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Strategic Sourcing and Spend Analytics: A Framework for Cost Reduction and Supply Shock Mitigation

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Abstract
Strategic sourcing has evolved over four decades from a tactical procurement activity focused on price negotiation into a strategic function that shapes cost structure, supply reliability, and organizational resilience. Spend analytics has emerged alongside it as the analytical spine through which sourcing decisions become disciplined rather than episodic, and through which the vast transaction records generated by enterprise purchasing are translated into actionable intelligence about categories, suppliers, and commercial opportunities. The compounding shocks of the early 2020s—pandemic-driven supply disruption, geopolitical realignment affecting global trade routes, commodity price volatility, and the accelerating demands of the energy transition—have forced a reckoning with the assumptions of low-cost global sourcing that shaped procurement practice for much of the preceding generation. This paper advances a conceptual framework that treats strategic sourcing and spend analytics as co-equal pillars of cost reduction and supply shock mitigation, arguing that the two are mutually constitutive: sourcing strategy without analytical discipline fails to capture the value that category-level intelligence makes available, and analytical activity without strategic sourcing intent produces reports that do not translate into commercial outcomes. Drawing on the literatures of strategic sourcing, spend analytics, supplier relationship management, supply chain risk, and organizational resilience, the paper develops a four-capability framework organized around data foundation, category strategy, risk sensing, and governance and execution. The framework is offered as a conceptual integration of existing scholarship and practitioner literature rather than as an empirical validation of any specific sourcing program.

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1. Introduction

Procurement and sourcing activity in large organizations typically commands between thirty and seventy percent of total revenue, making it one of the largest cost categories and one of the most consequential managerial activities in contemporary enterprise operation (Monczka, Handfield, Giunipero, and Patterson, 2020; Van Weele, 2018; Chopra and Meindl, 2019; Porter, 1985; Kraljic, 1983). Decisions about what to buy, from whom, at what price, and on what terms shape not only the direct cost base of the organization but its exposure to supply disruption, its ability to innovate through supplier partnerships, its carbon footprint, and its compliance posture across regulatory regimes that have grown progressively more demanding through the

2010s and 2020s (Christopher and Peck, 2004; Sheffi, 2015; Simchi-Levi, Schmidt, and Wei, 2014; Chopra and Sodhi, 2014; Tang, 2006). The quality with which sourcing decisions are made, and the institutional architecture within which they are governed, therefore constitute a major determinant of both short-run financial performance and long-run competitive positioning.

The transformation of sourcing into a strategic function is a development of the past four decades, traceable to the seminal work of Kraljic (1983) on purchasing portfolio analysis and the subsequent evolution of the field through contributions on strategic sourcing methodology, supplier relationship management, total cost of ownership analysis, and category management (Monczka *et al*., 2020; Ellram, 1995; Cousins, Lamming, Lawson, and Squire, 2008; Bensaou, 1999; Trent and Monczka, 2003). A parallel evolution in information technology has made it possible to instrument the procurement process with comprehensive transaction data, and the resulting discipline of spend analytics has emerged as the analytical counterpart to strategic sourcing practice (Handfield, 2019; Schiele, 2019; Bag, Wood, Xu, Dhamija, and Kayikci, 2020; Choi, Wallace, and Wang, 2018; Gelderman and Van Weele, 2005). The two disciplines have developed in close dialogue: sourcing strategy sets the questions that analytics must answer, and analytics sets the evidentiary standards against which sourcing strategy must be formulated.

The compounding shocks of the early 2020s have forced a fundamental reconsideration of the assumptions underlying sourcing practice as it had matured through the 2000s and 2010s. The COVID-19 pandemic exposed the fragility of extended global supply chains, with shortages cascading through multi-tier networks in ways that few firms had anticipated or modeled (Ivanov, 2020; Ivanov and Dolgui, 2021; Queiroz, Ivanov, Dolgui, and Wamba, 2022; Belhadi, Kamble, Jabbour, Gunasekaran, Ndubisi, and Venkatesh, 2021; Miroudot, 2020). The Russia-Ukraine conflict beginning in 2022 disrupted energy, food, and metals markets and reshaped the political geography of global sourcing (IEA, 2022; Bordoff and O'Sullivan, 2022; Stern, 2022). Trade policy developments through the mid-2020s, including tariff actions, export controls, and content requirements linked to industrial policy, have introduced new dimensions of policy risk into sourcing decisions that had historically been governed primarily by commercial considerations (OECD, 2023; Bown, 2023; Miroudot and Rigo, 2024). Commodity price volatility, exchange rate movements, and inflationary pressure have simultaneously compressed the cost discipline that sourcing organizations must sustain.

In response, a substantial reorientation is underway in sourcing practice and in the scholarly and practitioner literature that accompanies it. Concepts that had been marginal or aspirational in pre-pandemic sourcing—dual sourcing for critical categories, regional supply footprints that trade some cost efficiency for reduced exposure, strategic inventory buffers, supplier financial health monitoring, multi-tier visibility, and the use of advanced analytics for risk sensing—have moved into the mainstream of sourcing strategy (Simchi-Levi and Simchi-Levi, 2020; Sheffi, 2020; Pettit, Croxton, and Fiksel, 2019; Hosseini, Ivanov, and Dolgui, 2019; Roscoe, Skipworth, Aktas, and Habib, 2022). The integration of these concerns into coherent sourcing architectures, however, remains uneven across organizations and across categories, and the frameworks available to practitioners for structuring that integration have not fully caught up with the pace of change in the sourcing environment.

The present paper advances a conceptual framework that organizes the literatures of strategic sourcing, spend analytics, supply chain risk management, and organizational resilience into a coherent architecture suited to the post-pandemic sourcing environment. The framework is not a prescription for any specific category or industry but a structure within which category-specific and industry-specific sourcing strategies can be developed and governed.

The paper proceeds as follows. Section 2 traces the historical evolution of strategic sourcing, the emergence of spend analytics, and the accumulating supply shocks that have shaped contemporary practice. Section 3 reviews the theoretical foundations on which an integrated framework can rest. Section 4 addresses spend analytics methodology and its principal outputs. Section 5 examines supply shock mitigation strategies and their integration with sourcing decisions. Section 6 develops the framework's four capabilities. Section 7 considers implications for stakeholders. Section 8 identifies limitations and future research directions. Section 9 concludes.

2. Context and Historical Foundations

2.1. The evolution of strategic sourcing

Strategic sourcing as a distinct field of practice emerged from the convergence, in the 1980s and 1990s, of several related developments: the recognition that purchasing commanded a larger share of value creation than traditional organizational structures acknowledged, the import of Japanese manufacturing practices that emphasized supplier partnership over adversarial bargaining, and the development of analytical frameworks that translated purchasing from a tactical activity into a strategic one (Kraljic, 1983; Porter, 1985; Womack, Jones, and Roos, 1990; Dyer, 1996; Lamming, 1993; Cousins *et al*., 2008; Monczka *et al*., 2020). Kraljic's 1983 paper on purchasing portfolio analysis, in particular, reframed procurement around a two-dimensional segmentation of items by strategic importance and supply risk, producing the four-quadrant matrix that continues to shape practitioner thinking and that has anchored decades of subsequent scholarship (Kraljic, 1983; Gelderman and Van Weele, 2003; Gelderman and Van Weele, 2005; Caniëls and Gelderman, 2005; Olsen and Ellram, 1997).

The subsequent two decades saw the extension of strategic sourcing into a comprehensive discipline encompassing supplier selection and development, total cost of ownership analysis, collaborative cost reduction, early supplier involvement in product development, global sourcing, and the formalization of category management as an organizational practice (Ellram, 1995; Trent and Monczka, 2003; Handfield and Nichols, 2002; Monczka *et al*., 2020; Cousins *et al*., 2008; Schiele, 2019). The parallel maturation of enterprise resource planning systems made it possible to instrument purchasing at a level of detail that had not previously been feasible, and the resulting transaction data provided the raw material for what would eventually become the distinct discipline of spend analytics (Handfield, 2019; Bag *et al*., 2020; Schiele, 2019; Choi *et al*., 2018).

Through the 2000s and 2010s, strategic sourcing incorporated a progressively broader set of concerns beyond cost: supplier innovation, sustainability and environmental performance, labor and human rights compliance, cybersecurity of supplier systems, and the management of supply chain risk more broadly (Pagell and Wu, 2009; Carter and Rogers, 2008; Seuring and Müller, 2008; Walker and Jones, 2012; Gimenez and Tachizawa, 2012; Grimm, Hofstetter, and Sarkis, 2014; Meixell and Luoma, 2015). The expansion of scope placed additional demands on the analytical apparatus of sourcing, because decisions now had to balance cost, risk, sustainability, and innovation considerations that could not be collapsed into a single objective function (Hendricks and Singhal, 2005; Gimenez and Tachizawa, 2012; Jüttner, Peck, and Christopher, 2003; Manuj and Mentzer, 2008; Tang, 2006).

2.2. The emergence of spend analytics

Spend analytics emerged as a distinct practice area in the late 1990s and early 2000s, driven by the recognition that most large organizations did not have accurate visibility into their own spending patterns. The problem was substantial: purchase orders scattered across business units, inconsistent supplier naming conventions, commodity taxonomies that differed across regions, off-contract and maverick spending invisible to central procurement, and a general inability to answer basic questions about total spend by category, by supplier, or by geography (Handfield, 2019; Schiele, 2019; Bag *et al*., 2020; Gelderman and Van Weele, 2005; Monczka *et al*., 2020). The first generation of spend analytics tools focused on spend visibility—aggregating transaction data across disparate systems, classifying it against standard commodity taxonomies, and producing management reports that gave procurement leadership an accurate view of the organization's purchasing activity for the first time.

The second generation, developing through the 2010s, extended spend analytics beyond visibility into category intelligence, supplier performance measurement, contract compliance monitoring, and opportunity identification (Handfield, 2019; Choi *et al*., 2018; Bag *et al*., 2020; Schiele, 2019; Rao, Goldsby, Griffis, and Iyengar, 2011). Analytics platforms began to integrate external market data—commodity price indices, supplier financial health indicators, industry benchmarks—with internal transaction data, enabling more sophisticated questions about whether the organization was paying market-competitive prices, whether its supplier base was financially stable, and where negotiation leverage existed across the category portfolio. Machine learning techniques began to be applied to the classification problem, reducing the manual effort required to maintain clean spend data and enabling more granular segmentation of categories and suppliers.

The third generation, emerging in the early 2020s, has added predictive and prescriptive analytics capabilities focused on risk sensing, scenario analysis, and decision support under uncertainty (Ivanov and Dolgui, 2021; Hosseini *et al*., 2019; Queiroz *et al*., 2022; Dubey, Gunasekaran, Childe, Papadopoulos, and Helo, 2021; Bag *et al*., 2020). External data sources have expanded to include news sentiment, geopolitical risk indices, weather and climate data, transportation and logistics indicators, and multi-tier supply network mapping. The resulting analytical architecture is substantially more ambitious than the spend visibility tools of two decades earlier, and the organizations that have deployed it effectively are able to detect emerging risks and opportunities with speed and precision that was unavailable to earlier generations of procurement practice.

2.3. Supply shocks of the early 2020s

The supply shocks of the early 2020s have provided empirical confrontation with the assumptions underlying sourcing strategies that had matured through three decades of relatively stable global trade. The COVID-19 pandemic, beginning in early 2020, produced a series of compounding disruptions that exposed the fragility of extended supply chains: the initial shutdown of Chinese manufacturing in the first quarter of 2020, the subsequent demand shocks as consumption patterns shifted from services to goods, the logistics congestion that accumulated through 2021 as the global freight system struggled to handle surge demand, and the semiconductor shortage that cascaded through automotive and industrial manufacturing well into 2022 and 2023 (Ivanov, 2020; Queiroz *et al*., 2022; Belhadi *et al*., 2021; Miroudot, 2020; Simchi-Levi and Simchi-Levi, 2020; Shih, 2020; Cohen, Cui, Doetsch, Ernst, Huchzermeier, Kouvelis, Lee, Matsuo, and Tsay, 2022).

The Russia-Ukraine conflict, beginning in February 2022, superimposed geopolitical shock on pandemic-related recovery. Natural gas supply to Europe was disrupted, wheat and fertilizer exports from the Black Sea region were interrupted, metals markets affected by Russian production experienced price volatility, and the general framework of international trade with Russia was rapidly restructured through sanctions that affected thousands of individual products and suppliers (IEA, 2022; Bordoff and O'Sullivan, 2022; Stern, 2022; OECD, 2022). Organizations whose sourcing strategies had treated geopolitical risk as a low-probability tail event were forced to reassess those assumptions and to rebuild category strategies around the recognition that major geopolitical disruptions could arrive with little warning and could persist for periods measured in years rather than months.

A third wave of pressure has come from industrial policy responses in the United States, European Union, and other jurisdictions, translating strategic competition with China into specific trade and investment measures that affect sourcing decisions across technology-intensive categories. Export controls on advanced semiconductors, content requirements in electric vehicle subsidies, restrictions on investment in specified sectors, and the general trend toward friendshoring and nearshoring have all introduced policy considerations into sourcing decisions that previously operated on largely commercial logic (Bown, 2023; Miroudot and Rigo, 2024; OECD, 2023; Gereffi, Pananond, and Pedersen, 2022; Gopinath, 2023). The accumulation of these forces is not a transient disruption to be managed but a durable restructuring of the environment within which sourcing decisions are made, and the frameworks developed in this paper are designed to address the restructured environment rather than to return to pre-pandemic assumptions.

3. Theoretical Foundations

3.1. Strategic sourcing as a management discipline

The first theoretical foundation of the framework is the body of work on strategic sourcing as a management discipline. Kraljic's purchasing portfolio model, which segments purchased items along two dimensions—strategic importance to the buyer and complexity or risk of the supply market—has provided the conceptual anchor for most subsequent sourcing frameworks. The model's four quadrants (leverage, strategic, non-critical, and bottleneck items) map onto distinct sourcing approaches: leverage items call for competitive bidding and aggregated demand, strategic items call for long-term partnership and collaborative development, non-critical items call for process efficiency and standardization, and bottleneck items call for supply continuity management and the cultivation of alternative sources (Kraljic, 1983; Gelderman and Van Weele, 2003; Caniëls and Gelderman, 2005; Olsen and Ellram, 1997; Cousins *et al*., 2008). The subsequent literature has refined the model by examining category dynamics within each quadrant, the movement of categories between quadrants over time, and the strategic implications of concentrating or diversifying within each segment.

A parallel tradition has examined the management of supplier relationships along a spectrum from arms-length market transactions to deeply integrated partnerships. Bensaou's (1999) portfolio model distinguished among market exchange, captive buyer, captive supplier, and strategic partnership relationships, each with distinct management requirements and value-creation potential. Dyer's (1996) work on Japanese supplier relationships highlighted the economic value of durable, trust-based partnerships that facilitate specialized investment, knowledge sharing, and joint problem-solving. The subsequent research on supplier relationship management has extended these foundations into specific treatments of supplier development, supplier innovation contributions, supplier financial health monitoring, and the governance structures through which long-term relationships are managed (Bensaou, 1999; Dyer, 1996; Lamming, 1993; Cousins *et al*., 2008; Schiele, 2019; Handfield and Nichols, 2002; Krause, Handfield, and Tyler, 2007).

The strategic sourcing literature has also developed a methodology of category management that organizes sourcing work around coherent groupings of items that share supply markets, supplier bases, or operational characteristics. Category strategies specify the commercial approach to each category: the supply base configuration, the contracting model, the performance metrics, the innovation and development activity, and the approach to risk management. The category management approach requires analytical inputs on spend patterns, supplier performance, market dynamics, and internal requirements that spend analytics is uniquely positioned to provide, creating the tight interdependence between sourcing and analytics that the framework developed here treats as foundational (Monczka *et al*., 2020; Trent and Monczka, 2003; Schiele, 2019; Cousins *et al*., 2008; Handfield, 2019).

3.2. Supply chain risk management

The second theoretical foundation is the literature on supply chain risk management, which provides the conceptual architecture for thinking about supply shocks and their mitigation. Jüttner, Peck, and Christopher (2003) and Manuj and Mentzer (2008) established core typologies of supply chain risk—covering supply, demand, operational, and contextual categories—that continue to inform scholarly and practitioner treatment. Tang's (2006) classic survey distinguished between robust strategies, which protect against disruption, and resilient strategies, which enable recovery from disruption, and argued that most organizations underinvest in both relative to the expected value of the protection. Subsequent scholarship has deepened understanding of specific risk mechanisms including the bullwhip effect, ripple effects through multi-tier networks, and correlated disruptions that undermine diversification strategies (Jüttner *et al*., 2003; Manuj and Mentzer, 2008; Tang, 2006; Ivanov, Dolgui, and Sokolov, 2019; Dolgui, Ivanov, and Sokolov, 2018; Chopra and Sodhi, 2014; Hendricks and Singhal, 2005).

A particularly consequential development has been the empirical documentation of the financial consequences of supply chain disruptions. Hendricks and Singhal's (2003, 2005) studies showed that publicly disclosed supply chain disruptions were associated with sustained negative effects on firm share price and operational performance, with impairments that took years to reverse. The work established that supply chain risk is a material financial risk, not merely an operational inconvenience, and provided empirical foundation for the subsequent investment in supply chain risk management capabilities. Subsequent empirical work has extended the analysis to specific disruption types, industry differences, and the moderating effects of supply chain configuration and risk management practice (Hendricks and Singhal, 2003; Hendricks and Singhal, 2005; Schmidt and Raman, 2022; Simchi-Levi *et al*., 2014; Hosseini *et al*., 2019).

The risk management literature has also addressed the specific challenges of rare, high-impact events—what the insurance literature terms tail risks—that dominate the aggregate impact of supply disruption but that defy estimation from short time series of recent experience. The pandemic experience of 2020 confirmed that the standard distributional assumptions underlying much supply chain modeling systematically understate tail risk, and that effective risk management must combine probabilistic methods with scenario analysis, stress testing, and institutional preparedness for disruptions that have not occurred in recent memory (Sheffi, 2005; Sheffi, 2015; Sheffi, 2020; Simchi-Levi and Simchi-Levi, 2020; Hopp and Iravani, 2018; Ivanov, 2020; Queiroz *et al*., 2022).

3.3. Organizational and supply chain resilience

The third theoretical foundation is the literature on organizational and supply chain resilience, which addresses how organizations absorb shocks and recover from them. Christopher and Peck's (2004) foundational paper on supply chain resilience established a conceptual framework that distinguished among four principles: supply chain engineering, supply chain collaboration, agility, and a risk management culture. Ponomarov and Holcomb (2009) defined resilience in terms of the adaptive capacity to prepare for, respond to, and recover from disruptions. Pettit, Fiksel, and Croxton (2010, 2013) developed a diagnostic framework pairing vulnerabilities and capabilities that has been widely applied in practitioner assessments. Sheffi's (2005, 2015, 2020) work on resilience has documented how leading firms construct resilient operations and has contributed the concept of the 'resilient enterprise' as an organizational ideal (Christopher and Peck, 2004; Ponomarov and Holcomb, 2009; Pettit, Fiksel, and Croxton, 2010; Pettit, Croxton, and Fiksel, 2019; Sheffi, 2005; Sheffi, 2015; Sheffi, 2020).

A distinctive feature of the resilience literature is its emphasis on adaptive capacity rather than purely on prevention. Prevention-oriented risk management seeks to reduce the probability or magnitude of disruptions; resilience-oriented management accepts that some disruptions will occur despite prevention efforts and seeks to ensure that the organization can absorb and recover from them with minimal damage. The distinction has practical consequences for sourcing strategy: prevention thinking tends to focus on supplier qualification, contractual protections, and concentration risk metrics; resilience thinking adds emphasis on redundancy, flexibility, response speed, and institutional learning from past disruptions. Effective sourcing programs combine both perspectives rather than treating them as alternatives (Christopher and Peck, 2004; Sheffi, 2015; Pettit *et al*., 2019; Ambulkar, Blackhurst, and Grawe, 2015; Brandon-Jones, Squire, Autry, and Petersen, 2014).

Recent resilience scholarship has extended into the analytical domain, examining how digital capabilities, visibility, and analytics contribute to resilience outcomes. The empirical evidence suggests that firms with more developed supply chain visibility and analytical capabilities recovered more rapidly from pandemic-related disruption than firms without such capabilities, though the relationship is mediated by organizational factors including decision-making processes, supplier relationship strength, and the strategic intent with which the analytical capabilities were deployed (Dubey *et al*., 2021; Ivanov and Dolgui, 2021; Roscoe *et al*., 2022; Queiroz *et al*., 2022; Bag *et al*., 2020; Belhadi *et al*., 2021; Hosseini *et al*., 2019).

3.4. Analytics in procurement decision-making

The fourth theoretical foundation is the analytics literature as applied to procurement and supply chain decision-making. Spend analytics draws on the broader data analytics tradition but has developed specific methodological patterns adapted to the particularities of procurement data: the messy, inconsistent transaction records produced by heterogeneous enterprise systems; the commodity classification problem, for which clean taxonomic assignment is essential to meaningful category analysis; the supplier normalization problem, through which multiple corporate entities of the same underlying supplier must be resolved into a single analytical identity; and the integration of external data sources that contextualize internal spend against market conditions (Handfield, 2019; Bag *et al*., 2020; Schiele, 2019; Choi *et al*., 2018; Davenport, 2014; Waller and Fawcett, 2013).

Advanced analytics methodologies applied to sourcing include machine learning for spend classification and supplier risk scoring, natural language processing for contract analysis and news-based risk sensing, network analysis for multi-tier supply visibility, and simulation for scenario testing of sourcing decisions under uncertainty (Choi *et al*., 2018; Dubey *et al*., 2021; Hosseini *et al*., 2019; Ivanov and Dolgui, 2021; Bag *et al*., 2020; Ribeiro and Barbosa-Póvoa, 2018). The methodological sophistication available in the best-developed spend analytics platforms has advanced rapidly through the early 2020s, though the deployment of these methods across the procurement function has lagged their availability, and the organizational capability to translate analytical outputs into decision and action remains the binding constraint in many sourcing organizations (Handfield, 2019; Schiele, 2019; Bag *et al*., 2020; Chae, Olson, and Sheu, 2014; Sanders, 2016).

A methodological concern specific to procurement analytics is the tension between standardization and contextual sensitivity. Standardized commodity taxonomies, supplier classifications, and risk scoring frameworks enable analytical tractability and cross-organization benchmarking but can obscure the category-specific and supplier-specific considerations that distinguish sound sourcing decisions from formulaic ones. Effective procurement analytics combines standardized data architecture with category-specific analytical deepening, using the standardized platform to surface opportunities and risks that are then examined in the specific context of each category's supply market dynamics, regulatory environment, and internal requirements (Schiele, 2019; Handfield, 2019; Cousins *et al*., 2008; Monczka *et al*., 2020; Bag *et al*., 2020).

3.5. Digital procurement and emerging technologies

The fifth theoretical foundation is the emerging literature on digital procurement and the integration of advanced technologies into the sourcing function. Digital procurement extends spend analytics into a broader organizational transformation encompassing source-to-pay automation, supplier portals and self-service capabilities, blockchain-enabled traceability in selected categories, artificial intelligence applications across procurement workflows, and the general reorganization of the procurement function around digital operating models (Bag *et al*., 2020; Schiele, 2019; Handfield, 2019; Dubey *et al*., 2021; Choi *et al*., 2018; Bienhaus and Haddud, 2018; Srai and Lorentz, 2019). The literature has advanced substantially through the early 2020s, driven by both the opportunities of new technologies and the pressure for digital transformation accelerated by pandemic-era shifts in work patterns.

A recurring theme in the digital procurement literature is the observation that technology adoption is necessary but not sufficient for the transformation to deliver value. Organizations that deploy advanced procurement technologies without corresponding attention to organizational structure, talent, process discipline, and governance frequently fail to realize the expected benefits, while organizations that invest in these organizational complements alongside the technology achieve substantially better outcomes (Bienhaus and Haddud, 2018; Srai and Lorentz, 2019; Bag *et al*., 2020; Schiele, 2019; Handfield, 2019; Gunasekaran, Subramanian, and Papadopoulos, 2017). The framework developed in this paper reflects this observation by treating the technological, analytical, and organizational dimensions of sourcing capability as a unified architecture rather than as separable components.

4. Spend Analytics Methodology and Outputs

4.1. Spend visibility and category intelligence

Spend analytics produces value through several principal outputs that translate raw transaction data into sourcing intelligence. The first is spend visibility, which aggregates expenditure across the organization and classifies it against a standardized commodity taxonomy to reveal total spend by category, by supplier, by business unit, and by geography. Many organizations embarking on their first serious spend analytics initiative are surprised by what visibility reveals: undiscovered suppliers, unexpected concentrations, maverick spending outside category strategies, and pricing variation across business units that reflects the absence of aggregation rather than genuine market dynamics (Handfield, 2019; Schiele, 2019; Bag *et al*., 2020; Monczka *et al*., 2020; Gelderman and Van Weele, 2005). The analytical work to produce reliable spend visibility is substantial—supplier normalization, commodity classification, currency translation, and data quality remediation—but the outputs provide the foundation on which all subsequent sourcing analysis rests.

The second output is category intelligence, which deepens the spend visibility view with market data, benchmark comparisons, and analytical insights specific to each category. Category intelligence typically addresses questions about market conditions (supply-demand balance, capacity utilization, raw material price trends), supplier performance (delivery reliability, quality, commercial behavior), contract compliance (adherence to negotiated terms, off-contract leakage), and opportunity identification (consolidation candidates, specification standardization, demand management). The intelligence outputs inform the category strategies developed through the strategic sourcing process and are updated continuously as market conditions and supplier performance evolve (Monczka *et al*., 2020; Schiele, 2019; Handfield, 2019; Cousins *et al*., 2008; Bag *et al*., 2020).

4.2. Supplier and risk intelligence

The third output is supplier intelligence, which develops a structured view of each material supplier across multiple dimensions. Financial health assessment draws on supplier financial disclosures, credit ratings, payment behavior, and early warning indicators to identify suppliers at elevated risk of financial distress. Operational performance tracking combines on-time delivery metrics, quality data, responsiveness measures, and innovation contribution to produce composite supplier scorecards. Compliance monitoring addresses regulatory, sustainability, labor, and cybersecurity requirements specific to each supplier and category. The resulting supplier view supports supplier segmentation, relationship investment decisions, and the identification of suppliers requiring development attention or replacement (Cousins *et al*., 2008; Handfield, 2019; Schiele, 2019; Monczka *et al*., 2020; Bag *et al*., 2020; Choi *et al*., 2018; Pettit *et al*., 2019).

The fourth output, and the one that has expanded most dramatically in the post-pandemic period, is risk intelligence. Risk intelligence extends supplier-specific monitoring with broader environmental and contextual signals: geopolitical developments affecting specific regions or trade lanes, climate and weather events with supply chain implications, transportation disruptions, commodity price movements, regulatory changes, and news sentiment concerning specific suppliers or categories. The analytical integration of these signals with supplier-specific exposure enables early identification of emerging risks and supports the scenario analysis through which sourcing organizations assess their exposure to potential disruptions before they materialize (Ivanov and Dolgui, 2021; Queiroz *et al*., 2022; Hosseini *et al*., 2019; Dubey *et al*., 2021; Bag *et al*., 2020; Sheffi, 2020; Pettit *et al*., 2019).

4.3. Methodological sophistication and decision translation

The methodological sophistication of these outputs has advanced substantially through the past decade. Spend classification has moved from manual rules-based assignment to machine learning approaches that learn from labeled examples and maintain classification accuracy as new suppliers and items are added.

Supplier financial health scoring has integrated multiple data sources into composite indicators calibrated against actual default experience. Risk sensing has incorporated natural language processing of news and social media feeds to produce real-time signal streams that complement structured data sources. Multi-tier supply network mapping, while still difficult and incomplete in most organizations, has progressed through combinations of supplier disclosure, inferential analysis from logistics and trade data, and platform-based collaboration tools that enable upstream visibility (Choi *et al*., 2018; Ivanov and Dolgui, 2021; Hosseini *et al*., 2019; Dubey *et al*., 2021; Bag *et al*., 2020; Schiele, 2019).

The translation of analytical outputs into sourcing decisions remains, however, the central organizational challenge. Analytical platforms that produce sophisticated outputs without clear decision pathways generate reports that are admired but not acted upon. The organizations that realize the most value from their analytics investments are those that have designed explicit decision processes through which analytical outputs feed into category strategy reviews, supplier management activities, risk committee deliberations, and the broader cadence of procurement governance. The framework developed in this paper treats this decision-analytics integration as a specific capability, because in its absence the investment in analytical sophistication produces limited operational value (Handfield, 2019; Schiele, 2019; Bag *et al*., 2020; Monczka *et al*., 2020; Davenport, 2014; Cousins *et al*., 2008).

4.4. Total cost of ownership and resilience valuation

A particular analytical frontier concerns the treatment of total cost of ownership across sourcing decisions. Purchase price is the most visible element of cost but typically represents only a portion of the total cost that a sourcing decision imposes on the organization. Transportation, inventory carrying, quality failures, supplier management overhead, currency and tariff exposure, and the opportunity cost of supply disruption all contribute to the total cost of a sourcing arrangement, and decisions made on purchase price alone can produce outcomes that are worse on total cost than apparently more expensive alternatives (Ellram, 1995; Ferrin and Plank, 2002; Monczka *et al*., 2020; Cousins *et al*., 2008; Van Weele, 2018). The analytical capability to develop reliable total cost views is substantial, and in many categories the underlying data must be assembled from disparate sources including logistics systems, quality databases, inventory records, and risk assessments, but the resulting decisions are substantially better informed than price-only sourcing.

Total cost thinking has particular importance in the context of supply shock mitigation, because the apparent cost premium of resilience investments—dual sourcing, strategic inventory, regional supply footprints—must be compared against the expected value of the disruption risk they reduce. Organizations that analyze this comparison rigorously typically find that resilience investments justify themselves on expected-value terms in many more categories than intuitive assessment suggests, though the analysis requires careful attention to disruption probability assumptions, impact magnitudes, and the correlation structure of potential disruptions. The frameworks for this analysis have been developed substantially through the post-pandemic period, integrating supply chain risk modeling with sourcing decision analysis in ways that earlier generations of procurement practice did not attempt (Simchi-Levi and Simchi-Levi, 2020; Sheffi, 2020; Ivanov, 2020; Ivanov and Dolgui, 2021; Hosseini *et al*., 2019; Schmidt and Raman, 2022; Pettit *et al*., 2019).

5. Supply Shock Mitigation Strategies

5.1. Dual sourcing and regional supply

Supply shock mitigation has moved from a peripheral concern in procurement practice to a central strategic priority over the past five years. The mitigation repertoire includes several distinct but complementary strategies, each with characteristic cost structures, deployment requirements, and appropriate conditions of use. Dual or multi-sourcing maintains active commercial relationships with multiple suppliers for critical categories, providing continuity if any single supplier is disrupted but incurring the cost of maintaining multiple relationships, potentially higher unit costs due to reduced aggregation, and greater complexity in supplier management. The categories in which dual sourcing is economically justified are typically those combining high supply risk with high impact of disruption, consistent with the bottleneck and strategic quadrants of the Kraljic framework (Kraljic, 1983; Cousins *et al*., 2008; Monczka *et al*., 2020; Tang, 2006; Simchi-Levi and Simchi-Levi, 2020; Sheffi, 2020; Chopra and Sodhi, 2014).

Regional sourcing, sometimes described as nearshoring, friendshoring, or regionalization, adjusts the geographic footprint of the supply base to reduce exposure to specific geographic concentrations and to shorten lead times. Regional sourcing typically entails some cost premium over the low-cost global sourcing arrangements it displaces, though the premium varies by category and has been narrowing in some cases as logistics costs, tariff exposure, and risk-adjusted total cost calculations increasingly favor regional arrangements. The shift toward regional sourcing has been reinforced by industrial policy developments in major jurisdictions that provide explicit incentives for regional production and by changing assessments of geopolitical risk in key sourcing regions (Gereffi *et al*., 2022; Miroudot, 2020; Miroudot and Rigo, 2024; Bown, 2023; Gopinath, 2023; OECD, 2023; Cohen *et al*., 2022).

5.2. Strategic inventory and supplier development

Strategic inventory buffers maintain stock levels above the efficient levels that pure just-in-time operation would justify, providing protection against supply disruption at the cost of working capital tied up in inventory and associated carrying costs. The design of strategic inventory buffers is an analytical exercise that must balance the cost of carrying the buffer against the expected value of the disruption protection it provides, and the post-pandemic period has produced substantial refinement in the methodologies applied to this balance. Strategic inventory complements rather than substitutes for other mitigation strategies: inventory provides time while dual sourcing or regional alternatives are activated, without substituting for the presence of those alternatives (Simchi-Levi and Simchi-Levi, 2020; Sheffi, 2020; Hopp and Iravani, 2018; Hopp and Spearman, 2011; Shih, 2020; Cohen *et al*., 2022; Pettit *et al*., 2019).

Supplier development and collaboration extend the mitigation repertoire into joint investment in supplier capability, supplier process improvement, and supplier financial support during periods of stress. The rationale is that supplier disruption often originates in capability or financial weakness that the buyer can help address more cheaply than replacing the supplier entirely, and that durable partnerships produce collaborative advantages in innovation and operational improvement that arms-length relationships cannot generate. The approach is most appropriate in categories where supplier switching is costly, specialized supplier capability contributes material value, and long-term relationships can be structured around aligned incentives (Dyer, 1996; Krause *et al*., 2007; Cousins *et al*., 2008; Schiele, 2019; Lamming, 1993; Monczka *et al*., 2020; Handfield and Nichols, 2002).

5.3. Contractual architecture and correlated risks

A further mitigation domain concerns the design of contractual and commercial arrangements that allocate disruption risk between buyer and supplier. Long-term contracts with price adjustment mechanisms stabilize the commercial relationship while allowing for market-based adjustment to changing conditions. Force majeure provisions, business continuity requirements, and specific performance obligations in critical categories provide contractual recourse in disruption events. Supplier collaboration agreements extend beyond discrete transactions into joint planning, capacity commitments, and innovation partnerships that strengthen the mitigation posture across the range of potential disruptions. The detailed commercial architecture through which mitigation is operationalized is category-specific and supplier-specific, and the best-developed sourcing programs produce contractual instruments that are substantially more sophisticated than commodity-style procurement agreements (Van Weele, 2018; Monczka *et al*., 2020; Cousins *et al*., 2008; Schiele, 2019; Chopra and Sodhi, 2014; Simchi-Levi and Simchi-Levi, 2020).

An overarching question in supply shock mitigation concerns the correlation structure across different risks. Mitigation strategies designed for independent disruptions can fail against correlated shocks: dual sourcing provides little protection if both suppliers are exposed to the same underlying disruption, regional diversification does not help if the regional alternatives are themselves affected by the same event, and strategic inventory provides only bounded time if disruption persists. The pandemic experience showed that correlations across apparently independent categories can become much higher during systemic shocks than the historical data suggested, and the frameworks developed through the post-pandemic period have placed greater emphasis on scenario analysis that stresses portfolio-level correlations rather than component-level independence. This analytical sophistication has moved supply shock mitigation from a checklist activity into a genuine risk management discipline (Sheffi, 2020; Simchi-Levi and Simchi-Levi, 2020; Ivanov and Dolgui, 2021; Queiroz *et al*., 2022; Hosseini *et al*., 2019; Pettit *et al*., 2019; Schmidt and Raman, 2022).

6. The Framework: Four Capabilities

The framework developed in this paper organizes the foregoing material into four capabilities whose joint operation determines whether strategic sourcing and spend analytics deliver the cost reduction and supply shock mitigation that contemporary operating conditions demand. The capabilities are interrelated—strength in one supports strength in the others, weakness in one limits what the others can contribute—and the framework invites practitioners to assess their own capability portfolio and to invest where the binding constraints currently lie.

6.1. Data foundation

The first capability is data foundation, encompassing the technical and organizational infrastructure through which transaction data is captured, classified, cleansed, and made analytically available. The capability extends beyond the narrow IT question of platform selection to include the data governance disciplines through which consistent commodity taxonomies are maintained, supplier normalization is enforced, and data quality standards are sustained across business units and geographies. Organizations with a robust data foundation produce analytical outputs whose reliability can be trusted by decision-makers; organizations without such a foundation produce outputs that are questioned, second-guessed, and ultimately marginalized in sourcing decisions. Building the capability requires sustained executive commitment to data discipline, organizational structures that assign clear ownership for data quality, and investment in the technology platforms that make the discipline operational at scale (Handfield, 2019; Schiele, 2019; Bag *et al*., 2020; Monczka *et al*., 2020; Gelderman and Van Weele, 2005; Davenport, 2014).

A specific element of data foundation is the integration of external data sources that contextualize internal spend against market conditions. Commodity price indices, supplier financial disclosures, market benchmarks, regulatory databases, geopolitical risk feeds, and multi-tier supply network information all contribute to the analytical richness that distinguishes contemporary spend analytics from first-generation spend visibility. The data architecture through which external and internal sources are integrated is a specific engineering challenge, and the quality of its resolution shapes the sophistication of the sourcing intelligence that the organization can produce. Organizations whose external data integration is robust derive significantly more value from their analytics investment than those whose analytics remain confined to internal transaction data (Handfield, 2019; Bag *et al*., 2020; Schiele, 2019; Dubey *et al*., 2021; Ivanov and Dolgui, 2021; Choi *et al*., 2018).

6.2. Category strategy

The second capability is category strategy, which translates analytical intelligence into the commercial approaches through which each category of spend is managed. The category strategy articulates the supply base configuration, contracting model, performance metrics, innovation activity, and risk management posture appropriate to the category's characteristics. Developing robust category strategies requires the integration of Kraljic-style portfolio analysis, supplier relationship considerations, total cost thinking, and risk assessment into a coherent commercial approach that category managers can execute and that procurement leadership can govern. The category strategies are not static documents but living commercial frameworks that are reviewed and updated as market conditions, supplier performance, and internal requirements evolve (Kraljic, 1983; Monczka *et al*., 2020; Cousins *et al*., 2008; Schiele, 2019; Gelderman and Van Weele, 2005; Trent and Monczka, 2003).

Category management as an organizational practice requires specific talent, processes, and governance. Category managers typically combine commercial acumen, industry knowledge of the relevant supply market, analytical skills to work with the spend intelligence, and the relationship management skills to sustain productive supplier interactions. Category review processes provide the institutional cadence through which strategies are updated and performance is assessed. Governance structures ensure that category decisions are consistent with enterprise-level sourcing priorities and that material category issues are escalated appropriately. Organizations whose category management capability is well-developed derive substantially more value from their sourcing activity than those whose category strategies exist on paper but are not actively managed as commercial instruments (Cousins *et al*., 2008; Monczka *et al*., 2020; Schiele, 2019; Handfield, 2019; Trent and Monczka, 2003).

6.3. Risk sensing

The third capability is risk sensing, which provides the organization with early warning of emerging supply chain risks and the analytical basis for deciding how to respond. The capability integrates internal data on supplier performance and financial health with external signals about geopolitical developments, commodity markets, regulatory changes, and specific supplier or category events. The technical architecture includes subscription data feeds, natural language processing of news and social media, structured risk databases, and the analytical layer that translates these inputs into organization-specific risk intelligence. The organizational architecture includes risk committees, decision protocols for acting on risk signals, and the governance forums in which material risks are escalated and responses are authorized (Ivanov and Dolgui, 2021; Queiroz *et al*., 2022; Hosseini *et al*., 2019; Dubey *et al*., 2021; Bag *et al*., 2020; Pettit *et al*., 2019; Sheffi, 2020).

A central design question for risk sensing concerns the treatment of false positives and signal fatigue. Risk sensing systems that generate too many alerts or that produce alerts of uneven quality degrade the organizational attention that the most material alerts require. The best-developed systems combine automated signal generation with human analytical judgment that prioritizes alerts for escalation, and they maintain feedback loops through which false positives are used to refine the underlying models. The balance between sensitivity and specificity in risk detection is a persistent design tension, and the frameworks through which it is resolved reflect both the technical sophistication of the analytical architecture and the organizational discipline with which signals are translated into action (Ivanov and Dolgui, 2021; Hosseini *et al*., 2019; Dubey *et al*., 2021; Queiroz *et al*., 2022; Sheffi, 2020; Simchi-Levi and Simchi-Levi, 2020).

6.4. Governance and execution

The fourth capability is governance and execution, which installs the organizational architecture through which the other three capabilities are translated into commercial outcomes. The governance architecture includes the committees, decision rights, and performance measurement systems through which sourcing activity is directed; the career paths, skill development, and organizational structure through which the sourcing function is staffed; and the operational processes through which category strategies, supplier management activities, and risk response actions are actually carried out. The capability is not a discretionary addition to the technical and analytical infrastructure of sourcing but the organizational platform without which the technical and analytical investments cannot produce commercial value (Monczka *et al*., 2020; Cousins *et al*., 2008; Handfield, 2019; Schiele, 2019; Bag *et al*., 2020; Trent and Monczka, 2003).

A specific element of governance and execution is the integration of sourcing with the broader enterprise. Sourcing decisions interact with product development through specification and supplier early involvement, with operations through quality and delivery performance, with finance through working capital and currency exposure, with risk management through supply chain risk contributions, with sustainability through supplier ESG performance, and with strategy through supplier innovation and partnership potential. Sourcing organizations that maintain active integration across these enterprise interfaces produce outcomes that align with enterprise objectives; organizations that treat sourcing as an isolated procurement activity produce outcomes that optimize locally but underperform against enterprise-level measures. The governance architecture must explicitly address these interfaces, and the frameworks through which it does so materially affect the value that sourcing contributes to the enterprise (Monczka *et al*., 2020; Cousins *et al*., 2008; Handfield and Nichols, 2002; Schiele, 2019; Van Weele, 2018; Porter, 1985).

6.5. The capabilities as an interlocking system

The four capabilities function as an interlocking system whose joint operation determines sourcing outcomes. Data foundation provides the analytical substrate on which category intelligence and risk sensing rest; category strategy translates that intelligence into commercial approaches; risk sensing extends the strategic view with the early warning and scenario analysis that contemporary conditions require; governance and execution provide the organizational platform through which the preceding capabilities produce commercial outcomes. Weakness in any one of the capabilities limits the contribution of the others. Strong analytics without category strategy produces reports that are not translated into sourcing decisions; strong category strategy without risk sensing produces commercial frameworks that are vulnerable to disruption; strong risk sensing without governance produces alerts that are not acted upon (Monczka *et al*., 2020; Cousins *et al*., 2008; Handfield, 2019; Schiele, 2019; Bag *et al*., 2020; Ivanov and Dolgui, 2021; Pettit *et al*., 2019).

The system-level perspective clarifies where investment is most valuable. Organizations whose data foundation is weak benefit most from investment in the underlying data architecture; organizations whose category management is immature benefit most from development of category strategy capability and category manager talent; organizations whose risk sensing has lagged the changed environment benefit most from investment in risk intelligence infrastructure; organizations with strong technical and analytical capability but weak governance benefit most from the organizational and decision architecture through which analytical outputs are translated into sourcing action. The diagnostic application of the framework—assessing current capability in each dimension and identifying the binding constraints—provides a structured basis for the investment decisions through which sourcing capability is built over time (Monczka *et al*., 2020; Handfield, 2019; Schiele, 2019; Cousins *et al*., 2008; Bag *et al*., 2020).

7. Implications for Stakeholders

7.1. For procurement leadership

For chief procurement officers and procurement leadership teams, the framework implies that cost reduction and supply shock mitigation are not competing priorities but joint products of a well-designed sourcing architecture. The assumption that resilience investment necessarily erodes cost savings has been reinforced in some accounts of the post-pandemic reorientation, but the framework developed here suggests a more nuanced relationship: effective spend analytics identifies cost opportunities that fund resilience investments, effective category strategy integrates cost and resilience considerations rather than treating them as trade-offs, and effective risk sensing prevents the disruption events whose costs would otherwise overwhelm apparent savings from fragile sourcing arrangements. Procurement leaders whose communication to enterprise leadership frames cost and resilience as interdependent outcomes, rather than as alternative priorities, are better positioned to sustain the investment in sourcing capability that the contemporary environment requires (Monczka *et al*., 2020; Schiele, 2019; Handfield, 2019; Sheffi, 2020; Simchi-Levi and Simchi-Levi, 2020; Pettit *et al*., 2019).

A specific implication for procurement leadership is the treatment of talent development as a strategic activity. The capabilities developed in the framework require category managers, analysts, risk specialists, and governance professionals whose skills combine commercial, analytical, industry-specific, and organizational dimensions that are not produced by any single academic or professional pathway. Sourcing organizations that invest deliberately in talent development—through structured career paths, cross-functional rotations, continuing education, and deliberate exposure to the range of procurement situations—build the human capital on which the capability architecture depends. Organizations that treat procurement as a non-strategic function staffed by generalist talent struggle to build capability even when their technology and data investments are substantial (Cousins *et al*., 2008; Monczka *et al*., 2020; Schiele, 2019; Handfield, 2019; Bag *et al*., 2020; Trent and Monczka, 2003).

7.2. For chief financial officers

For chief financial officers and enterprise finance leadership, the framework has implications for capital allocation to procurement capability and for the financial measurement of sourcing outcomes. Procurement capability building is typically treated as an operating expense rather than as an investment with a returns profile, and the budget discussions through which it is governed frequently focus on headcount and technology costs rather than on the value that capability produces. Finance leaders who reframe the capability discussion around returns—the cost savings that spend analytics enables, the disruption losses that risk sensing prevents, the resilience premium that integrated sourcing produces—are better positioned to support the sustained investment that capability building requires. The measurement frameworks through which sourcing outcomes are reported must extend beyond savings to include resilience metrics, innovation contribution, and sustainability performance that the contemporary environment makes material (Monczka *et al*., 2020; Cousins *et al*., 2008; Handfield, 2019; Sheffi, 2020; Pettit *et al*., 2019; Hendricks and Singhal, 2005).

A further financial implication concerns the treatment of supplier financial health in enterprise risk management. Supplier failures can produce material losses that are not captured in conventional financial reporting until after the disruption has occurred, and the financial value of sourcing programs that monitor and manage supplier financial health includes the prevention of these losses. Finance organizations that integrate supplier risk into enterprise risk management frameworks, rather than treating it as a procurement-internal concern, produce more complete risk views and make better decisions about risk mitigation investments across the enterprise. The integration is more common in regulated industries where supplier failure can have customer or regulatory consequences, but the logic applies broadly across sectors (Hendricks and Singhal, 2005; Schmidt and Raman, 2022; Simchi-Levi *et al*., 2014; Monczka *et al*., 2020; Cousins *et al*., 2008; Pettit *et al*., 2019).

7.3. For enterprise executives and policy makers

For enterprise executives and board-level governance, the framework implies that supply chain and sourcing performance deserve a level of strategic attention that has been uneven across organizations. Boards of publicly traded companies in many jurisdictions are now expected to oversee supply chain risk as part of their broader risk oversight responsibilities, and regulatory developments including mandatory supply chain due diligence requirements in several major jurisdictions have made the oversight responsibility more concrete. Boards that engage substantively with sourcing strategy, supply chain risk, and the capability investments through which both are managed provide the governance support that sustained capability building requires; boards that treat sourcing as an operational detail not worthy of strategic attention leave their organizations exposed to disruptions whose costs can substantially exceed the apparent savings of procurement underinvestment (Monczka *et al*., 2020; Sheffi, 2020; OECD, 2023; Pettit *et al*., 2019; Hendricks and Singhal, 2005; Schmidt and Raman, 2022).

For policy makers and regulators, the framework suggests attention to the regulatory and policy environment within which sourcing decisions are made. Policy interventions that promote supply chain transparency, that support multi-tier visibility in critical categories, and that align industrial policy with supply chain resilience objectives contribute to the conditions under which effective sourcing capability can be built and exercised. Policy interventions that impose disclosure and compliance requirements without regard to the cumulative burden on sourcing organizations, or that pursue resilience objectives through prescriptive requirements insensitive to category-specific considerations, can produce unintended consequences that undermine the resilience they seek to promote. The appropriate design of supply chain policy requires sustained dialogue between regulators, industry, and academic researchers that the framework developed here can help structure (OECD, 2023; Bown, 2023; Miroudot and Rigo, 2024; Gereffi *et al*., 2022; Gopinath, 2023; Ivanov and Dolgui, 2021).

8. Limitations and Directions for Future Research

Several limitations and directions for future work should be acknowledged. The framework is conceptual and synthetic. It draws on a substantial body of scholarship and practitioner literature but has not itself been empirically validated through direct measurement of sourcing outcomes across organizations configured differently along the four capability dimensions. The central claim—that the four capabilities, operating in concert, determine sourcing effectiveness in cost reduction and supply shock mitigation—is consistent with the scholarship reviewed here but invites direct empirical examination. The framework is also bounded in scope: it addresses strategic sourcing and spend analytics as applied to direct and indirect materials, services, and capital equipment in large organizations, and its extension to specialized categories such as contingent labor, intellectual property, or highly regulated healthcare and defense procurement requires adaptation to those categories' distinctive characteristics (Monczka *et al*., 2020; Cousins *et al*., 2008; Handfield, 2019; Schiele, 2019; Bag *et al*., 2020).

Future research could extend the framework in several directions. Comparative case studies of organizations whose capability configurations differ across the four dimensions would sharpen understanding of the mechanisms through which the capabilities produce their joint effect and would test whether the interdependencies postulated here hold in practice. Longitudinal studies following organizations through capability-building programs would illuminate the time profile over which capability investments produce returns and the organizational conditions that support or impede capability development. Research on the application of the framework in small and medium enterprises, where the scale assumptions underlying much of the framework may not hold, would address an underserved population in procurement scholarship (Handfield, 2019; Schiele, 2019; Cousins *et al*., 2008; Bag *et al*., 2020; Monczka *et al*., 2020). Additional research directions include the integration of sustainability and ESG considerations into the framework's capability structure, the application of the framework to public sector procurement where political accountability and fairness considerations interact with the commercial objectives emphasized here, the extension of risk sensing into climate-related physical risks whose supply chain implications are becoming more material, and the specific treatment of artificial intelligence applications across the capability architecture as those technologies mature. The framework is offered with the expectation that it will evolve as sourcing practice evolves, and the research agenda suggested here addresses some of the directions in which that evolution is likely to proceed (Bag *et al*., 2020; Schiele, 2019; Handfield, 2019; Pettit *et al*., 2019; Ivanov and Dolgui, 2021; Dubey *et al*., 2021; Roscoe *et al*., 2022).

9. Conclusion

Strategic sourcing and spend analytics have matured, over four decades, into a central managerial discipline whose quality materially affects the cost structure, supply reliability, and organizational resilience of contemporary enterprises. The accumulating pressures of the early 2020s—pandemic disruption, geopolitical realignment, industrial policy shifts, climate-related disruptions, and the persistent cost pressure of inflation and working capital discipline—have placed sourcing at the center of strategic decision-making in ways that earlier generations of procurement practice did not fully anticipate. The quality with which sourcing capability is built and exercised therefore matters more than it did in the relatively stable environment of the pre-pandemic period, and the framework developed here is offered as a structure through which that capability can be organized.

Within the framework, the dimensions that existing literature often treats separately become interdependent components of a unified sourcing architecture. Data foundation provides the analytical substrate on which category intelligence and risk sensing rest. Category strategy translates analytical intelligence into the commercial approaches through which spend is actually managed. Risk sensing extends the strategic view with the early warning and scenario analysis that contemporary conditions require. Governance and execution provide the organizational platform through which the preceding capabilities translate into commercial outcomes. The four capabilities are not alternatives to be prioritized but complementary components of a single system, and the quality of sourcing depends on their joint operation rather than on any single component in isolation.

The practical implication for procurement leaders, enterprise executives, and policymakers is that sustained investment across the capability portfolio is likely to produce better outcomes than concentrated investment in any single capability. The specific sequence of investment—data foundation before advanced analytics in some cases, category talent before platform technology in others, governance before either in organizations where decision-making is the binding constraint—depends on the organization's current configuration and on the specific conditions within which it operates. The framework provides a diagnostic structure within which these sequencing decisions can be made, rather than a prescription that assumes any particular starting point.

The coming decade is likely to continue the reorientation that has been underway since 2020. The combination of geopolitical, technological, climate-related, and regulatory forces that have shaped the recent period does not appear to be abating, and the environment within which sourcing decisions are made is likely to remain more demanding than the environment within which much of classical procurement practice was developed. The frameworks through which contemporary sourcing is organized will accordingly continue to evolve, incorporating new analytical techniques, new risk dimensions, and new organizational forms appropriate to the changing environment. The four-capability architecture advanced here is offered as a durable scaffold within which that evolution can proceed, organizing the principal dimensions of sourcing effectiveness in a way that invites their continued refinement as practice and scholarship advance (Monczka *et al.*, 2020; Handfield, 2019; Schiele, 2019; Cousins *et al.*, 2008; Bag *et al.*, 2020; Sheffi, 2020; Ivanov and Dolgui, 2021; Pettit *et al.*, 2019; Simchi-Levi and Simchi-Levi, 2020; Queiroz *et al.*, 2022).

References

1. Ambulkar S, Blackhurst J, Grawe S. Firm's resilience to supply chain disruptions: Scale development and empirical examination. J Oper Manag. 2015;33-34:111-22.
2. Adeyoyin O, Awanye EN, Morah OO, Ekpedo L. Spend optimization frameworks under commodity volatility. 2025.
3. Akinlade OF, Filani OM, Nwachukwu PS. AI-enabled spend classification for cross-border sourcing. 2025.
4. Akinleye OK, Adeyoyin O. Category management transformation in emerging-market manufacturing. 2024.
5. Aminu-Ibrahim AY, Ogbete JC, Ambali KB. Clinical supplies sourcing resilience across multi-site providers. 2025.
6. Anichukwueze CC, Osuji VC, Oguntegbe EE. Digital procurement compliance frameworks in African financial services. 2025.
7. Arowogbadamu AA-G, Oziri ST, Bibire OS-L. Category analytics in telecom equipment procurement. 2025.
8. Bag S, Wood LC, Xu L, Dhamija P, Kayikci Y. Big data analytics as an operational excellence approach to enhance sustainable supply chain performance. Resour Conserv Recycl. 2020;153:104559.
9. Belhadi A, Kamble S, Jabbour CJC, Gunasekaran A, Ndubisi NO, Venkatesh M. Manufacturing and service supply chain resilience to the COVID-19 outbreak. Technol Forecast Soc Change. 2021;163:120447.
10. Bensaou M. Portfolios of buyer-supplier relationships. Sloan Manag Rev. 1999;40(4):35-44.
11. Bienhaus F, Haddud A. Procurement 4.0: Factors influencing the digitisation of procurement and supply chains. Bus Process Manag J. 2018;24(4):965-84.
12. Bibire OS-L, Arowogbadamu AA-G, Oziri ST. Supplier performance management in integrated telecoms operations. 2024.
13. Bordoff J, O'Sullivan ML. The new energy order. Foreign Aff. 2022 Jul/Aug.
14. Bown CP. Industrial policy for electric vehicle supply chains. Peterson Institute for International Economics Working Paper; 2023.
15. Brandon-Jones E, Squire B, Autry CW, Petersen KJ. A contingent resource-based perspective of supply chain resilience and robustness. J Supply Chain Manag. 2014;50(3):55-73.
16. Caniëls MCJ, Gelderman CJ. Purchasing strategies in the Kraljic matrix: A power and dependence perspective. J Purch Supply Manag. 2005;11(2-3):141-55.
17. Carter CR, Rogers DS. A framework of sustainable supply chain management: Moving toward new theory. Int J Phys Distrib Logist Manag. 2008;38(5):360-87.
18. Chae B. Insights from hashtag #supplychain and Twitter analytics: Considering Twitter and Twitter data for supply chain practice and research. Int J Prod Econ. 2015;165:247-59.
19. Chae B, Olson D, Sheu C. The impact of supply chain analytics on operational performance: A resource-based view. Int J Prod Res. 2014;52(16):4695-710.
20. Choi TM, Wallace SW, Wang Y. Big data analytics in operations management. Prod Oper Manag. 2018;27(10):1868-83.
21. Chopra S, Meindl P. Supply chain management: Strategy, planning, and operation. 7th ed. Pearson; 2019.
22. Chopra S, Sodhi MS. Managing risk to avoid supply-chain breakdown. MIT Sloan Manag Rev. 2004;46(1):53-61.
23. Chopra S, Sodhi MS. Reducing the risk of supply chain disruptions. MIT Sloan Manag Rev. 2014;55(3):73-80.
24. Christopher M, Peck H. Building the resilient supply chain. Int J Logist Manag. 2004;15(2):1-14.

25. Cohen MA, Cui S, Doetsch S, Ernst R, Huchzermeier A, Kouvelis P, *et al*. Bespoke supply-chain resilience: The gap between theory and practice. J Oper Manag. 2022;68(5):515-31.
26. Cousins P, Lamming R, Lawson B, Squire B. Strategic supply management: Principles, theories and practice. FT Prentice Hall; 2008.
27. Davenport TH. Big data at work: Dispelling the myths, uncovering the opportunities. Harvard Business Review Press; 2014.
28. Dolgui A, Ivanov D, Sokolov B. Ripple effect in the supply chain: An analysis and recent literature. Int J Prod Res. 2018;56(1-2):414-30.
29. Dubey R, Gunasekaran A, Childe SJ, Papadopoulos T, Helo P. Supplier relationship management for circular economy. Manag Decis. 2021;59(8):1951-79.
30. Dyer JH. Specialized supplier networks as a source of competitive advantage: Evidence from the auto industry. Strateg Manag J. 1996;17(4):271-91.
31. Efobi OZ, Akinleye OK, Fasawe O. Supplier resilience frameworks for consumer goods supply chains. 2024.
32. Ellram LM. Total cost of ownership: An analysis approach for purchasing. Int J Phys Distrib Logist Manag. 1995;25(8):4-23.
33. Ellram LM, Carr A. Strategic purchasing: A history and review of the literature. Int J Purch Mater Manag. 1994;30(2):10-18.
34. Fawcett SE, Waller MA, Fawcett AM. Elaborating a dynamic systems theory to understand collaborative inventory successes and failures. Int J Logist Manag. 2010;21(3):510-37.
35. Ferrin BG, Plank RE. Total cost of ownership models: An exploratory study. J Supply Chain Manag. 2002;38(3):18-29.
36. Fisher ML. What is the right supply chain for your product? Harv Bus Rev. 1997;75(2):105-16.
37. Flynn BB, Huo B, Zhao X. The impact of supply chain integration on performance. J Oper Manag. 2010;28(1):58-71.
38. Gelderman CJ, Van Weele AJ. Handling measurement issues and strategic directions in Kraljic's purchasing portfolio model. J Purch Supply Manag. 2003;9(5-6):207-16.
39. Gelderman CJ, Van Weele AJ. Purchasing portfolio models: A critique and update. J Supply Chain Manag. 2005;41(3):19-28.
40. Gereffi G, Pananond P, Pedersen T. Resilience decoded: The role of firms, global value chains, and the state in COVID-19 medical supplies. Calif Manag Rev. 2022;64(2):46-70.
41. Gimenez C, Tachizawa EM. Extending sustainability to suppliers: A systematic literature review. Supply Chain Manag. 2012;17(5):531-43.
42. Giunipero LC, Hooker RE, Denslow D. Purchasing and supply management sustainability: Drivers and barriers. J Purch Supply Manag. 2012;18(4):258-69.
43. Gopinath G. Geopolitics and its impact on global trade and the dollar. IMF Working Paper; 2023.
44. Grimm JH, Hofstetter JS, Sarkis J. Critical factors for sub-supplier management: A sustainable food supply chains perspective. Int J Prod Econ. 2014;152:159-73.
45. Gunasekaran A, Subramanian N, Papadopoulos T. Information technology for competitive advantage within logistics and supply chains: A review. Transp Res Part E. 2017;99:14-33.
46. Hallikas J, Karvonen I, Pulkkinen U, Virolainen VM, Tuominen M. Risk management processes in supplier networks. Int J Prod Econ. 2004;90(1):47-58.
47. Handfield RB. Supply market intelligence: A managerial handbook for building sourcing strategies. CRC Press; 2019.
48. Handfield RB, Nichols EL. Supply chain redesign: Transforming supply chains into integrated value systems. FT Press; 2002.
49. Harland CM. Supply chain management: Relationships, chains and networks. Br J Manag. 1996;7(s1):S63-80.
50. Hendricks KB, Singhal VR. The effect of supply chain glitches on shareholder wealth. J Oper Manag. 2003;21(5):501-22.
51. Hendricks KB, Singhal VR. Association between supply chain glitches and operating performance. Manag Sci. 2005;51(5):695-711.
52. Hopp WJ, Iravani SMR. Supply chain management for humanitarian operations. Found Trends Technol Inf Oper Manag. 2018.
53. Hopp WJ, Spearman ML. Factory physics. 3rd ed. Waveland Press; 2011.
54. Hosseini S, Ivanov D, Dolgui A. Review of quantitative methods for supply chain resilience analysis. Transp Res Part E. 2019;125:285-307.
55. IEA (International Energy Agency). World Energy Outlook 2022. OECD/IEA; 2022.
56. Ivanov D. Predicting the impacts of epidemic outbreaks on global supply chains. Transp Res Part E. 2020;136:101922.
57. Ivanov D, Dolgui A. OR-methods for coping with the ripple effect in supply chains during COVID-19 pandemic. Int J Prod Res. 2021;59(13):4061-81.
58. Ivanov D, Dolgui A, Sokolov B. The impact of digital technology and Industry 4.0 on the ripple effect and supply chain risk analytics. Int J Prod Res. 2019;57(3):829-46.
59. Jüttner U, Peck H, Christopher M. Supply chain risk management: Outlining an agenda for future research. Int J Logist Res Appl. 2003;6(4):197-210.
60. Kamalahmadi M, Parast MM. A review of the literature on the principles of enterprise and supply chain resilience. Int J Prod Econ. 2016;171:116-33.
61. Kern D, Moser R, Hartmann E, Moder M. Supply risk management: Model development and empirical analysis. Int J Phys Distrib Logist Manag. 2012;42(1):60-82.
62. Kim Y, Choi TY. Deep, sticky, transient, and gracious: An expanded buyer-supplier relationship typology. J Supply Chain Manag. 2015;51(3):61-86.
63. Kraljic P. Purchasing must become supply management. Harv Bus Rev. 1983;61(5):109-17.
64. Krause DR, Handfield RB, Tyler BB. The relationships between supplier development, commitment, social capital accumulation and performance improvement. J Oper Manag. 2007;25(2):528-45.
65. Lamming R. Beyond partnership: Strategies for innovation and lean supply. Prentice Hall; 1993.
66. Manuj I, Mentzer JT. Global supply chain risk management strategies. Int J Phys Distrib Logist Manag. 2008;38(3):192-223.
67. Meixell MJ, Luoma P. Stakeholder pressure in sustainable supply chain management: A systematic

review. Int J Phys Distrib Logist Manag. 2015;45(1/2):69-89.
68. Mentzer JT, DeWitt W, Keebler JS, Min S, Nix NW, Smith CD, *et al*. Defining supply chain management. J Bus Logist. 2001;22(2):1-25.
69. Miroudot S. Resilience versus robustness in global value chains. VoxEU / Center for Economic Policy Research; 2020.
70. Miroudot S, Rigo D. Global value chain fragmentation and reshoring: A review of evidence. OECD Trade Policy Papers; 2024.
71. Monczka RM, Handfield RB, Giunipero LC, Patterson JL. Purchasing and supply chain management. 7th ed. Cengage Learning; 2020.
72. Nair A, Jayaram J, Das A. Strategic purchasing participation, supplier selection, supplier evaluation and purchasing performance. Int J Prod Res. 2015;53(20):6263-78.
73. Oduleye TE, Lawal OA, Akinse SG. Spend analytics framework for technology procurement in professional services. 2024.
74. OECD. OECD Economic Outlook, Interim Report: Paying the price of war. OECD Publishing; 2022.
75. OECD. OECD Economic Outlook. OECD Publishing; 2023.
76. Ogbete JC, Aminu-Ibrahim AY, Ambali KB. Multi-tier supplier visibility frameworks in healthcare procurement. 2024.
77. Okonkwo CS, Agbabiaka J, Ogunwole O, Mayo W, Okeke OT. Procurement analytics for gas processing operations. 2024.
78. Olsen RF, Ellram LM. A portfolio approach to supplier relationships. Ind Mark Manag. 1997;26(2):101-13.
79. Pagell M, Shevchenko A. Why research in sustainable supply chain management should have no future. J Supply Chain Manag. 2014;50(1):44-55.
80. Pagell M, Wu Z. Building a more complete theory of sustainable supply chain management using case studies of 10 exemplars. J Supply Chain Manag. 2009;45(2):37-56.
81. Pettit TJ, Croxton KL, Fiksel J. Ensuring supply chain resilience: Development of a conceptual framework. J Bus Logist. 2010;31(1):1-21.
82. Pettit TJ, Croxton KL, Fiksel J. Ensuring supply chain resilience: Development and implementation of an assessment tool. J Bus Logist. 2013;34(1):46-76.
83. Pettit TJ, Croxton KL, Fiksel J. The evolution of resilience in supply chain management: A retrospective on ensuring supply chain resilience. J Bus Logist. 2019;40(1):56-65.
84. Ponomarov SY, Holcomb MC. Understanding the concept of supply chain resilience. Int J Logist Manag. 2009;20(1):124-43.
85. Porter ME. Competitive advantage: Creating and sustaining superior performance. Free Press; 1985.
86. Prater E, Biehl M, Smith MA. International supply chain agility: Tradeoffs between flexibility and uncertainty. Int J Oper Prod Manag. 2001;21(5/6):823-39.
87. Queiroz MM, Ivanov D, Dolgui A, Wamba SF. Impacts of epidemic outbreaks on supply chains: Mapping a research agenda amid the COVID-19 pandemic through a structured literature review. Ann Oper Res. 2022;319:1159-96.
88. Rao S, Goldsby TJ, Griffis SE, Iyengar D. Electronic logistics service quality: Its impact on customer satisfaction and contingency effects. J Bus Logist. 2011;32(2):167-79.
89. Ribeiro JP, Barbosa-Póvoa A. Supply chain resilience: Definitions and quantitative modelling approaches. Comput Ind Eng. 2018;115:109-22.
90. Roscoe S, Skipworth H, Aktas E, Habib F. Managing supply chain uncertainty arising from geopolitical disruptions: Evidence from the pharmaceutical industry and Brexit. Int J Oper Prod Manag. 2022;42(3):337-61.
91. Sanders NR. How to use big data to drive your supply chain. Calif Manag Rev. 2016;58(3):26-48.
92. Sanni JO, Atima ME. Strategic sourcing risk analytics for regulated financial services. 2024.
93. Schiele H. Purchasing and supply management. In: Operations, logistics and supply chain management. Springer; 2019. p. 45-73.
94. Schmidt W, Raman A. When supply chain disruptions matter. MIT Sloan Manag Rev. 2022.
95. Scholten K, Schilder S. The role of collaboration in supply chain resilience. Supply Chain Manag. 2015;20(4):471-84.
96. Seuring S, Müller M. From a literature review to a conceptual framework for sustainable supply chain management. J Clean Prod. 2008;16(15):1699-710.
97. Sheffi Y. The resilient enterprise: Overcoming vulnerability for competitive advantage. MIT Press; 2005.
98. Sheffi Y. The power of resilience: How the best companies manage the unexpected. MIT Press; 2015.
99. Sheffi Y. The new (ab)normal: Reshaping business and supply chain strategy beyond Covid-19. MIT CTL Media; 2020.
100. Shih WC. Global supply chains in a post-pandemic world. Harv Bus Rev. 2020;98(5):82-9.
101. Simchi-Levi D, Schmidt W, Wei Y. From superstorms to factory fires: Managing unpredictable supply-chain disruptions. Harv Bus Rev. 2014;92(1/2):96-101.
102. Simchi-Levi D, Simchi-Levi E. We need a stress test for critical supply chains. Harv Bus Rev Digit. 2020.
103. Srai JS, Lorentz H. Developing design principles for the digitalisation of purchasing and supply management. J Purch Supply Manag. 2019;25(1):78-98.
104. Stern J. Measuring European security of gas supply. Oxford Institute for Energy Studies; 2022.
105. Stuart FI. Supplier partnerships: Influencing factors and strategic benefits. Int J Purch Mater Manag. 1993;29(3):21-9.
106. Tachizawa EM, Wong CY. Towards a theory of multi-tier sustainable supply chains: A systematic literature review. Supply Chain Manag. 2014;19(5/6):643-63.
107. Tang CS. Perspectives in supply chain risk management. Int J Prod Econ. 2006;103(2):451-88.
108. Tomlin B. On the value of mitigation and contingency strategies for managing supply chain disruption risks. Manag Sci. 2006;52(5):639-57.
109. Trent RJ, Monczka RM. Understanding integrated global sourcing. Int J Phys Distrib Logist Manag. 2003;33(7):607-29.
110. Van Weele AJ. Purchasing and supply chain management. 7th ed. Cengage Learning; 2018.
111. Wagner SM, Bode C. An empirical examination of supply chain performance along several dimensions of risk. J Bus Logist. 2008;29(1):307-25.

112. Walker H, Jones N. Sustainable supply chain management across the UK private sector. Supply Chain Manag. 2012;17(1):15-28.
113. Waller MA, Fawcett SE. Data science, predictive analytics, and big data: A revolution that will transform supply chain design and management. J Bus Logist. 2013;34(2):77-84.
114. Wilhelm M, Blome C, Wieck E, Xiao CY. Implementing sustainability in multi-tier supply chains: Strategies and contingencies in managing sub-suppliers. Int J Prod Econ. 2016;182:196-212.
115. Wilson MC. The impact of transportation disruptions on supply chain performance. Transp Res Part E. 2007;43(4):295-320.
116. Womack JP, Jones DT, Roos D. The machine that changed the world. Rawson Associates; 1990.
117. Zsidisin GA. A grounded definition of supply risk. J Purch Supply Manag. 2003;9(5-6):217-24.