computing and Communication.

10. Mohammad, A., & Mahjabeen, F. (2023). Revolutionizing solar energy: The impact of artificial intelligence on photovoltaic systems. International Journal of Multidisciplinary Sciences and Arts, 2(3), 591856.

11. Dalal, A. (2023). Data Management Using Cloud Computing. Available at SSRN 5198760.

12. Dalal, A. (2023). Building Comprehensive Cybersecurity Policies to Protect Sensitive Data in the Digital Era. Available at SSRN 5424094.

13. Dalal, Aryendra. (2019). Maximizing Business Value through Artificial Intelligence and Machine Learning in SAP Platforms. SSRN Electronic Journal. 10.2139/ssrn.5424315.

14. Hegde, P. (2019). AI-Powered 5G Networks: Enhancing Speed, Efficiency, and Connectivity. International Journal of Research Science and Management, 6(3), 50-61.

15. Mohammad, A., Mahjabeen, F., Al-Alam, T., Bahadur, S., & Das, R. (2022). Photovoltaic Power Plants: A Possible Solution for Growing Energy Needs of Remote Bangladesh. Available at SSRN 5185365.

16. Dalal, A. (2018). Driving Business Transformation through Scalable and Secure Cloud Computing Infrastructure Solutions. Available at SSRN 5424274.

17. Dalal, A. (2018). Revolutionizing Enterprise Data Management Using SAP HANA for Improved Performance and Scalability. Available at SSRN 5424194.

18. Dalal, Aryendra. (2022). Addressing Challenges in Cybersecurity Implementation Across Diverse Industrial and Organizational Sectors. SSRN Electronic Journal. 10.2139/ssrn.5422294.

19. Tiwari, A. (2022). AI-Driven Content Systems: Innovation and Early Adoption. Propel Journal of Academic Research, 2(1), 61–79.

20. Dalal, A. (2020). Exploring Next-Generation Cybersecurity Tools for Advanced Threat Detection and Incident Response. Available at SSRN 5424096.

21. Dalal, Aryendra. (2020). Exploring Advanced SAP Modules to Address Industry-Specific Challenges. SSRN Electronic Journal. 10.2139/ssrn.5268100.

22. Hegde, P., & Varughese, R. J. (2023). Elevating Customer Support Experience in Telecom: AI chatbots, virtual assistants, AR. Propel Journal of Academic Research, 3(2), 193–211.

23. Tiwari, A. (2023). Generative AI in Digital Content Creation, Curation and Automation. International Journal of Research Science and Management, 10(12), 40–53.

24. Dalal, A. (2020). Cybersecurity and privacy: Balancing security and individual rights in the digital age. Available at SSRN 5171893.

25. Dalal, A. (2017). Developing Scalable Applications Through Advanced Serverless Architectures in Cloud Ecosystems. Available at SSRN 5423999.

26. Maizana, D., Situmorang, C., Satria, H., Yahya, Y. B., Ayyoub, M., Bhalerao, M. V., & Mohammad, A. (2023). The Influence of Hot Point on MTU CB Condition. Journal of Renewable Energy, Electrical, and Computer Engineering, 3(2), 37–43.

27. Tiwari, A. (2022). Ethical AI Governance in Content Systems. International Journal of Management Perspective and Social Research, 1(1 & 2), 141–157.

28. Hegde, P., & Varughese, R. J. (2022). Predictive Maintenance in Telecom Using AI. Journal of Mechanical, Civil and Industrial Engineering, 3(3), 102–118.

29. Dalal, A. (2020). Leveraging Artificial Intelligence to Improve Cybersecurity Defences Against Sophisticated Cyber Threats. Available at SSRN 5422354.

30. Dalal, Aryendra. (2017). Exploring Emerging Trends in Cloud Computing and Their Impact on Enterprise Innovation. SSRN Electronic Journal. 10.2139/ssrn.5268114.

31. Dalal, Aryendra. (2018). Leveraging Cloud Computing to Accelerate Digital Transformation Across Diverse Business Ecosystems. SSRN Electronic Journal. 10.2139/ssrn.5268112.

32. Hegde, P., & Varughese, R. J. (2020). AI-Driven Data Analytics: Insights for Telecom Growth Strategies. International Journal of Research Science and Management, 7(7), 52–68.

33. Mohammad, A., & Mahjabeen, F. (2023). Promises and challenges of perovskite solar cells: a comprehensive review. BULLET: Jurnal Multidisiplin Ilmu, 2(5), 1147–1157.

34. Orugboh, O. G., Omabuwa, O. G., & Taiwo, O. S. (2024). Predicting Neighborhood Gentrification and Resident Displacement Using Machine Learning on Real Estate, Business, and Social Datasets. Journal of Social Sciences and Community Support, 1(2), 53-70.

35. Daniel, E., Opeyemi, A., Ruth, O. E., & Gabriel, O. (2020). Understanding Childbearing for Households in Emerging Slum Communities in Lagos State, Nigeria. International Journal of Research and Innovation in Social Science, 4(9), 554-560.