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WHITEPAPER

Supply Chain Management in View of Climate Change

A Manufacturing Perspective

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Contents

Introduction

Climate change has undergone a remarkable transformation, becoming one of the most crucial considerations in decision-making across industries in recent years. This shift marks a stark change from the past, when it wasn't given as much importance. As the global climate crisis worsens, businesses in diverse sectors must confront the challenges posed by climate change in their supply chain management strategies.

Supply chain management now plays a pivotal role in addressing the complexities of climate change. The intricate network of interconnected suppliers, manufacturers, distributors, and customers offers significant opportunities to curb greenhouse gas emissions, promote sustainability, and foster resilience in the face of climate-related disruptions. In this evolving landscape, businesses must now navigate a more demanding and risk-prone environment. To effectively respond to sustainability challenges, companies must consider various perspectives, including resource-based, institutional, supply chain, and stakeholder views. These factors collectively shape and define corporate strategic responses to sustainability issues posed by climate change.

50%

Transport issues caused by extreme weather have delayed or prevented 50% of companies from acquiring critical products

32%

Extreme weather has forced 32% of businesses to source goods from a more expensive supplier

13%

A total of 13% of companies have invested in extra warehouses to accommodate increased stockpiling

Source: BCI Extreme Weather and Climate Change Report 2022

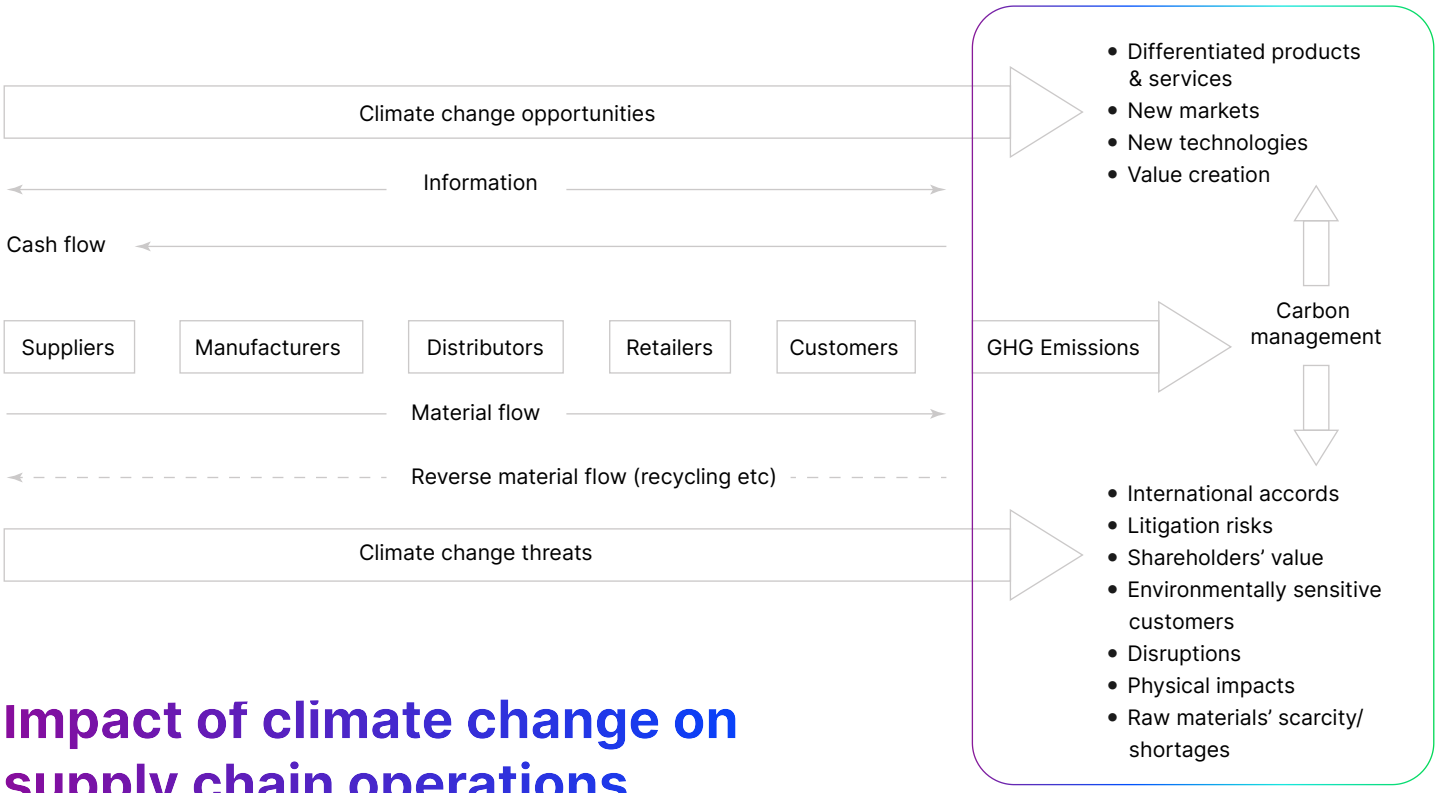
The role of supply chain management in addressing climate change challenges

Three types of climate change risks can affect a business — risks to core operations, risks to the value chain, and risks that arise from broader changes in the economy and infrastructure. Also, climate change mitigation and adaptation policies may further affect business operations in a rather indirect way.

Until now, the perspective of climate change in supply chain management has primarily focused on operations management, while the challenges of streamlining complexity throughout the supply chain have not received sufficient attention. However, the role of supply chain management in addressing climate change extends beyond merely mitigating emissions. Taking a strategic approach, supply chain networks can leverage changing climate conditions to their advantage. This requires a comprehensive outlook that incorporates sustainability principles into every supply chain stage, from procurement to disposal. Supply chain management must adopt a holistic approach to effectively tackle climate change challenges. This approach involves collaborating closely with suppliers, optimizing transportation and logistics processes, embracing green manufacturing practices, fostering innovation and technology adoption, and promoting employee engagement and education.

This white paper explores the implications of climate change on supply chain management from a manufacturing perspective. It highlights the importance of integrating sustainability practices into the manufacturing supply chain and proposes strategies to enhance resilience, reduce emissions, and promote sustainable practices throughout the value chain. By adopting these recommendations, manufacturers will contribute to climate change mitigation efforts, improve operational efficiency, ensure long-term viability, and enhance their reputation among environmentally conscious consumers.

Climate change threats and opportunities for supply chain networks



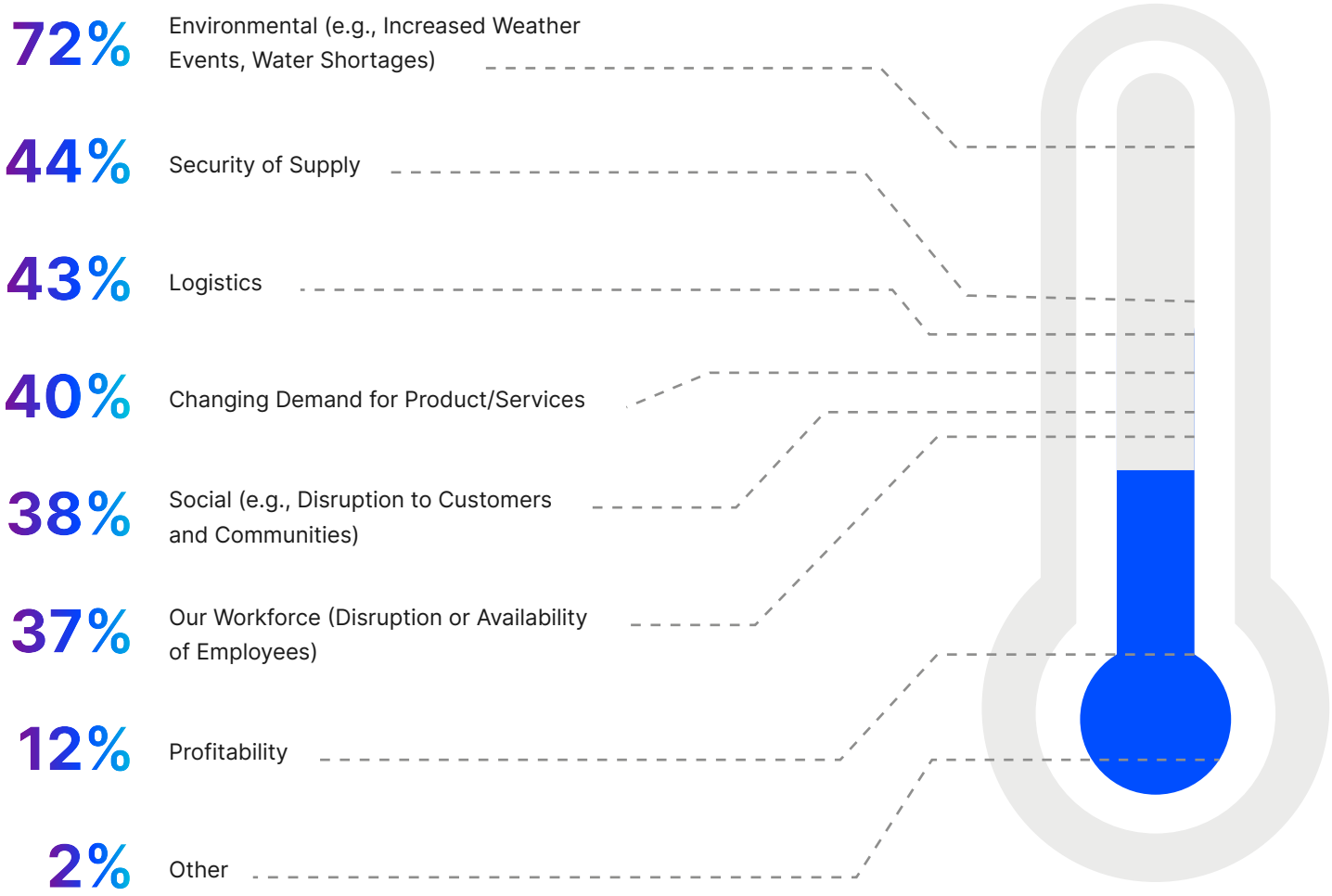
Impact of climate change on supply chain operations

As products move through each stage of the supply chain, they gain value, but this process also contributes to environmental degradation, particularly in terms of climate change, as it leads to the release of greenhouse gases (GHGs). Consequently, each link in the supply chain faces various risks and opportunities related to climate change, including extreme events like flooding, high winds, more frequent hot summers, desertification, rising sea levels, hurricanes, temperature fluctuations, changes in weather pattern, increased storm intensity and frequency, water shortages, and the spread of diseases. Thus, the relationship between climate change and supply chain operations is interdependent, affecting one another. Given that manufacturing activities significantly contribute to greenhouse gas emissions adopting sustainable supply chain management practices has become more critical than ever before.

Supply Chain links	Climate change impacts/risks
Manufacturing	• Damage or complete destruction of assets • Liability risks • Disruption of plants and production lines • Regulation regarding carbon emissions • Changes in the effectiveness or efficiency of production processes • Increased costs for energy and maintenance activities • Increased cost of upstream operations and product quality • Stimulation of investments in renewable energy and energy efficiency projects increase in demand for biofuels and renewable energy sources in the energy sector • Increase in demand for pharmaceuticals' sector • Stimulation of demand for non-emitting products • Deployment of lower carbon intensity operating practices by market leaders' development of diversified products based on lower GHG emissions

Transportation	• Increase in buckled rails and rutted roads • Delays leading to paying compensation to operators and causing problems to customers • Overhead cables brought down because of strong winds • Problems related to coastal defense's • Drainage issues • Landslip resulting from heavy rainfall • Securing stability of structures
Warehousing and storage	• Vulnerability of infrastructure, personnel, communications, supply etc. • Possible dislocation due to extreme weather events
Trading Consumption and Customer Service	• Reputational risk in downstream sectors due to increased need for transparency • New regulations regarding product labeling • Increases in the consumer goods production costs and prices • Decrease of demand for consumer products • Need for improved product design aiming at the elimination of packaging material and the • Enhancement of product durability, reusability, recyclability, and materials efficiency

Climate change impact areas in supply chain



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Source: 2022 Gartner Emerging Priorities in Supply Chain Survey 2022

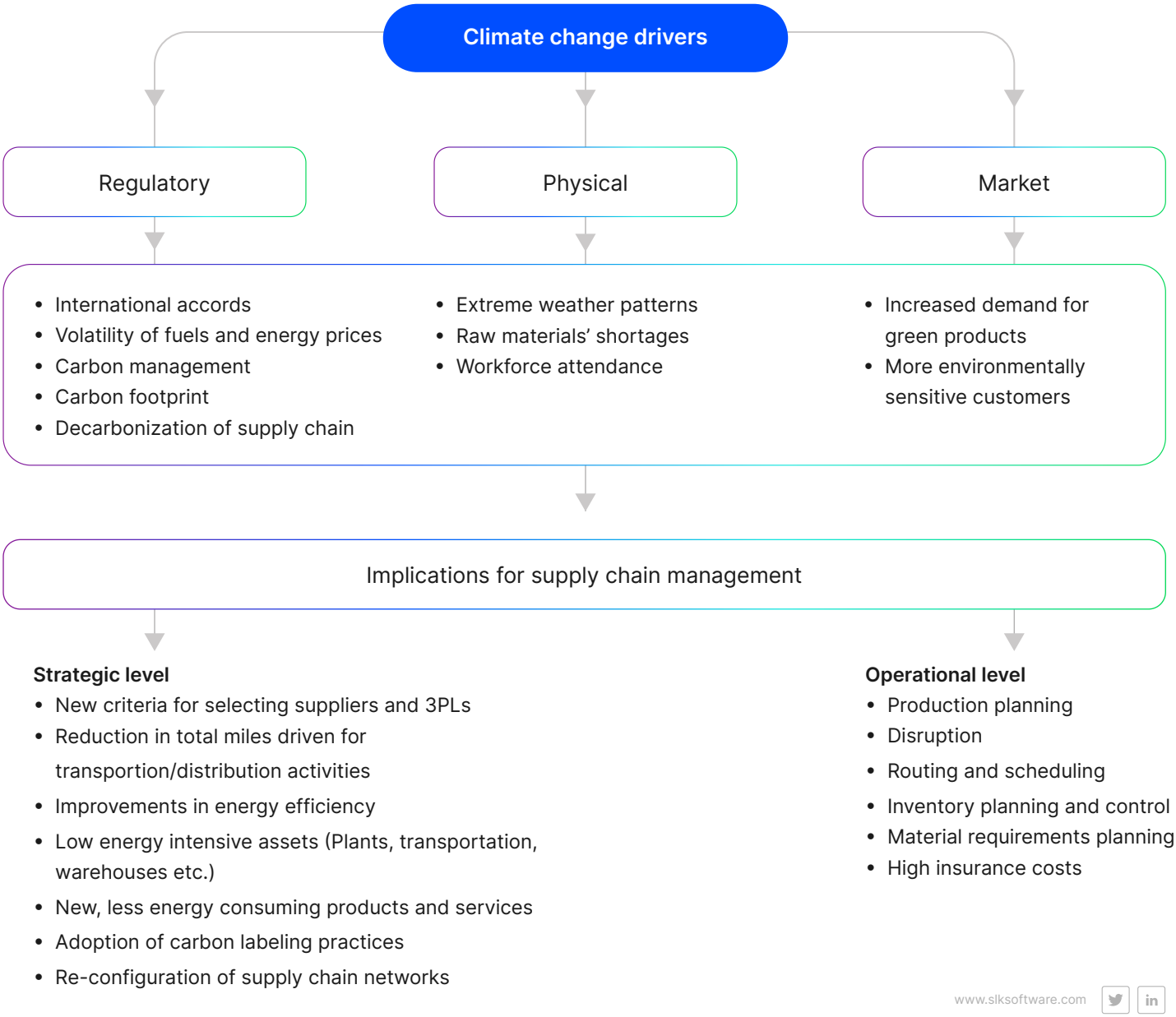
The impact of climate change is typically split into three groups

Transition risks: These risks stem from policy and market changes during the transition to a lower-carbon economy. For instance, if the cost of carbon increases or regulations on emissions become more stringent, fossil fuel assets might become stranded. Stranded assets might then face a threat to early write-downs and fail to yield expected financial returns.

Physical risks: These risks can be event-driven or represent longer-term shifts in climate patterns. Event-driven risks mean floods and wildfires, which can have immediate and severe impacts, while longer-term shifts cover the risks associated with rising average temperatures, increasing sea levels, and chronic heat waves that gradually affect ecosystems and communities.

Climate change opportunities: These opportunities arise from changes in consumer preferences for products or services and the emergence of new markets. For instance, as consumers shift towards sustainable choices, opportunities arise for products or services that align with environmentally friendly values. An example of this trend is the growing adoption of electric vehicles and the development of associated charging infrastructure.

Implications of climate change for supply chain management



Climate change impact on manufacturing

Manufacturing industries are now facing even greater volatility due to the impact of climate change. The industry heavily relies on various supply chain assets vulnerable to the effects of changing climate conditions. Disruptions caused by climate-related hazards can significantly impact day-to-day manufacturing processes and operations. Hence, supply chain management in manufacturing must consider the potential effects of climate-related factors.

One notable consequence of rising global temperatures and changing weather patterns is the disruption of manufacturing operations. For example, during August and September 2022, a combination of drought and heat waves in Southern China resulted in water scarcity and hydroelectric power rationing. As a result, factories in the key manufacturing hub of Sichuan province had to shut down, leading to significant supply chain disruptions in the automobile and semiconductor industries, particularly those relying on water-intensive processes.

The frequency of extreme weather events also causes disruptions in supply chain networks. Infrastructure damage from these climate hazards can hinder trade routes and lead to longer waiting times, affecting the entire supply chain.

For instance, in July 2021, flooding in Belgium, the Netherlands, and Germany substantially increased delayed shipments, impacting multiple manufacturing industries. Research by CDP suggests that by 2026, companies may face up to US$120 billion in costs from environmental risks in their supply chains.

From the consumer standpoint, there is a growing demand for high-quality products and services at affordable prices while also considering environmental factors like carbon footprint and energy efficiency. Manufacturers failing to incorporate these environmental concerns into their supply chain strategy or neglecting climate change issues may face the consequences from environmentally conscious customers.

In this context, supply chain management plays a critical role in meeting the new requirements posed by climate change, as supply chains compete more than individual companies. Developing an appropriate supply chain strategy will enable firms to capitalize on the opportunities climate change presents while mitigating potential threats.

Aspects of Supply Chain Design	Climate Change implications
Facilities	• Imposition of regulatory frameworks in certain geographical areas • Dislocation of energy-intensive production processes • Technology selection and relevant investments conditioned to emissions reduction frameworks • Capacity planning affected by specific production technologies adopted (producing fewer emissions) • Placement of facilities as near as possible to consumption sites (minimization of transportation costs and total emissions) • Proximity aspects (manufacturing plants producing “green” products directed towards more “green-sensitive” markets) • Resources’ scarcity
Facilities	• Climate change implications

Sourcing	• New or different criteria for the selection of sourcing agents. • Changes of buyers' negotiating power over suppliers (cost, quality and lead time should be complemented by emissions) • Suppliers having to put in place well-established carbon auditing frameworks • Proximity to suppliers and “near sourcing” becoming key-sourcing drivers • Considerations regarding natural resources and their availability, quality, and price • Reinforcement of shifting or diversifying sourcing locations strategies • Incorporation of carbon considerations into contract management
Transportation and distribution	• Emissions reduction forcing total miles driven and number of nodes downwards • Higher consolidation of nodes and more consolidated and aggregated shipments • New drivers for selecting modes of transportation and distribution considering with vehicles’ technology, the utilization of low carbon fuels, the usage of lightweight materials, aerodynamics, infrastructure quality • Switches between the usage of energy and less energy intensive transportation modes • New approaches of delivering products to customers (neighborhood delivery) or transporting products • Transportation assets placed in locations where vulnerability assessments have been carried out
Product design	• Evaluation of alternative scenarios for product design using GHG inventories involving alternative materials, sources of purchasing, production processes, parameters affecting better handling and storage of products and packaging options • Wider adoption of End-to-End approaches like the embedded emissions of a product’s parts • Throughout its life cycle during the bill of materials phase
Supply chain configuration	• Coordination, alignment, collaboration, and information issue having to be revisited (efficient carbon management will be an additional driver and responsibilities, regarding GHG emissions, among partners will have to be redefined) • Aspects of centralized versus decentralized supply chain networks to be reconsidered • Agile supply chains forced to find alternative ways of fulfilling emergency orders in terms of reduced carbon emissions • Just-in-Time systems having to be revisited as their need for frequent deliveries contradicts carbon emissions reductions targets

Key challenges in supply chain management

Supply chain management faces several difficulties in climate change due to its complex and interconnected nature. Here are some reasons why it can be challenging:

Uncertainty and unpredictability:
Climate change introduces high uncertainty and unpredictability. Extreme weather events, shifting climate patterns, and their impacts are difficult to forecast accurately. This uncertainty makes it challenging for supply chain managers to plan and make informed procurement, production, and distribution decisions.

Increased risk of disruptions:
Climate change amplifies the risk of disruptions in supply chains. Natural disasters can damage infrastructure, disrupt transportation routes, and disrupt production and distribution networks. These disruptions can lead to delays, increased costs, and reduced customer satisfaction.

The complexity of supply chain networks:
Modern supply chains are global and complex, involving multiple suppliers, manufacturers, distributors, and retailers across different regions. Climate change impacts can vary geographically, affecting different parts of the supply chain differently. Coordinating and managing these diverse networks while accounting for climate-related risks becomes challenging.

Vulnerability of critical infrastructure:
Supply chains rely on critical infrastructure, such as transportation networks, ports, and warehouses. Climate change increases the vulnerability of this infrastructure to damage and disruption. For example, rising sea levels can threaten coastal ports and warehouses, while extreme temperatures can affect the functioning of transportation systems. Ensuring the resilience of this infrastructure is a significant challenge.

Increased pressure for sustainability and transparency:
Climate change has led to heightened consumer and regulatory pressure for sustainability and transparency in supply chains. Stakeholders expect companies to reduce their carbon footprint, monitor and report environmental impacts, and adopt sustainable practices. Meeting these expectations requires significant effort and investment in measuring, managing, and improving the environmental performance of supply chains.

Lack of data and tools:
Adequate data on climate-related risks and their impact on supply chains can be limited. Historical data may not accurately reflect future climate patterns, and there can be gaps in information on specific locations or industries. Additionally, tools and models to assess and manage climate risks in supply chains are still developing, making incorporating climate change considerations into decision-making processes challenging.

Strategies for climate-resilient supply chain management

Strategies for climate-resilient supply chain management include diversifying supplier networks, adopting sustainable practices, incorporating climate risk assessments, investing in technology and data analytics, fostering collaboration with stakeholders, and developing robust contingency plans to mitigate climate-related disruptions.

Supply chain mapping:
This could identify all the global sites that directly or indirectly contribute to manufacturing; collect and analyze data on the costs, risks, delivery times, and carbon footprints associated with each location. It is recommended to refresh this information annually to ensure its accuracy and relevance.

Risk assessment to identify climate vulnerabilities:
This evaluation should include a multitude of interlinked factors, including the susceptibility of each site to local natural disasters, local economic indicators, geopolitical risks, proximity to suppliers and customers, access to reliable energy sources, availability of natural resources, long-term availability of skilled and unskilled labor, and more. Assessing these aspects is crucial as it helps identify site-specific vulnerabilities and risks related to climate change. It is important to note that a uniform strategy to mitigate climate risks across all sites is impractical due to their unique characteristics and challenges.

Invest in early-detection systems and associated expertise:

Integrating climate data and predictive analytics empowers supply chain management with informed decision-making capabilities. By analyzing climate data, including historical patterns and real-time information, and applying predictive analytics, supply chain managers can anticipate climate-related risks and make proactive decisions. This integration helps optimize logistics, identify vulnerable areas, plan for disruptions, and mitigate the impact of climate change. By leveraging climate data and predictive analytics, supply chain managers can enhance resilience, reduce costs, minimize disruptions, and ensure efficient and sustainable operations in the face of evolving climate challenges.

Adoption of sustainable manufacturing practices and renewable energy sources:

This includes implementing energy-efficient processes, optimizing material usage, promoting recycling and waste reduction, and sourcing renewable energy for manufacturing facilities and distribution centers. By embracing sustainable practices and renewable energy sources, supply chain management can achieve cost savings, improve brand reputation, enhance resilience, and contribute to a greener future. This shift towards sustainability aligns with evolving consumer expectations and regulatory requirements, driving the integration of environmentally conscious strategies into supply chain operations.

Development of contingency plans and alternative sourcing options:

Contingency plans involve identifying potential climate-related risks and establishing strategies to mitigate their impact on the supply chain. This includes diversifying supplier networks, establishing backup facilities in less vulnerable regions, and implementing disaster response protocols. Additionally, alternative sourcing options involve identifying and engaging new suppliers or exploring local sourcing to reduce dependence on regions prone to climate-related disruptions. By developing robust contingency plans and alternative sourcing options, SCM and manufacturing can enhance their resilience, minimize disruptions, and ensure continuity of operations in the face of climate change challenges.

Ensure climate models are sufficiently sensitive.

Supply chains need to be adaptable and responsive to changing conditions brought about by climate change, such as extreme weather events and shifting demand patterns. This involves optimizing inventory management, improving communication and collaboration with suppliers and partners, and implementing real-time monitoring and tracking systems. By embracing agility and flexibility, supply chains can quickly adjust operations, reroute logistics, and allocate resources to mitigate the impact of climate-related disruptions. This proactive approach enables faster recovery, reduces downtime, and ensures continued customer service in the face of climate challenges.

Final Thoughts

Assessing the impact of climate change on businesses and implementing necessary adjustments to mitigate its overall effects has become an undeniable imperative. The issue of data collection, validation, security, and timeliness is indeed a significant challenge in ESG reporting. With various standards and different data set requirements, ensuring data accuracy, integrity, and timely availability is crucial for effective reporting.

The importance of reliable data cannot be overstated, as it forms the foundation for informed decision-making and effective management of ESG risks and opportunities. Without accurate and comprehensive data, it becomes difficult to measure, monitor, and control the impact of ESG factors on business operations and outcomes.

To address this challenge, innovative approaches are emerging to streamline the data collection process and enhance data quality. This is where our solutions come into play. By leveraging predictive algorithms, we can analyze historical patterns and real-time information to anticipate future trends and their potential impact on ESG performance.

Our solution empowers data set owners to make prescriptive binary decisions based on the insights generated. By identifying key areas for action, we can guide organizations toward impactful ESG reporting, enabling them to proactively manage risks, capitalize on opportunities, and drive sustainable practices.

Additionally, we recognize the criticality of data security and confidentiality in the ESG reporting process. We have implemented robust security measures to protect sensitive data, maintaining its integrity and preventing unauthorized access or tampering.

About Us

SLK is a global technology services provider focused on bringing AI, intelligent automation, and analytics together to create leading-edge technology solutions for our customers through a culture of partnership, led by an evolutionary mindset. For over 20 years, we've helped organizations across diverse industries - insurance providers, financial service organizations, investment management companies, and manufacturers - reimagine their business and solve their present and future needs. Being A Great Place To Work Certified, we encourage an approach of constructively challenging the status quo in all that we do to enable peak business performance for our customers and for ourselves, through disruptive technologies, applied innovation, and purposeful automation. Find out how we help leading organizations reimagine their business at https://www.slksoftware.com/

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