Enhancing Supply Chain Resilience Throughout Reasoning

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Abstract

Supply chain is the network of organizations, people, activities and information involved in moving a product or service from supplier to customer. While it has been highly optimized for cost and time efficiency, it encounters obstacles when faced with rapid changes in demand, resources, or concerns of stakeholders. In previous studies, the supply chain has been considered as a system of contracts among various agents. This system has been formalized using declarative language that can represent many types of supply chains. This formal structure answers questions about contract feasibility, violation, and concern satisfaction as well as proposing mitigation strategies to enhance resilience in the supply chain. However, these formalizations are not able to handle volatile changes to evaluate the feasibility of contracts.

In this research, we aim at improving the resilience in the supply chain by identifying and formalizing the properties of contracts that are at the higher risk of breaking them. These properties reveal highly influenced agents or most constraining contracts and rank them based on their ability to impact the feasibility of contracts under change. For example, in the event of a disaster, a highly influenced agent will have many contracts to uphold, and a highly constrained contract will need extra consideration. We are representing these properties based on cyber-physical systems framework confirmed by National Institute of Standards and Technology and implementing them using answer set programming. The potential outcomes of integrating these properties include improved foresight of agents and an additional metric to determine the resilience.