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RISK MANAGEMENT AND GLOBAL RESILIENCE IN SUPPLY CHAIN IN THE FEDERAL CAPITAL DEVELOPMENT AUTHORITY (FCDA)

***Gyang Garos Davou, Kyone Ladi Sale**

Institute of Governance and Development Studies, Nasarawa State University, Keffi-Nigeria.

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***Corresponding Author: Gyang Garos Davou**

Institute of Governance and Development Studies, Nasarawa State University, Keffi-Nigeria.

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ABSTRACT

This study investigates how risk-management practices can bolster global supply-chain resilience within the Federal Capital Development Authority (FCDA) of Nigeria. As the agency responsible for planning and delivering infrastructure in the Federal Capital Territory, FCDA faces a complex risk environment characterized by material-procurement delays, vendor reliability issues, transportation disruptions, and regulatory compliance challenges. Guided by three objectives—(i) to identify and categorize the primary risk factors affecting FCDA's supply-chain operations, (ii) to assess the current state of supply-chain resilience, and (iii) to develop evidence-based recommendations for improvement—this research employs a mixed-methods design. A survey of 108 stakeholders (90 % response rate) and 12 key-informant interviews yield quantitative and qualitative data.

The analysis revealed that supplier-related risks, especially late cement deliveries, and logistics disruptions are the most frequent and highest-impact threats. FCDA's composite Resilience Index stands at 2.93 (on a 5-point scale), indicating moderate resilience, with visibility (2.6) and redundancy (2.9) as the weakest dimensions. Regression results show that risk-management practices explain 38 % of the variance in resilience ($\beta = 0.68$, $p < 0.001$) and are positively linked to cost efficiency and delivery reliability. Qualitative insights highlight a reactive, siloed culture and limited use of real-time technology.

Based on these findings, the study proposes a six-point action plan: (1) create a centralized risk register with a heat-map for prioritization; (2) institutionalize quarterly risk-identification workshops; (3) conduct a resilience audit and develop a tracking index; (4) design an integrated risk-management framework with clear trigger points for contingency actions; (5)

deploy a cloud-based supply-chain control tower and pilot *dual-sourcing for critical materials; and (6) establish a cross-functional Supply-Chain Resilience Committee, embed risk-management into procurement policies, provide regular training, and publish an annual resilience report.*

Implementing these recommendations will shift FCDA from a reactive to a proactive risk-management posture, enhancing cost efficiency, delivery reliability, and stakeholder satisfaction. The study contributes to the limited literature on public-sector supply-chain resilience in developing economies and offers a replicable framework for other infrastructure agencies.

KEYWORDS: Risk Management, Supply-Chain Resilience, FCDA, Infrastructure Development, Public Procurement, Nigeria.

1. INTRODUCTION

The Federal Capital Development Authority (FCDA) serves as the principal government agency tasked with the comprehensive planning, development, and coordination of infrastructure within Nigeria's Federal Capital Territory, Abuja. Established under Decree No. 6 of 1976, the FCDA operates at the intersection of urban planning, infrastructure development, and public administration, managing complex supply chains that support the capital city's continuous expansion and modernization (Abubakar & Doan, 2020). The agency's mandate encompasses the procurement and distribution of construction materials, coordination of multiple contractor networks, management of equipment and machinery supplies, and oversight of service delivery systems that sustain one of Africa's fastest-growing capital cities.

In recent years, global supply chain disruptions have intensified, exposing vulnerabilities in procurement and logistics systems worldwide. The COVID-19 pandemic, geopolitical tensions, climate-related disasters, and economic uncertainties have collectively highlighted the critical importance of supply chain resilience for organizations operating in both private and public sectors (Christopher & Peck, 2020; Ivanov, 2020). For public infrastructure agencies like FCDA, these disruptions translate directly into project delays, budget overruns, compromised service delivery, and diminished public confidence in governmental capacity.

The FCDA's supply chain ecosystem comprises diverse stakeholders including international and domestic suppliers, construction contractors, logistics service providers, regulatory bodies, and community stakeholders. This complexity creates multiple points of vulnerability where disruptions can cascade throughout the system. Historical analysis of FCDA operations reveals recurring challenges: procurement delays averaging 6-8 months beyond scheduled timelines, material cost fluctuations exceeding budget provisions by 15-30%, contractor performance variability, and coordination difficulties among multiple project sites (Oyewobi et al., 2021).

Nigeria's position as a developing economy introduces additional supply chain considerations. The country's heavy reliance on imported construction materials exposes FCDA to foreign exchange volatility, international shipping disruptions, and customs clearance uncertainties. Domestic supply limitations for specialized materials necessitate global sourcing strategies, while inadequate local manufacturing capacity constrains options for supply chain localization. Furthermore, infrastructure deficits in transportation networks, power supply, and digital connectivity compound logistical challenges, increasing operational costs and delivery uncertainties (Oke et al., 2020).

Despite FCDA's critical role in national development, the organization faces persistent supply chain vulnerabilities that compromise project delivery and resource utilization. Current risk management approaches remain largely reactive, focusing on addressing disruptions after occurrence rather than implementing proactive mitigation strategies. The absence of a comprehensive risk assessment framework prevents systematic identification and prioritization of supply chain threats. Limited integration of digital technologies constrains visibility across the supply chain, hindering real-time monitoring and rapid response capabilities (Adejare et al., 2022).

Existing procurement procedures, while designed to ensure transparency and accountability, often lack the flexibility required to respond to dynamic market conditions. Rigid adherence to lowest-price selection criteria may inadvertently prioritize cost over reliability, sustainability, and long-term value creation. Insufficient supplier relationship management results in adversarial rather than collaborative partnerships, limiting opportunities for joint risk mitigation and innovation. Moreover, organizational silos within FCDA impede information sharing and coordinated decision-making across departments involved in supply chain activities.

This study pursues the following specific objectives:

1. *To identify and categorize the primary risk factors affecting FCDA's supply chain operations, including their sources, manifestations, and potential impacts on organizational performance.*

2. *To assess the current state of supply chain resilience within FCDA, evaluating existing risk management practices, organizational capabilities, and adaptive capacities.*
3. *To develop evidence-based recommendations for enhancing supply chain resilience through integrated risk management frameworks, technological innovations, and organizational restructuring.*

This research addresses critical gaps in academic literature and professional practice. While extensive scholarship examines private sector supply chain management, comparatively limited attention focuses on public infrastructure agencies operating in developing economies. This study provides empirical evidence specific to FCDA's operational context, generating insights applicable to similar governmental organizations across Africa and other emerging markets.

For practitioners, the findings offer actionable frameworks for risk identification, assessment, and mitigation. Proposed recommendations balance theoretical rigor with practical feasibility, acknowledging resource constraints and institutional realities characteristic of public sector organizations. Enhanced supply chain resilience within FCDA promises multiple benefits: improved project completion rates, optimized resource utilization, reduced cost overruns, increased transparency, and ultimately, better service delivery to Nigeria's capital territory residents.

Beyond FCDA-specific implications, this research contributes to policy discourse on public procurement reform, infrastructure governance, and institutional capacity building. Insights generated inform national strategies for improving public project delivery, enhancing accountability in government operations, and strengthening Nigeria's overall infrastructure development ecosystem. In an era of increasing global uncertainty, building resilient public sector supply chains represents not merely operational optimization but strategic necessity for sustainable national development.

This study focuses specifically on supply chain operations within FCDA's infrastructure development mandate, encompassing procurement, logistics, inventory management, and contractor coordination. The temporal scope covers supply chain activities from 2020 to 2025, capturing experiences during and following the COVID-19 pandemic period. Geographically, the research concentrates on operations within the Federal Capital Territory, though implications extend to broader Nigerian public sector contexts.

Certain limitations warrant acknowledgment. The study relies on self-reported data from organizational stakeholders, potentially introducing response biases. Organizational sensitivities regarding procurement information may constrain access to certain data categories. Time and resource constraints limit the sample size and depth of analysis possible. Rapidly evolving global conditions mean findings reflect circumstances at the time of data collection, requiring periodic reassessment. Despite these limitations, rigorous methodology and triangulated data sources enhance confidence in the study's validity and reliability

2. LITERATURE REVIEW

Supply chain risk encompasses potential events or conditions that may adversely affect an organization's ability to procure, produce, or deliver products and services to end-users (Sodhi et al., 2021). Contemporary risk typologies distinguish between operational risks (supplier failures, quality issues, capacity constraints), strategic risks (market shifts, technological disruptions, competitive dynamics), environmental risks (natural disasters, climate change impacts), and systemic risks (geopolitical instability, pandemics, economic crises). These risk categories exhibit complex interdependencies, where disruptions in one area frequently cascade across multiple dimensions.

Supply chain resilience represents organizational capacity to anticipate, prepare for, respond to, and recover from disruptions while maintaining continuity of operations and minimizing negative impacts (Ponomarov & Holcomb, 2009; Tukamuhabwa et al., 2021). Resilient supply chains demonstrate four core capabilities: robustness (ability to resist disruptions), redundancy (backup resources and alternative options), flexibility (adaptive capacity to changing conditions), and velocity (speed of recovery and return to normal operations). Christopher and Peck (2020) emphasize that resilience extends beyond mere survival to encompass learning and adaptation, where organizations emerge stronger from disruptions through knowledge acquisition and capability enhancement.

The relationship between risk management and resilience follows a dynamic, iterative process. Effective risk management provides the foundation for resilience by systematically identifying threats, assessing vulnerabilities, implementing controls, and monitoring effectiveness. However, resilience transcends traditional risk management's focus on known, quantifiable risks to embrace uncertainty and complexity. Resilient organizations cultivate adaptive capabilities that enable effective response even to unanticipated black swan events that fall outside conventional risk assessment parameters (Taleb, 2020). This integration of risk management discipline with resilience thinking represents contemporary best practice in supply chain scholarship and application.

Academic literature proposes various frameworks for systematic supply chain risk management. The Supply Chain Operations Reference (SCOR) model, developed by the Association for Supply Chain Management, provides comprehensive process reference architecture encompassing planning, sourcing, making, delivering, and returning activities. Within this framework, risk management integrates across all process categories, emphasizing cross-functional coordination (Kocaoğlu et al., 2011). The model's standardized metrics enable benchmarking and performance tracking, facilitating identification of vulnerability areas requiring attention.

Manuj and Mentzer (2008) propose a strategic framework distinguishing between risk management strategies based on control orientation. Avoidance strategies eliminate risk exposure through alternative sourcing or product redesign. Control strategies reduce risk probability or impact through supplier development, quality programs, or contractual provisions. Cooperation strategies share risks through partnerships, insurance, or collaborative planning. Flexibility strategies enhance adaptive capacity through modular designs, postponement, or multi-sourcing. Organizations typically employ portfolio approaches, combining multiple strategies tailored to specific risk profiles and organizational contexts.

The ISO 31000 risk management standard offers internationally recognized principles and processes applicable across sectors and organizational types. The framework emphasizes integration of risk management into governance structures, decision-making processes, and organizational culture. Key principles include creating and protecting value, systematic and structured approaches, customization to organizational context, inclusive stakeholder engagement, dynamic and responsive approaches, and continuous improvement through learning (ISO, 2018). While not supply chain-specific, ISO 31000 provides foundational guidance widely adapted for supply chain applications.

2.1 Global Supply Chain Disruptions and Emerging Risks

The global supply chain landscape has experienced unprecedented disruption intensity over the past decade. The COVID-19 pandemic exposed fundamental vulnerabilities in globally distributed, just-in-time supply chains optimized for efficiency over resilience. Factory closures, logistics bottlenecks, demand volatility, and labor shortages created cascading effects across industries and geographies (Ivanov & Dolgui, 2021). Organizations discovered that geographic diversification alone provided insufficient protection when disruptions affected entire regions simultaneously. The pandemic experience accelerated recognition that resilience requires deliberate design, not merely risk diversification.

Climate change presents escalating supply chain threats through increased frequency and severity of extreme weather events, rising sea levels affecting port operations, temperature changes impacting agricultural supplies, and resource scarcity driving material costs (Linton & Kakhki, 2021). Infrastructure-dependent sectors face particular vulnerability as transportation networks, power grids, and communication systems experience climate-related disruptions. Adaptation strategies increasingly incorporate climate risk assessments into supplier selection, facility location decisions, and contingency planning processes.

Geopolitical tensions introduce supply chain uncertainties through trade restrictions, tariffs, sanctions, and political instability. Recent examples include US-China trade conflicts, Brexit complications, Russian-Ukraine war impacts, and regional conflicts affecting critical supply corridors. Organizations navigate these challenges through geopolitical risk mapping, supply chain diversification beyond single-country dependencies, and enhanced scenario planning capabilities (Choi et al., 2020). Political risk analysis increasingly integrates into strategic sourcing decisions, particularly for critical materials and components with limited supplier options.

Cybersecurity threats have evolved from peripheral concerns to central supply chain risks. Digitalization of procurement, logistics tracking, and supplier integration creates cyber vulnerability points throughout supply networks. High-profile attacks on logistics providers, component manufacturers, and distribution systems demonstrate potential for widespread operational disruption (Ghadge et al., 2020). Protection strategies encompass technical security measures, supplier cybersecurity assessments, incident response planning, and supply chain security awareness training across organizational levels.

2.2 Theoretical Foundation: Dynamic Capabilities Theory

To explain how risk management influences supply-chain resilience, this study draws on *Dynamic Capabilities Theory* (Teece, Pisano, & Shuen, 1997). Dynamic capabilities are defined as a firm's ability to *sense* emerging threats, *seize* opportunities by mobilizing resources, and *reconfigure* its asset base to maintain competitive advantage in rapidly changing environments. In the context of SCRM, dynamic capabilities translate into three interrelated processes:

1. Sensing – continuously scanning the environment for potential risks (e.g., supplier instability, currency fluctuations, geopolitical events).

2. Seizing – deploying resources to design and implement risk-mitigation actions (e.g., alternative sourcing, safety stock, contractual safeguards).
3. Reconfiguring – adjusting supply-chain structures, processes, and relationships to embed resilience (e.g., creating flexible logistics networks, enhancing information-sharing platforms).

When these capabilities are well-developed, an organization can anticipate disruptions, respond swiftly, and adapt its supply chain configuration, thereby achieving higher resilience. Empirical studies have demonstrated that firms with strong dynamic capabilities exhibit greater operational flexibility and faster recovery after supply-chain shocks (Eisenhardt & Martin, 2000; Wieland & Wallenburg, 2013).

3. 0 METHODOLOGY

This study employs a mixed-methods research design combining qualitative and quantitative approaches to comprehensively examine risk management and supply chain resilience within FCDA. The convergent parallel design involves simultaneous collection of qualitative and quantitative data, independent analysis of each dataset, and integration of findings during interpretation to provide holistic understanding of the research problem (Creswell & Plano Clark, 2018). This approach leverages the strengths of both methodologies: quantitative methods enable statistical analysis of risk prevalence, impacts, and relationships with performance outcomes, while qualitative methods provide rich contextual insights into stakeholder experiences, organizational dynamics, and implementation challenges.

The research adopts a primarily descriptive and exploratory orientation, appropriate given limited prior empirical research on FCDA's supply chain operations. Descriptive elements document current risk profiles, management practices, and resilience capacities. Exploratory components investigate relationships between risk factors, management strategies, and performance outcomes. The case study approach focusing on FCDA provides depth of analysis within specific organizational and contextual parameters, generating insights transferable to similar public infrastructure agencies while acknowledging context-specific considerations.

The study population comprises all stakeholders involved in FCDA's supply chain operations, categorized into three primary groups: (1) FCDA internal personnel including procurement officers, project managers, logistics coordinators, and senior management; (2) external contractors and suppliers engaged in ongoing or recent FCDA projects; and (3) regulatory and oversight bodies involved in FCDA procurement processes. The estimated total population across these categories exceeds 500 individuals, necessitating sampling approaches for practical data collection.

For quantitative data collection, a stratified random sampling technique selected respondents proportionally from each stakeholder category. The sample size was determined using Yamane's formula with 95% confidence level and 5% margin of error, yielding a target sample of 222 respondents. Distribution across strata allocated 100 FCDA personnel, 90 contractors/suppliers, and 32 regulatory/oversight representatives. This stratification ensures adequate representation across stakeholder groups while maintaining statistical validity.

Qualitative sampling employed purposive selection criteria to identify information-rich participants with substantial experience and insights regarding FCDA supply chain operations. Selection criteria included: minimum three years involvement with FCDA projects, direct responsibility for supply chain activities, and willingness to participate in in-depth interviews. This approach yielded 18 key informants comprising 8 FCDA senior managers and procurement specialists, 7 major contractors and supplier representatives, and 3 regulatory officials. Purposive sampling prioritizes depth and quality of information over statistical representativeness, appropriate for qualitative research objectives

Quantitative data were collected through structured questionnaires designed specifically for this research. The questionnaire comprised five sections: (1) demographic and background information; (2) supply chain risk identification and assessment, employing Likert scales to rate frequency and impact of various risk factors; (3) current risk management practices and tools utilized; (4) perceptions of supply chain resilience across multiple dimensions; and (5) supply chain performance outcomes including cost efficiency, delivery reliability, and stakeholder satisfaction. Questions drew from validated instruments in supply chain risk management literature, adapted to FCDA's public sector infrastructure context.

Questionnaire development followed rigorous procedures including literature review to identify relevant constructs, expert review by supply chain management academics and practitioners, pre-testing with small sample (n=15) of FCDA personnel, and refinement based on feedback regarding clarity, relevance, and comprehensiveness. The final instrument demonstrated good internal consistency with Cronbach's alpha coefficients exceeding 0.70 for all multi-item scales, indicating acceptable reliability.

Qualitative data collection utilized semi-structured interview protocols allowing flexibility to explore emerging themes while ensuring coverage of core research questions. Interview guides addressed: experiences with supply chain disruptions and their impacts, current risk management approaches and perceived effectiveness, organizational capabilities supporting resilience, barriers to improved risk management, and recommendations for enhancement. Interviews averaged 45-60 minutes, were conducted in English, audio-recorded with participant consent, and professionally transcribed for analysis. Secondary data supplemented primary collection through review of FCDA documents including procurement records, project reports, and performance evaluations.

4.0 RESULTS AND DISCUSSION

4.1 Demographic Breakdown

Respondent Demographics (n = 108).

Category	Frequency (n)	Percentage (%)
Respondent type		
FCDA personnel	52	48.1
Contractors / Suppliers	44	40.7
Regulatory / Oversight bodies	12	11.2
Education		
Bachelor's degree or higher	72	66.7
Post-graduate (MSc/PhD)	36	33.3
Years of supply-chain experience		
< 5 years	24	22.2
5-10 years	39	36.1
> 10 years	45	41.7

All 12 targeted key informants (senior procurement officers, project directors, risk managers, and logistics heads) participated in the semi-structured interviews (100% response). Interviewees averaged 12.3 years of experience with FCDA operations, providing rich contextual insight.

4.2 Presentation of Results by Objective

Table 4.1: Risk-factor frequency and impact rating (n = 108)

Objective 1 – Identify and categorize primary risk factors

Risk source	Example manifestation	Frequency (n)	Mean impact score* (1-5)	Rank
Supplier	Late delivery of cement	78	4.2	1
Logistics	Transport strike, port congestion	65	3.9	2
Financial	Exchange-rate volatility	58	3.7	3
Regulatory	Permit delays, compliance checks	45	3.4	4
Environmental	Flood-related site closure	30	3.1	5

*Impact score: 1 = negligible, 5 = critical.

Interpretation: Supplier-related risks dominate both in occurrence and perceived severity, followed by logistics and financial risks. A risk-heat-map (probability × impact) places "late cement delivery" and "transport strike" in the high-risk quadrant, demanding immediate mitigation.

Objective 2 – Assess current supply-chain resilience

A Resilience Index (RI) was constructed from four sub-dimensions (each scored 1-5):

Dimension	Mean score	SD
Flexibility (ability to switch suppliers)	3.2	0.68
Redundancy (safety-stock levels)	2.9	0.71
Visibility (real-time information)	2.6	0.79
Collaboration (cross-functional meetings)	3.0	0.65
Composite RI	**2.93**	**0.70**

The composite score of 2.93 indicates moderate resilience, with visibility being the weakest element. A one-sample t-test against a neutral midpoint (3.0) shows the index is not significantly different from neutral ($t = -0.89$, $p = 0.38$), suggesting room for improvement.

Objective 3 – Examine relationship between risk-management practices and performance

Variables	RMP	SCR	CE	DR
Risk-management practice (RMP)	1.00	0.62**	0.48**	0.55**
Supply-chain resilience (SCR)	0.62**	1.00	0.51**	0.59**
Cost efficiency (CE)	0.48**	0.51**	1.00	0.63**
Delivery reliability (DR)	0.55**	0.59**	0.63**	1.00

Table 4.2: *Pearson correlations (n = 108)*

Note: **p < 0.01.

Simple Linear Regression Results

Dependent Variable: Supply-Chain Resilience (SCR)

Independent Variable: Risk-Management Practices (RMP)

Variable	Coefficient	p-value
Intercept (Constant)	1.15	—
Risk-Management Practices (RMP)	0.68	< 0.001

Model Fit Statistics

Statistic	Value
R^2 (Coefficient of Determination)	0.38
Variance Explained	38%
Overall Model Significance	$p < 0.001$

Regression Equation

SCR = 1.15 + 0.68(RMP)

Interpretation: Risk-management practices explain 38% of the variance in resilience, confirming a strong positive link.

Qualitative Themes (from 12 interviews)

1. Reactive culture – “We act after a delay occurs; there’s no pre-approved contingency plan.” (Procurement Head)
2. Information silos – “Finance and projects work separately; we rarely share risk data.” (Risk Manager)

3. Technology gap – "We still use spreadsheets; no real-time visibility of shipments." (Logistics Officer)
4. Collaboration benefits – "Joint planning meetings reduced material hold-ups by ~12 %." (Project Director)

These themes echo the quantitative findings: low visibility and collaboration scores, and the need for a systematic, technology-enabled risk-management framework.

4.3 DISCUSSION OF FINDINGS

The dominant supplier-related risks (especially cement delays) align with prior studies on Nigerian public-sector construction (Akinyemi & Adeyemi, 2020). The moderate resilience index (2.93) suggests that FCDA's supply chain can absorb shocks to a limited extent, but not enough to prevent project overruns. The strong correlation between risk-management practices and resilience ($r = 0.62$, $p < 0.01$) supports the dynamic-capabilities view (Teece et al., 1997) that sensing and seizing capabilities drive adaptive performance.

The qualitative evidence of a reactive culture and information silos explains why visibility scores are low, reinforcing the need for a cloud-based control tower and a cross-functional Supply-Chain Resilience Committee. Moreover, the significant relationship between resilience and cost efficiency ($r = 0.51$) implies that improving resilience will yield tangible financial benefits—an important argument for senior management.

Overall, the results confirm that *enhancing risk-identification, visibility, and collaborative response mechanisms* will raise FCDA's supply-chain resilience, leading to more reliable project delivery and better value for money.

5.1 Summary of Findings

1. Sample profile – 108 respondents (90 % response) with a balanced mix of FCDA staff (48 %), contractors (41 %), and regulators (11 %); 67 % hold at least a bachelor's degree and 42 % have >10 years of supply-chain experience.
2. Risk landscape – Supplier-related delays (especially cement) and logistics disruptions are the most frequent and highest-impact risks.
3. Resilience level – Composite Resilience Index = 2.93 (moderate). Visibility (2.6) and redundancy (2.9) are the weakest dimensions.
4. Key relationship – Risk-management practices strongly predict resilience ($\beta = 0.68$, $p < 0.001$) and are positively linked to cost efficiency and delivery reliability.

5. Qualitative insights – A reactive, siloed culture and lack of real-time technology hinder effective risk response; collaborative meetings show potential for improvement.

5.2 CONCLUSIONS

1. Effective risk management is a critical driver of supply-chain resilience* in FCDA.
2. Current practices are moderately mature but insufficient to prevent costly delays and cost overruns.
3. Visibility and collaboration are the primary bottlenecks; addressing them will yield the greatest resilience gains.
4. A systematic, technology-enabled, and cross-functional approach (centralized risk register, control tower, resilience committee) is essential for transitioning from reactive to proactive supply-chain management.

5.3 Recommendations

1. Create a centralized risk register and heat-map – Log all risks by source and impact, then use a probability × impact matrix to prioritize mitigation.
2. Institutionalize quarterly risk-identification workshops – Bring procurement, projects, finance, and key suppliers together to update the register and capture emerging threats.
3. Conduct a resilience audit and develop a resilience index* – Measure flexibility, redundancy, visibility, and collaboration; track the index over time to gauge improvement.
4. Design an integrated risk-management framework with clear trigger points – Link the risk register to the resilience index, specifying when to activate contingency actions (
5. Deploy a cloud-based supply-chain control tower and pilot dual-sourcing for critical materials; and
6. Establish a cross-functional Supply-Chain Resilience Committee, embed risk-management into procurement policies, provide regular training, and publish an annual resilience report.

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