

Enhancing Supply Chain Resilience: Insights from Disruption Impact and Support Strategies

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Abstract

Amidst the unpredictable dynamics of the supply chain environment, this study emphasizes the resilience of supply chain networks (SCNs) in mitigating ripple effects caused by disruptions. It analyzes the impact of disrupted elements and tiers on resilience and explores resilience enhancement strategies. By bridging essential gaps in the literature, our study delves into the heterogeneous structure of SCNs, explores disruption sources from both nodes and links and evaluates the effectiveness of mitigation strategies such as proactive and reactive supports. Utilizing an SCN creator algorithm, we generated a dataset comprising SCNs with structures varying from two tiers to seven tiers. A disruption/recovery simulation procedure was utilized to assess the resilience of the generated SCNs, measuring two metrics, average functionality and recovery duration, across various scenarios. Findings reveal that disruptions originating from initial tiers have a more severe impact and longer recovery durations, emphasizing the critical role of managing disruptions effectively, particularly at the beginning of the supply chain. Additionally, prioritizing proactive support for initial tiers substantially enhances resilience, highlighting the importance of bolstering these foundational layers to safeguard the entire network. Regional government support plays a critical role in facilitating swift recovery, underscoring the need for collaboration and coordination among stakeholders to streamline recovery efforts and minimize disruptions' impact on SCN operations. Our findings offer crucial insights, offering practical insights for decision-makers seeking to enhance supply chain resilience while proposing directions for additional academic investigation in this domain.

Keywords: Multi-tier supply chain, Network analysis, Ripple effect, Risk management, Supply chain management