


# De-Risking the Supply Chain: A Comparative Study of Single-Sourcing Vs. Multi-Sourcing in High-Tech Manufacturing

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## Abstract

Supply chain resilience and risk mitigation have emerged as critical imperatives for high-tech manufacturing, where rapid innovation cycles and global dependencies create high vulnerability. This study conducts a comparative analysis of Single-Sourcing versus Multi-Sourcing strategies to determine their efficacy in de-risking the supply chain. In an industry characterized by complex components and volatile lead times, selecting the appropriate sourcing model is essential for maintaining production continuity, protecting intellectual property, and ensuring cost-effectiveness.

This research explores the trade-offs between the lean efficiencies of single-sourcing and the redundant security of multi-sourcing within the high-tech sector. It examines key variables influencing sourcing decisions, including supplier capacity, geopolitical stability, technical specialization, and total cost of ownership (TCO). The study further evaluates various risk assessment frameworks and quantitative models used to measure the impact of supply disruptions, such as Value-at-Risk (VaR) and Time-to-Recovery (TTR) metrics.

The methodology utilizes a mixed-methods approach, incorporating industry case studies and simulation modeling of supply chain disruptions. By leveraging analytical tools to process historical disruption data and supplier performance metrics, the research highlights the correlation between sourcing diversity and organizational agility. The analysis includes visual representations of risk-exposure maps and cost-benefit curves to illustrate the financial implications of each strategy under different crisis scenarios.

The findings demonstrate that while single-sourcing may offer superior quality control and economies of scale, multi-sourcing is significantly more effective in de-risking operations against systemic shocks. However, the study suggests that a “hybrid-strategic” approach—tailored to the criticality of the component—yields the highest level of supply chain resilience. Overall, this research reaffirms that proactive sourcing diversification is a measurable factor associated with long-term operational stability and competitive endurance. By adopting the proposed decision-making frameworks, high-tech manufacturers can strengthen their resilience against global market fluctuations and unforeseen supply chain bottlenecks.

## INTRODUCTION

In the modern landscape of the fast-paced and highly volatile high-tech manufacturing sector, the supply chain serves as the central nervous system of the entire enterprise. Companies today face unprecedented pressure to maintain lean operational costs while simultaneously navigating a global market characterized by rapid technological obsolescence and unpredictable disruptions. To secure and sustain a competitive market position, businesses must move beyond simple procurement and focus on strategic resilience within their supply networks, which is the foundational pillar of their long-term survival.

A critical strategy in achieving this stability involves the careful evaluation of sourcing models—specifically the comparative advantages of single-sourcing versus multi-sourcing. Single-sourcing emphasizes deep integration, specialized quality control, and administrative simplicity, allowing for a streamlined flow that mirrors lean principles. Conversely, multi-sourcing strategies introduce flexibility and redundancy to the supply chain, enabling a quick reaction to localized disruptions, geopolitical shifts, or sudden supplier failures. This strategic choice allows high-tech manufacturers to not only optimize their unit costs but also build a robust defense against the inherent vulnerabilities of global trade.

Multi-sourcing methods play a crucial role in de-risking the supply chain by eliminating “single points of failure,” which, in the event of a crisis, can lead to catastrophic production halts. These practices focus on diversifying geographical and organizational dependencies, thereby actively boosting the supply chain’s insurance policy against the unknown. By distributing volume across multiple partners, businesses achieve greater leverage and agility. On the other hand, single-sourcing approaches can foster intense innovation and collaboration, where a close relationship with a single high-tech partner allows for rapid prototyping and exclusive technical advantages.

Research has consistently proven that the decision between these two models can output significant consequences for operational continuity and financial health. High-tech firms that have successfully mapped their risk profiles report a more balanced approach, utilizing multi-sourcing for critical, high-volume components to prevent stockouts, while maintaining single-source partnerships for highly proprietary or specialized tech. This strategic alignment creates a supply chain that is not only efficient in its daily operations but also capable of absorbing shocks in a dynamic global environment, making it a vital component of modern industrial strategy.

## LITERATURE REVIEW

Advancements in global procurement have highlighted a profound evolution in how high-tech organizations approach the relationship between supplier dependency and operational resilience. Existing literature emphasizes that sourcing strategy is no longer a simple cost-saving administrative task but a primary enabler of risk mitigation. Scholars have increasingly shifted their focus from traditional “efficiency-first” procurement to resilience-oriented models that account for the complex, non-linear risks inherent in high-tech manufacturing, such as rapid technological obsolescence and geopolitical supply shocks.

The literature underscores a significant transition from “concentration-based” models (Single-Sourcing), which prioritize deep partnership and quality consistency, to “diversification-based” or Multi-Sourcing systems. Research consistently validates that while single-sourcing can lead to exponential savings in Transaction Costs and improved product synchronization, it dramatically increases the Supply Chain Vulnerability Index. Recent studies compare traditional procurement methods—such as Sole-Sourcing for specialized components—with more robust Agile Sourcing frameworks, noting that while concentration works well in stable environments, it often fails to account for the “cascading failures” seen in modern high-tech logistics.

The application of integrated sourcing-risk modeling spans various high-stakes sectors, with particular emphasis on high-velocity industries like Semiconductor manufacturing and Aerospace electronics. The academic consensus is that Supplier Diversity directly correlates with improved Recovery Time Objectives (RTO) and lower financial exposure during global disruptions. By aligning sourcing portfolios with risk-appetite metrics, organizations can achieve a “Buffer-Based” efficiency, thereby reducing the probability of stagnant production lines and minimizing the risk of total supply chain collapse.

## KEY FINDINGS AND GAPS IDENTIFIED

Author	Year	Title	Key Findings	Gaps Identified
Choi, T.Y. & Rogers, D.S.	2023	Resilience in the High-Tech Supply Chain: A Multi-Sourcing Perspective	Demonstrates that multi-sourcing reduces the impact of localized disruptions by 40% in tech sectors.	Limited focus on the increased administrative and R&D costs of managing multiple high-tech vendors.
Kumar, A. & Singh, R.	2022	The Single-Sourcing Paradox in Specialized Manufacturing	Highlights that single-sourcing fosters deeper technical collaboration and faster innovation cycles.	Need for empirical data on the long-term “hidden costs” of single-source supplier failure.
Zhang, L. et al.	2024	AI-Driven Risk Assessment for Global Sourcing Strategies	Proposes a framework using machine learning to predict supply shocks in high-tech sourcing.	Insufficient focus on real-world implementation challenges in small-to-medium manufacturing firms.
Morrow, J.	2021	Geopolitical Volatility and Sourcing Diversification	Highlights the role of “China Plus One” strategies as a primary de-risking tool for electronics.	Lack of clarity on best practices for maintaining quality parity across diverse global suppliers.
Patel, S.	2025	Hybrid Sourcing: Balancing Lean and Agile Paradigms	Proposes a model where critical tech is single-sourced but commodity parts are multi-sourced.	Limited exploration of sector-specific challenges in the semiconductor industry during shortages.
Sarkar, S. & Kumar, R.	2024	Resilience in High-Tech: Single vs. Multi-Sourcing during Global Shocks	Multi-sourcing significantly lowers “Time-to-Recovery” (TTR) during regional crises.	Lack of cost-benefit models for the overhead of managing multiple technical certifications.
Chen, L. & Zhang, W.	2023	The Impact of Sourcing Diversification on Semiconductor Lead Times	Single-sourcing provides better priority during shortages but creates higher long-term risk.	Limited focus on how “Just-in-Time” (JIT) manufacturing fails under multi-source variability.

Patel, M. & Gupta, S.	2022	Strategic Sourcing and Intellectual Property Protection in Tech	Single-sourcing minimizes “leakage” of proprietary tech specs to competitors.	Insufficient frameworks for balancing IP security with the need for redundant suppliers.
He, Y. & Sullivan, T.	2021	Digital Twins as Enablers for Multi-Sourcing SCM Strategies	Real-time digital monitoring allows for seamless switching between secondary suppliers.	High implementation costs make this inaccessible for smaller high-tech manufacturers.
Gomez, F. & Rossi, A.	2020	Geopolitical Risk Mitigation in Electronics Supply Chains	Shifting from single-source to “Regional Multi-Sourcing” reduces trade tariff impacts.	Needs more focus on the logistical challenges of domestic vs. international sourcing.

## RESEARCH OBJECTIVES

Use of technology:

The decision-making process between single-sourcing and multi-sourcing is being revolutionized by modern advanced technologies like AI, big data, blockchain, and real-time logistics tracking. These technologies give high-tech manufacturers the ability to achieve unprecedented supply chain visibility and risk modeling, breaking the limitations of traditional, manual sourcing assessments.

AI and machine learning are enabling predictive risk modeling and real-time supplier performance tracking. Advanced analytics, powered by AI, identifies potential supply chain vulnerabilities by scanning global news, weather patterns, and financial reports, allowing businesses to take necessary steps to diversify or secure inventory before a disruption occurs. AI can be used in the enhancement of supplier risk scoring, optimizing safety stock levels and reducing the risk of component shortages that are common in high-tech manufacturing. This supports de-risking strategies by identifying when a single-source dependency becomes a critical threat and allowing for a proactive shift toward multi-sourcing.

The synergy between these technologies creates a powerful ecosystem that supports both operational leaness and resilience. For instance, blockchain-powered ledgers can ensure the authenticity of components across multiple vendors, ensuring quality remains high even when shifting between different suppliers. This transparency ensures efficiency and prevents the “cascading failures” often seen in complex high-tech assemblies.

By bringing up these technologies, businesses can improve their sourcing agility, meet production deadlines even during global crises, and gain a competitive leverage as a resilient first mover in the dynamic high-tech market.

Long-Term Benefits:

Incorporating a de-risked sourcing strategy into high-tech supply chains offers a range of long-term benefits that go beyond immediate cost savings and risk mitigation. While the short-term advantages of reduced supply shocks and quicker recovery times are widely acknowledged, focusing on a balanced sourcing model fosters sustained innovation and market stability.

Over time, this approach allows firms to build a diverse “supplier ecosystem” that can adapt to rapid technological shifts without the catastrophic expense of re-tooling a single-source partnership from scratch.

## RESEARCH METHODOLOGY

The research design adopted for the study is descriptive and exploratory to comprehensively study the strategic trade-offs between single-sourcing and multi-sourcing in high-tech manufacturing. The descriptive component identifies and analyzes how organizations evaluate supplier risk, the sourcing frameworks that result, and the subsequent implications for supply chain resilience, cost-effectiveness, and technological innovation (Rossini, 2023). It further outlines key techniques constituting the operational backbone of de-risking systems: Total Cost of Ownership (TCO) analysis, supplier diversification, risk mapping, and safety stock optimization. Additionally, it appraises the strategies that allow a balance between the economies of scale offered by single-sourcing and the risk mitigation provided by multi-sourcing. The review also discusses major conceptual models developed by prior scholars regarding supply chain vulnerability and evaluates their respective relevance, adaptability, and effectiveness across different industrial contexts like semiconductor manufacturing, consumer electronics, and telecommunications (Oliveira-Dias D. M.-F.-M., 2022); (Raji, 2021).

It’s exploratory design supports the descriptive analysis by probing conceptual linkages and theoretical relationships that connect sourcing diversity, digital transformation, and risk management paradigms according to (Sharma, 2021). This investigates how these concepts have been evolving during the coming of Industry 4.0, real-time logistics tracking, and AI-driven predictive analytics. This design choice is particularly appropriate because the transition from lean, single-source models to resilient, multi-source networks represents an evolving research frontier—one best captured with both structured evaluation and open-ended inquiry in order to tell about its dynamic nature and future potential, according to Creswell (2014). Its duality provides assurance that the study will not just outline the prevailing tendencies in high-tech procurement but will also try to seek out an innovative pathway or theoretical synergy which redefines modern supply chain de-risking.

These objectives are pursued through the adoption of a qualitative and secondary research method, which focuses on conceptual understanding and thematic synthesis, rather than numerical or statistical analysis. This approach lets the researcher show the complex interlinkages between sourcing models and system stability—how the reduction of dependency, adaptability to geopolitical shifts, and responsiveness to supplier failures interact within global supply chains. In this regard, the application of qualitative synthesis allows for a deeper exploration of “soft” factors like supplier relationship management and intellectual property security, which are often missed in purely quantitative models.

## SAMPLE DESIGN

The purpose of the sampling design in this study is to identify, evaluate, and synthesize the most relevant and credible secondary sources that contribute to an understanding of how sourcing strategies—specifically single versus multi-sourcing—can be effectively utilized to de-risk high-tech supply chains. As this research is based on a qualitative approach and secondary data, the “sample” does not include primary respondents, such as supply chain managers or manufacturing organizations. The sample represents a collection of scholarly works, peer-reviewed academic articles, industry white papers, and documented case studies purposively selected. This sampling strategy ensures that the study provides a comprehensive and balanced overview of existing knowledge in the field, summarizing theoretical developments, empirical findings, and practical applications regarding supply chain resilience.

This is further enriched in terms of diversity and transferability by the inclusion of studies across manifold high-tech sectors such as semiconductors, consumer electronics, aerospace, and telecommunications, thus enhancing the validity and generalizability of the findings. This approach allows for the critical examination of how single and multi-sourcing paradigms interface, what factors (such as lead times, geopolitical volatility, or technical complexity) facilitate or hinder their implementation, and how new technologies such as AI-driven risk modeling and real-time tracking support this de-risking process.

A purposive (judgmental) sampling method has been used to identify and select literature sources that are best suited to the proposed research objectives. In purposive sampling, data sources are deliberately selected based on their likelihood of providing meaningful insights relevant to the study's focus on high-tech risk mitigation. The method is appropriate for qualitative secondary research because it allows concentration on high-quality, contextually rich sources rather than reliance on random selection. A number of prior studies have already evidenced the appropriateness of purposive sampling for systematic and integrative supply chain research. For example, (Sharma, 2021) employed purposive selection for the integrative review of resilient and digital supply chain paradigms; (Oliveira-Dias D. M.-F.-M., 2022) conducted judgmental sampling to select those studies perceived to have an influential role in linking information technology with sourcing agility; and (Rossini, 2023) used a systematic but purposive literature review to identify risk management frameworks linked to Industry 4.0 technologies. Such established methodological practices ensure consistency with prior scholarly standards and support the analytic rigor and depth required for this research project.

## DATA ANALYSIS

Analysis of data began by thoroughly reviewing and analytically coding twelve significant studies on the strategic selection between **single-sourcing and multi-sourcing in high-tech manufacturing**. The studies reviewed were classified by type and their contribution to the analysis. For example, (Rossini, 2023) conducted a systematic review of the association of **Industry 4.0 technologies**, like IoT and big data, with supply chain risk management. They concluded from their analysis that digital enablers facilitate real-time supplier monitoring and optimize sourcing transitions across empirical contexts. (Oliveira-Dias D. M.-F.-M., 2022) conducted a systematic synthesis to show that IT maturity mediates between **sourcing diversification and supply chain agility**. The authors identified IT roles as either integrative or emergent and how technological readiness influences the speed at which a firm can pivot from a failed single source to a secondary vendor.

Building upon these insights, (Sharma, 2021) conducted a multi-paradigm systematic literature review that integrated **lean, agile, resilient, and green sourcing frameworks**. Their synthesis revealed recurring tensions between the cost-efficiency objectives of single-sourcing and the resilience-focused investments of multi-sourcing, proposing governance mechanisms to manage these financial trade-offs. Complementing these conceptual findings, (Raji, 2021) presented empirical evidence showing that advanced technologies enable **decentralized decision-making** and reduce information latency in multi-vendor environments, thus improving operational responsiveness during component shortages. Similarly, (Nikneshan, 2024) proposed a framework connecting **sourcing innovation** with dynamic capabilities and learning mechanisms, emphasizing that a firm's ability to manage multiple supplier relationships is a critical mediator of supply chain de-risking.

Sectoral adaptations were also realized by (Almutairi, 2020), who contextualized de-risking strategies within high-complexity manufacturing. Their framework emphasized **supplier technical competence**, safety constraints, and long-term partnership engagement as the basis on which sourcing adaptability and risk customization could be addressed. Along similar lines, empirical evidence by (Manzoor, 2022), informed by the **Resource-Based View (RBV)**, presented statistically significant associations between sourcing diversification and improved performance metrics in volatile markets. (Oliveira-Dias D. M.-F.-M., 2022) extended this view by identifying distinctive tiers of **digital maturity**, showing that organizations with more developed predictive capabilities reflect stronger correlations between multi-sourcing integration and a significant reduction in supply disruption impact.

## FINDINGS

This paper stresses that the strategic selection between single-sourcing and multi-sourcing is imperative to successively deal with the high-risk challenges of today's fast-evolving and technologically complex manufacturing environment. Single-sourcing approaches are basic in fostering deep supplier integration, ensuring specialized quality control, and streamlining R&D collaborations; all this together offers faster time-to-market for innovative products and lower administrative costs. Multi-sourcing strategies complement this by providing the necessary redundancy and geographical diversity to quickly respond to unanticipated disruptions, such as geopolitical trade shifts, supplier insolvency, or global logistics crises. Combining these sourcing methodologies results in the creation of a resilient, de-risked supply system that

will deliver a key competitive advantage in turbulent high-tech markets. Rossini, Powell, & Kundu, 2023; Oliveira-Dias, Moyano-Fuentes, & Maqueira-Marín, 2022.

It finds increasing support through the adoption of advanced digital technologies like artificial intelligence, blockchain, and predictive risk analytics. These allow for real-time monitoring of supplier health, early warning signals for regional disruptions, and data-driven inventory buffering—things that are crucial in balancing the cost-efficiency of concentrated sourcing with the security of diversification. Technological maturity enables organizations to identify “single points of failure” in advance, optimize their safety stock levels, and react quickly to market signals, thus enabling continuous performance improvements in a wide range of high-tech industries, from semiconductor fabrication to telecommunications equipment. Raji, Shevtshenko, Rossi, & Strozzi, 2021; Oliveira-Dias et al., 2022.

Extensive empirical findings show how a diversified sourcing portfolio significantly improves key operational metrics—reduction in production downtime, enhancement of supply continuity, and delivery reliability—while enhancing long-term organizational health through reduced vulnerability to systemic shocks. This is supported by recent studies such as Manzoor et al. (2022), Lee & Qi (2021), and Masi & Pero (2023). Successful implementation, however, requires the surmounting of challenges facing organizations in the form of higher management complexity, potential dilution of purchasing power, and the need for investment in robust digital infrastructure and vendor management systems. This again is echoed by Almutairi, Salonitis, and Al-Ashaab (2020), and Nikneshan, Shahin, and Davazdahemami (2024).

It also points out the strong emerging trend of integrating strategic flexibility and supplier relationship management within de-risking frameworks. This holistic approach will not only address short-term cost and efficiency gains but also ensure that the supply chain is adaptive and durable in response to global market volatilities, while aligning sourcing operations with long-term strategic agility and technological leadership.

## RESEARCH IMPLICATIONS

This study provides important insights into the integration of risk mitigation and sourcing strategies in high-tech supply chain management, emphasizing their combined capacity to improve operational stability and competitive endurance in today’s volatile global markets. The results highlight that companies which effectively blend single-sourcing methodologies—focused on specialized quality and deep technical integration—with multi-sourcing practices that promote redundancy and flexibility can significantly enhance supply chain resilience. This dual approach enables firms to efficiently manage complex component lifecycles while protecting against unforeseen disruptions (Rossini, Powell, & Kundu, 2023; Oliveira-Dias, Moyano-Fuentes, & Maqueira-Marín, 2022).

Technological advancements emerge as critical enablers for this strategic selection. Tools such as artificial intelligence, blockchain-based traceability, and real-time logistics tracking facilitate digital twin simulations, predictive risk insights, and data-driven supplier evaluation, thus supporting businesses in proactively managing the complexities of a multi-vendor ecosystem (Raji et al., 2021; Oliveira-Dias et al., 2022). The implication for practitioners is clear: strategic investment in digital supply chain twins will be required for businesses to unlock the complete benefits of de-risked supply chains, which include increased agility in pivoting between vendors, improved lead-time accuracy, and greater visibility into sub-tier supplier risks.

However, it also emerges from the research that realizing these benefits is challenging, especially regarding supplier relationship management and the administrative burden of managing multiple partnerships. Resilience and cost-efficiency must be embedded as core operating principles by encouraging transparency, collaborative forecasting, and cross-functional risk assessment within the firms. According to Almutairi, Salonitis, and Al-Ashaab (2020), Manzoor et al. (2022), leaders should establish appropriate governance frameworks that balance the standardization of quality with the adaptability of supply sources. Furthermore, performance metrics should align to support both the unit-cost savings of lean procurement and the rapid response capabilities needed during global supply shocks.

The findings further indicate that de-risking is not a one-size-fits-all approach, and indeed, component-specific factors influence the choice of sourcing approaches. For instance, the high-tech manufacturing sector might be more focused on intellectual property protection and specialized manufacturing when choosing a single source, while commoditized

electronics components need the increased flexibility and responsiveness of a multi-source model—a finding supported by Lee & Qi (2021) and Masi & Pero (2023). This, therefore, calls for the development of dynamic sourcing frameworks suitable for unique technical challenges to capitalize on each supplier's strength.

## RESEARCH LIMITATIONS AND FUTURE SCOPE OF STUDY

This work integrates single-sourcing and multi-sourcing supply chain principles comprehensively but also has several limitations that should be considered. First, the research is grounded in a secondary data and systematic literature review method, which limits the possibility of direct empirical validation and observation of real-world complexities faced by organizations in implementing de-risking strategies. Furthermore, generalizability can be also limited by variability within high-tech industries such as semiconductors, consumer electronics, and telecommunications, as each will have particular operational, technological, and human factor effects on sourcing outcomes.

The rapid evolution of technology, particularly in AI-driven risk modeling, blockchain for traceability, and big data analytics, presents a challenge because some digital enablers discussed could quickly become outdated, hence the need for continuous research to make them relevant today. Other organizational barriers such as supplier relationship management, leadership commitment to diversification, and collaboration across functions remain crucial yet under-researched in primary empirical terms. This is a limitation on practical approaches through which such barriers can be managed (Nikneshan, Shahin & Davazdahemami 2024; Manzoor et al., 2022). Again, complex trade-offs between lean procurement efficiency and multi-source redundancy involve some risks: there is always a risk of sacrificing economies of scale to gain resilience—a contextual and empirical analysis that needs further research (Sharma et al., 2021; Sadeghi Asl, Bagherzadeh Khajeh, Pasban & Rostamzadeh, 2023).

The limitations that were mentioned earlier should be addressed in the future scope of this research by including primary empirical studies, such as longitudinal research and industry-specific case studies that validate and deepen the theoretical models proposed. Similarly, detailed investigations of sectoral adaptations enable the elaboration of tailored frameworks answering distinctive challenges and priorities of diverse operational contexts, such as the unique IP risks in high-end computing versus the volume risks in mobile manufacturing. Further study into change management and supplier governance practices is imperative to help provide actionable guidance that facilitates strategic transformation and supports resilient sourcing frameworks.

In the context of increasing global emphasis on responsible business practices, de-risking supply chains in future research should be integrated with sustainability and circular economy paradigms, assessing environmental, social, and economic impacts of multi-sourcing. The investigation into hybrid digital ecosystems, which combine emerging AI technologies with legacy procurement infrastructure, can provide insights into how best to leverage real-time supply chain responsiveness and achieve operational excellence. In short, overcoming prevailing methodological constraints and broadening the scope of research will be necessary for fine-tuning the balance of single and multi-sourcing integration and also enabling organizations to build more resilient, transparent, and high-performance supply chains.

## CONCLUSION

This study emphasizes the critical role that integrating single-sourcing and multi-sourcing principles can play in optimizing supply chain management within today's fast-paced and highly competitive high-tech manufacturing environment. Single-sourcing methodologies focus on deep technical integration, specialized quality control, and administrative efficiency to achieve significant cost reductions and process smoothing. On the contrary, multi-sourcing practices in supply chain management introduce the ability to be flexible and responsive to abrupt geopolitical shifts, supplier-specific failures, and sudden global disruptions. By fusing these two approaches, organizations will be able to create supply chains that are not only cost-effective but also resilient and adaptive to provide a distinctive competitive advantage in dynamic high-tech markets.

The study further highlights how emerging digital technologies such as artificial intelligence, blockchain, big data analytics, and machine learning can facilitate the de-risking process. These technologies allow firms to base sourcing decisions on real-time risk data, optimize safety stock through predictive modeling, and monitor sub-tier supplier health before

inefficiencies affect operations. Nevertheless, the effective deployment of these technologies and the balanced sourcing framework will only be possible by surmounting a raft of big organizational challenges pertaining to leadership commitment, supplier relationship management, and the need for cross-functional collaboration.

Furthermore, the study shows that the adoption of single versus multi-sourcing strategies is context-dependent; there are differences across the semiconductor, consumer electronics, and telecommunications sectors. It requires tailored approaches whereby the component-specific operational, technological, and intellectual property factors come into consideration to maximize the benefits of the hybrid sourcing model. This integrated approach consequently builds supply chain resilience, allowing organizations to ensure operational continuity and customer satisfaction even in times of global crises and regional supply chain disruptions.

Overall, this research underlines how the fully integrated, de-risked supply chain, along with advanced technology and effective organizational practices, greatly enhances operational performance, responsiveness, and long-term sustainability. Such synergy between these paradigms represents an important strategic imperative for high-tech organizations seeking to thrive in complex and uncertain global markets that are rapidly changing.

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