Beyond Disruption:
Navigating the Future
With Resilient Supply Chains

Introduction

In an era of unprecedented disruptions, the resilience of supply chains has become a crucial factor for businesses' success. Understanding the urgency behind resilience and taking steps to fortify your supply chains against various threats is essential. By analyzing your supply chain, identifying vulnerabilities, and implementing risk management strategies, you can minimize the impact of disruptions and maintain the future resilience of your supply chain. In this white paper, we address some key challenges impacting businesses today and outline the proactive measures that Vertiv is undertaking to tackle them effectively.

Key Terms and Concepts

This white paper focuses on three key themes: supply chain resilience, risk management, and sustainability. Supply chain resilience is the ability of a supply chain to recover from disruptions and continue to function effectively, whereas risk management entails identifying and mitigating potential threats. As defined by the United Nations, sustainability means *"meeting present needs without jeopardizing future generations' ability to meet their own."*

Objectives and Benefits

This paper's main objective is to give business leaders a better understanding of the resilience imperative. By doing so, it aims to empower organizations to navigate the future with supply chains that are not only robust, but adaptable. The benefits extend beyond survival; they encompass the ability to turn disruptions into opportunities for growth and innovation.

The Resilience Imperative

Central to this exploration is the Resilience Imperative — an analysis of why resilience has become non-negotiable in modern supply chain management. From examining the impact of natural disasters to dissecting the consequences of geopolitical tensions, this section emphasizes the urgent need for organizations to acknowledge these risks and allocate the necessary resources.

Vertiv's Approach to Resilience

This chapter lays out the approach Vertiv has taken to enhance the resilience of its supply chain. These measures go beyond individual suppliers, to focus on broader initiatives that promote organizational adaptability, sustainability, and operational strength.

About Vertiv

Enabling the Continuity of Today's and Tomorrow's Vital Applications

Technology and data connectivity are essential for human progress. At Vertiv, we envision future-ready infrastructures and leverage our expertise and passion to serve our customers. Our hardware, software, analytics, and services portfolio enables our customers to run their vital applications continuously, perform optimally, and scale with business needs.

Our solutions cover a range of end markets, including data centers (Hyperscale/Cloud, Colocation, Enterprise, and Edge), communication networks (macro site, central office, small cell, and data center), and commercial and industrial sectors (healthcare, manufacturing, rail/mass transit, power generation, and oil and gas).

We aim to meet the world's increasing demand for data more efficiently through innovation, close collaboration with our suppliers and customers, and implementation of effective sourcing strategies. By doing so, we earn a reputation as a reliable partner for businesses seeking to establish sustainable and resilient supply chain networks.

Meeting our customers' demand for data — wherever they are.

Global Presence

Manuf. and Assembly Locations **24**
Service Centers **220+**
Service Field Engineers **3,500+**
Technical Support/Response **220+**
Customer Experience Centers/Labs **19**

Americas

Manuf. and Assembly Locations **10**
Service Centers **80+**
Service Field Engineers **1,600+**
Technical Support/Response **90+**
Customer Experience Centers/Labs **5**

Europe, Middle East and Africa

Manuf. and Assembly Locations **10**
Service Centers **65+**
Service Field Engineers **650+**
Technical Support/Response **100+**
Customer Experience Centers/Labs **5**

Asia Pacific and India

Manuf. and Assembly Locations **4**
Service Centers **75+**
Service Field Engineers **1,250+**
Technical Support/Response **30+**
Customer Experience Centers/Labs **9**

Fig. 1: Global Reach - A map illustrating Vertiv's network of influence and operations across the globe as of FY 2022.

Evolution of Global Supply Chains

In the early days, supply chains were primarily local, with businesses sourcing materials and producing goods near consumers. However, the Industrial Revolution led to the development of mass production and transportation technologies, which enabled companies to source materials and make goods more efficiently in lower-cost locations. This development led to global supply chains, with businesses sourcing materials and producing goods worldwide.

Main Drivers

Globalization

McKinsey's research indicates that in 2021, large companies are connected to more than 5,000 suppliers on average. This connection highlights globalization as the leading force shaping modern supply chains and underscores the need for understanding global dynamics to ensure the resilience and vitality of supply chains.

Digital Transformation

Over the last few decades, businesses have undergone a significant transformation in response to the growing impact of digital technologies. Companies had to adapt to increasing customer expectations through greater efficiency, transparency, and collaboration by elevating the strategic importance of supply chain management and digitizing the functioning of supply chains. (Supply Chain 4.0 – the next-generation digital supply chain | McKinsey).

Sustainability

A 2021 IBM study based on thousands of interviews with chief executive officers (CEOs) indicates that 83% of global CEOs see sustainability as a top business priority and expect sustainability investments to produce improved business results in the next five years. With environmental and social concerns in focus, businesses prioritize supply chain practices such as reducing carbon emissions, promoting ethical treatment of workers, and sourcing eco-friendly materials, as a condition of market access and access to capital.

Customer Expectations

Evolving consumer preferences, including a desire for personalized and convenient shopping experiences, drive businesses to enhance product delivery efficiency. A Deloitte study indicates a concurrent shift in consumer behavior toward sustainability, with individuals increasingly seeking durable, repairable, and responsibly sourced products. This alignment highlights a growing awareness among consumers about environmental considerations, influencing their choices in the marketplace.

The Resilience Imperative

The necessity for resilient supply chains is accentuated by the profound impact of recent catastrophic events, underscoring the urgency of fortifying our systems. In taking stock of the past, we position ourselves not only to weather the storms of today but to build a supply chain that is robust, adaptive, and future-ready.

Types of Risks

Economic Disruptions

Recessions, inflationary periods, and currency fluctuations can severely affect global supply chains, resulting in substantial financial impacts. According to Interos, a supply-chain risk management company, economic disruptions caused an average of $82 million in annual losses in key industries per company last year. Resilient supply chains are key to protecting profitability in uncertain environments.

Geopolitical Risks

Geopolitical risk in the global supply chain refers to challenges companies face due to political tensions impacting their operations, performance, and personnel. This risk is amplified by increasing international competition for influence, as reported in the US National Intelligence Council's "Global Trends 2040."

Technological Risks

[Supply chain cyberattacks have risen by more than 430% in the last few years](#). Cybercriminals are now targeting the weaker parts of a system, allowing them to go undetected and gain access to high-value targets, as seen in the attack on upstream servers of high-profile software vendors used across global industries. Businesses must be aware of and improve their cybersecurity measures to prevent or minimize the impact of these attacks.

Operational Risks

Supply chains face internal, external, and human error risks. [The 2023 Global Supply Chain Risk report](#) highlights the importance of addressing these operational threats. Almost half of the companies surveyed believe they can control the root causes of these risks while more than 70% say that they only have "some influence over the quality of supply chain risk management." The recognition of a lack of control over the root causes of risks highlights the importance of being able to thrive, despite inevitable disruptive events.

Recent Disruptions

COVID-19

The COVID-19 pandemic significantly impacted the global economy in 2020 and 2021, causing a decrease in output across all regions compared to their pre-pandemic trend. A [study](#) has shown that India was the most affected country, experiencing a 12.23% drop in real GDP. Conversely, Emerging and Developing (E&D) Europe was the least affected, with only a 1.07% decrease. Even advanced countries saw a decline, with a 3.27% decrease in real GDP. Regarding inflation, most countries experienced higher prices than anticipated, ranging from -3.49% in China to 6.46% in E&D Sub-Saharan Africa. Additionally, the COVID-19 pandemic's supply chain challenges and Russia's invasion of Ukraine could result in a cumulative loss of €920 billion to the gross domestic product (GDP) across the Eurozone by 2023, as per a [report by Accenture](#). This potential loss equates to 7.7% of the Eurozone GDP in 2023.

Tariffs

[According to a study by the International Monetary Fund (IMF)](#), increased tariffs between the United States and China have disturbed the supply chain stages of various goods, from steel to washing machines. The research indicates the impact of a reciprocal and uniform increase in bilateral tariffs by 25 percentage points between the two nations could reduce approximately 5% in Chinese value added and around 3% in US value added. These figures suggest that tariffs could have a ripple effect on global value chains, potentially impacting countries and industries beyond those directly targeted.

Cyberattacks

[In 2022, there were 150 cyberattacks on industrial operations](#) — a 140% increase from the previous year. If this trend continues, it could shut down 15,000 industrial sites by 2027. These ransomware-based attacks targeted information technology (IT) and operational technology (OT) networks. The need to digitalize comes with an imperative to embed cyber resiliency in supply chains.

Natural Disasters

The United States faced an unprecedented [23 separate billion-dollar weather and climate disasters](#) in the first eight months of 2023, surpassing the previous record of 22 for the entire year of 2020. These natural disasters caused widespread destruction, resulting in 253 direct and indirect fatalities and more than $57.6 billion in damages. Operational risks from climate disasters are a present and growing challenge that require flexibility in supply chain design given the unpredictable nature of these events.

Global Supply Chain Disruption Impact by the Numbers

$82 Million
The average loss from economic disruptions in 2022 per company in key industries
(Source: interos.com)

430%
Rise in global supply chain software cyber-attacks since 2020
(Source: 2020 State of the Software Supply Chain)

€920 Billion
Cumulative impact of COVID-19 on the gross domestic product (GDP) across the Eurozone by 2023
(Source: From Disruption to Reinvention – The Future of Supply Chains in Europe)

23
The record number of billion-dollar weather and climate disasters in the United States for 2023
(Source: NOAA National Centers for Environmental Information)

What's on the Horizon

The insights from McKinsey's 2023 Supply Chain Pulse Survey underscore the importance of proactive preparation for potential disruptions and their implications. Businesses can navigate challenges, stay ahead of the curve, and adeptly manage risks and uncertainties through a dedicated focus on and investment in resilient supply chain strategies.

Regionalization Trends

The survey shows that 64% of respondents are actively working to regionalize their supply chains. Findings also indicate a notable increase in actions taken to improve resilience, with companies adopting strategies such as increasing inventory buffers, pursuing dual sourcing, and obtaining inputs from suppliers closer to their production sites.

Digital Planning Challenges

The pandemic has accelerated a technological revolution in supply chain management, which recognizes that resilient supply chain systems require pivotal elements such as end-to-end visibility, high-quality master data, and effective scenario planning. However, challenges persist in Advanced Planning and Scheduling (APS) systems, with many citing manual interventions and limited organizational usage.

Geopolitical Considerations

The rising tensions between countries have increased the risk of supply chain disruptions across industries. Companies are responding by improving their supply chain risk management systems. A survey shows that 71% of companies have in-house capabilities to manage supply chain risks, and 93% are actively measuring the impact of these risks on their revenue. This shift in focus from costs to revenue is a positive trend.
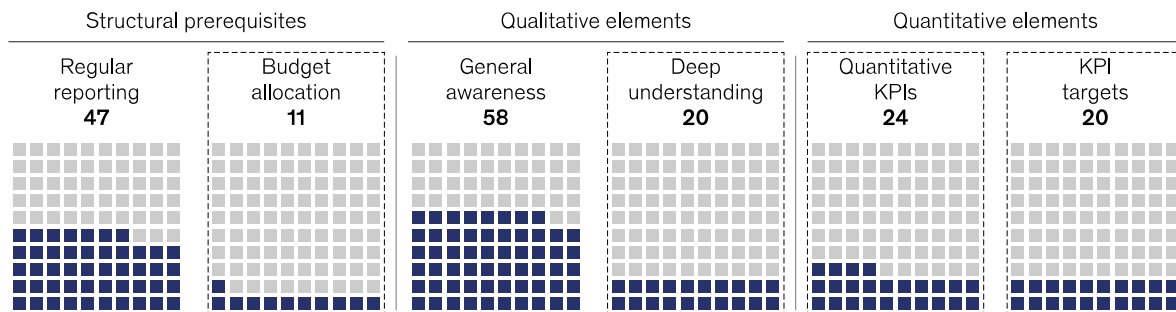
Board-Level Engagement

A gap exists in the board-level engagement with supply chain risks. Less than half of the respondents report regularly at the board level, and only a minority allocate specific budgets for risk management. Confidence in senior leaders' deep understanding of supply chain risks is also limited.

Executives say boards have a general awareness of supply chain risks, but highly effective risk practices remain rare.

Supply chain executives' assessment of board-level engagement in supply chain risk issues, % of respondents

Area of concern

Structural prerequisites		Qualitative elements		Quantitative elements	
Regular reporting **47**	Budget allocation **11**	General awareness **58**	Deep understanding **20**	Quantitative KPIs **24**	KPI targets **20**

Source: McKinsey Annual Supply Chain Pulse Survey, conducted mid-April to mid-May 2023, n = 101

McKinsey & Company

Fig. 2: Limited Board Understanding and Key Performance Indicator Usage - 1 in 5 boards understand supply chain risks deeply; few use quantitative KPIs for effective mitigation.

Summary

The McKinsey 2023 Supply Chain Pulse Survey highlights persistent challenges despite improving supply chain flexibility and efficiency. Respondents surpassed digitization goals but acknowledged untapped potential, hindered by weak processes and a digital talent shortage. As advanced technologies, such as artificial intelligence (AI), become more prevalent, it is a call to action for companies to address the challenges, reinforce their processes, and invest in digital talent now to bridge the gap.

Vertiv's Approach to Building Resilience

Vertiv provides uninterrupted operations through its digital infrastructure hardware, software, and services and adapts its product portfolio to align with global conditions while minimizing ecological impact. Vertiv recently implemented a Global Supply Chain Risk and Resiliency program to address supply chain disruptions and build an ever-increasing level of resilience in its operations.

A critical element of resiliency at Vertiv is Sustainability—ensuring a continuing and responsible business operation. Vertiv's values, regulatory requirements, and customer perceptions all drive Vertiv's sustainability initiatives. The following guide shares Vertiv's proactive measures and data from **Forrester's Q4 2022 Global Environmental Sustainability IT Buying Survey** to pave the way for a strong, flexible, and environmentally sustainable supply chain. While Vertiv is adopting these practices, it is important to note that some are still in the early stages of implementation.

About the Survey

Forrester's Q4 2022 Global Environmental Sustainability IT Buying Survey sampled 397 decision-makers from global enterprises in North America, Europe, and Asia Pacific (APAC). The survey included organizations from various sectors, such as manufacturing, energy, retail, technology, and financial services, with more than 1,000 employees, $250 million in revenue, and a dedicated budget for environmental sustainability.

Forrester published a report, The State of Manufacturing Sustainability Initiatives, 2023, that examines the current state of environmental sustainability in manufacturing firms, which use energy, raw materials, and equipment to create products, consume finite resources and emit greenhouse gases. The report provides valuable insights that sustainability leaders in manufacturing firms can use to benchmark their metrics, goals, and challenges and understand the state of their sustainability initiatives.

The Forrester data cited below is based on the survey responses of 78 global sustainability and technology-related manufacturing decision-makers and influencers at enterprises.

Proactive Assessment and Partnerships

Vertiv's proactive collaboration with external partners in assessing its environmental impact is a key approach for companies aiming to advance supply chain resiliency through sustainability goals. The insights Vertiv gleaned from the survey conducted by Forrester emphasize the pivotal role of such collaborations in crafting a robust and holistic sustainability plan.

By involving external partners, companies can tap into a wealth of expertise, data, and perspectives that contribute to a more nuanced understanding of their environmental footprint. This collaborative approach allows companies to align with industry best practices, navigate emerging challenges, and fortify their supply chains against disruptions, all while making strides toward environmental stewardship.

Environment, Health, Safety, And Sustainability Management Platforms

Survey results reveal a significant industry trend, with 76% of manufacturing respondents actively incorporating environment, health, safety, and sustainability (EHSS) management platforms into their operations. This widespread adoption underscores the critical role that EHSS programs play in addressing concerns while aligning with broader sustainability goals.

Moreover, the complexities associated with reporting Scope 3 emissions, as highlighted by the survey (only 32% of Forrester survey respondents in manufacturing say they report annually), emphasize the broader industry awareness of the challenges involved. Vertiv collaborates closely with its partner organizations to obtain valuable EHSS data. This involves conducting outreach campaigns to suppliers and business partners, who can report the data to Vertiv through information-sharing portals in specific areas. Additionally, Vertiv has adopted an EHSS Management Platform to streamline the process.

Carbon Emission Reporting

Vertiv strongly emphasizes addressing carbon emissions as part of its Global Supply Chain Risk and Resiliency program. Vertiv measures scope 1, 2, and 3 greenhouse gas (GHG) emissions. The company does not publicly disclose GHG emissions data, however, it does report to select organizations such as the Carbon Disclosure Project (CDP). Reporting emissions can be challenging, as highlighted by the Forrester survey, which found that only 67% of companies report scope 1 and 2 emissions, and a mere 32% of companies report scope 3 emissions annually. Vertiv partners with a leading service provider to maximize coverage and accuracy across scope 1, 2, and 3 emissions reporting.

"Which of the following metrics does your organization report to its shareholders/stakeholders on at least annually?"
(Multiple responses accepted)

67% - Scope 1 and 2 GHG emissions

44% - Generation of harmful substances/pollution

60% - Energy usage

37% - Usage of raw materials

58% - Water consumption and wastewater management

37% - Usage of scarce materials

51% - Volume of waste

32% - Scope 3 GHG emissions

44% - Air quality

26% - Land use

Base: 78 global sustainability and technology-related manufacturing decision-makers and influencers at enterprises.

Source: Forrester Research, Inc. Q4 2022 Global Environmental Sustainability IT Buying Survey

Leadership Support of Sustainability Goals

Forrester survey findings align with Vertiv's leadership approach, indicating that 69% of manufacturing respondents entrust pivotal roles for steering sustainability goals.
The involvement of other key positions, such as chief operating officers (COOs) at 47% and CEOs at 37%, acknowledges that sustainability is a shared responsibility cutting across various organizational functions.

In Vertiv, Sustainability leadership starts at the top. Our Board is kept apprised of our ESG efforts and performance, especially as it pertains to risks and opportunities for the company. Our ESG Executive Steering Committee, made up of C-suite officers and other global leaders, helps shape and guide our ESG strategy, programs, policies and performance. This committee meets quarterly and engages with our Board to share ESG information and progress.

Bill of Materials (BOM) Health Approach

The industry has shown considerable interest in management platforms enhanced with sustainability features. Additionally, there is a notable adoption of various technologies within manufacturing companies, encompassing sustainability ratings, ESG analytics, carbon and energy management, sustainability management software, and e-waste and climate risk analytics.

Vertiv's BOM health approach aligns with this trend. It scrutinizes a broad range of risk factors associated with each part of a product to minimize the impact of any potential disruptions. This systematic, measurable, and repeatable approach identifies and addresses potential risks before they turn into recurring disorders.

IT Strategies Driving Resiliency

Vertiv believes that based on the results of the Forrester survey, the manufacturing industry is transforming, with sustainability seamlessly integrated into technological advancements. Noteworthy contributors to this shift, including Vertiv, are infusing digitalization and sustainable principles into their supply chains. Integrating these technologies enhances efficiency and strengthens operational resilience by streamlining operations, minimizing waste, and optimizing resource use.

Collaborative Efforts for IT Sustainability Needs

This engagement from the manufacturing industry covers essential areas such as developing training programs, creating communication frameworks, implementing assessment procedures, auditing processes, managing carbon components, optimizing operational processes, and ensuring the sustainability of products and materials. This alignment provides flexibility to tackle future challenges and positions the sector as a leader in innovative and sustainable business practices.

Prevalent Adoption of AI and Machine Learning (ML) in Risk Management

A prominent trend emerging across the manufacturing sector is the widespread adoption of AI and ML in supply chain risk management. This shared adoption of AI and ML is a trend and a strategic imperative to help managers make informed decisions quickly and fortify the supply chain against emerging challenges. AI and ML tools can analyze vast data, provide valuable insights, optimize delivery routes, automate trucks, predict transit, and avoid weather events—allowing real-time visibility of risks across the entire supply network.

Vertiv's Actionable Approach to Supply Chain Risk Management

Vertiv believes that supply chain risk management is a continual process of repeatable practices, rather than a one-off activity. Monitoring the health of every aspect of the supply chain is essential to mitigate various risks. Vertiv ensures a secure, reliable, and efficient supply chain with dedicated professionals, practical tools, and robust systems. With this understanding, let's explore how Vertiv manages its global supply chain and maintains a proactive approach toward risk management.

1. Team Composition Strategy: Building Expertise

Assemble a cross-functional Risk and Resiliency team with diverse expertise.

Implementation Steps:

- Identify and recruit experts from various functions, including data reporting and sustainable procurement, and leaders with operations, planning, and risk management backgrounds.
- Ensure ongoing training and development to keep the team updated on industry trends and risk management practices.

2. Onboarding Process Strategy: Proactive Risk Screening

Implement a comprehensive risk assessment during supplier onboarding.

Implementation Steps:

- Develop a standardized risk screening process for new suppliers.
- Include factors such as compliance practices, production capacity, and quality processes in the screening criteria.
- Establish clear guidelines for addressing identified risks during onboarding.

3. Bill of Materials (BOM) Health Strategy: Targeted Risk Reduction

Vertiv has developed the BOM Health model for focused supply chain risk reduction.

Implementation Steps:

- Prioritize customer experience in the evaluation of risk factors.
- Utilize the BOM Health model to assess risks related to sourcing methods, supplier risk, technical specifications, and execution.
- Establish a structured risk mitigation plan linked to business success.

4. Managing Geopolitical Risks Strategy: Enhanced Supply Chain Mapping

Integrate supply chain mapping with geographic threat data for proactive risk management.
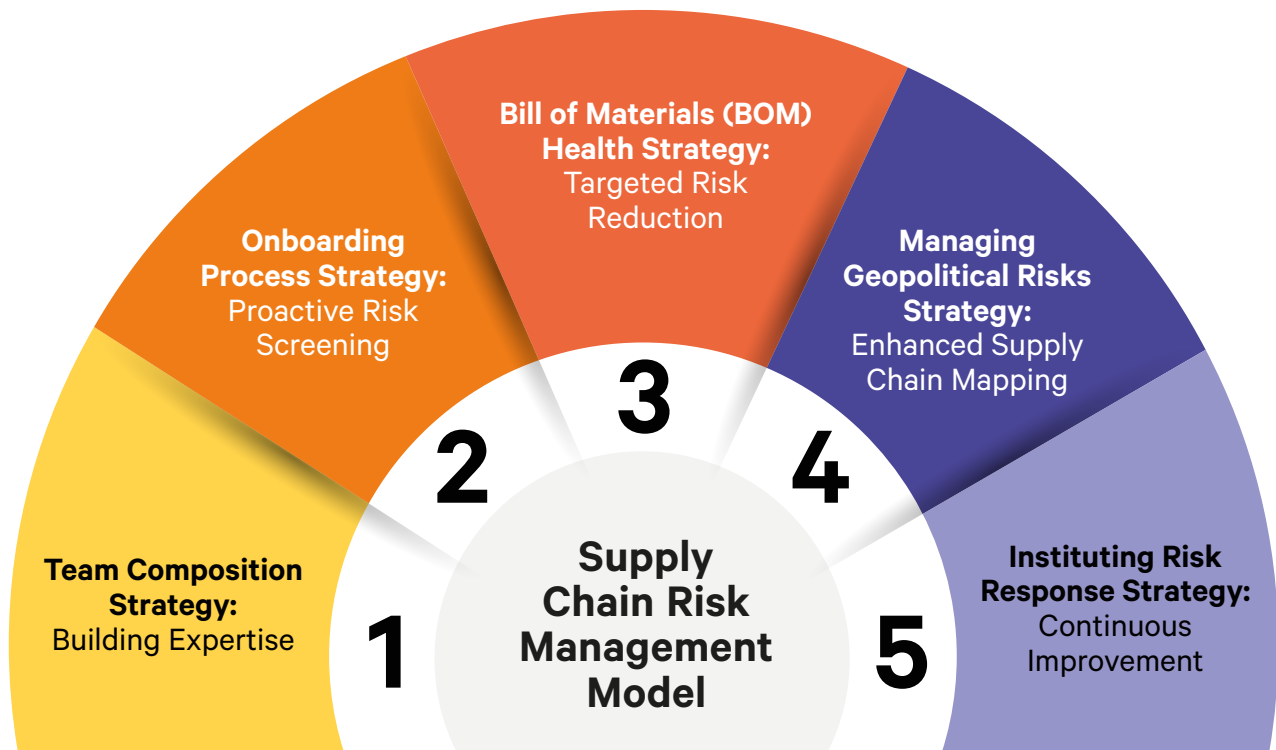
Implementation Steps:

- Utilize data modeling and emerging AI technologies to map the entire supply chain.
- Extend the mapping to include Vertiv's suppliers and their suppliers within the supply chain.
- Establish a real-time monitoring system to assess geopolitical risks and take prompt actions.

5. Instituting Risk Response Strategy: Continuous Improvement

Implement a systematic approach for identifying, assessing, monitoring, and mitigating known risks.

Implementation Steps:

- Develop a standardized risk management framework with transparent scoring methodologies.
- Utilize digital tools for continuous monitoring, incorporating early warning mechanisms.
- Institute a cross-functional governance mechanism, ensuring representation from every value-chain node for regular reviews and proactive mitigation planning.

Supply Chain Risk Management Model

1. **Team Composition Strategy:** Building Expertise
2. **Onboarding Process Strategy:** Proactive Risk Screening
3. **Bill of Materials (BOM) Health Strategy:** Targeted Risk Reduction
4. **Managing Geopolitical Risks Strategy:** Enhanced Supply Chain Mapping
5. **Instituting Risk Response Strategy:** Continuous Improvement

Conclusion

When reviewing the strategies addressed in this white paper — proactive risk management, integration of sustainability, and collaborative strength — it is clear that they are not mere abstracts but practical guidelines for your operations. Embrace them, customize them to your specific needs, and witness the operational strength that emerges even during uncertain times.

This brief exploration of supply chain resilience is an open invitation to action. Vertiv is constantly searching for new suppliers and partners who share our ambitions and can assist us in developing an ever more resilient and sustainable supply chain.

Contact Vertiv to be part of our journey towards resilience and sustainability today.