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Beyond SCRM: Supply Chain Risk and Resilience as the Fourth Pillar of Design

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Abstract

The growing complexity and globalization of supply chains across multiple industry sectors has increased the volatility, uncertainty, complexity, and ambiguity (VUCA) of their internal and external operating environments. In additional to their already-high VUCA operating environments, supply chains also experience large perturbation events, both deliberate changes and unintended shocks. For example, a change in domestic and foreign access, control, and ownership of entities happens near-instantly through mergers and acquisitions with little notification or awareness to other entities in the shared supply chain. A ship gets stuck in the Suez Canal causing a ripple of disruption across global supply networks. A pandemic disrupts material and labor markets and international trade. As large complex systems, this list is nearly endless. Furthermore, these events ripple through supply chain networks so quickly that centralized monitoring and control is difficult.

Traditional supply chain risk management (SCRM), like failure modes and effects analysis (FMEA), focuses on identifying and addressing causes of risk, which are then mitigated through continuous improvement and re-design activities. The effectiveness of risk management regimes depends not only on how we define and measure risk, but also how we look for them. This contrasts to design for robustness or resilience that focus on designing the system to withstand the consequences of risks, irrespective of source. Existing approaches to supply chain resiliency include some, but not enough, incorporating safety factors and tolerances, establishing backup/redundant components, and creating options for scalability to meet demand fluctuations.

In fact, despite the overwhelming literature on supply chain design, supply chains, like many production and logistics systems, often are not "designed" in the engineering design sense, but rather evolve from previously successfully designs. This contrasts to the systematic rigor put into the design of product systems, including requirements specification, evaluating the ***-ilities*** tradespace, and testing, evaluation, verification, and validation (TEVV). While it's likely that supply chain systems cannot and do not need to be engineered to same level of rigor and dependability as information technology (IT) systems, cyber-physical system (CPS), or embedded (safety-critical) systems, a strategic and global approach to designing resilience into supply chain will require comparing the state of supply chain practice to other network-type systems of systems. How do we adapt methods from other disciplines to engineer "cannot fail" into a supply chain? This talk explores conceptual models for solving this challenge and identifies research recommendations for adapting and applying these ideas.

Keywords

Supply Chain; Resilience; Network Measures

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