

Resilience of supply chain networks to major disruptions can now be measured using a multi-factor test

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Disruptions to supply chain networks can have significant domino-effects.
Credit: JIRAROJ PRADITCHAROENKUL/Alamy Stock Photo

By analyzing the structure of a supply chain network and the resilience of its components, A*STAR researchers have developed an analytic measure that will allow a company to determine its vulnerability to major supply chain disruptions. The measure has the potential to dramatically improve decision-making in supplier management and lower financial risk across many sectors.

Disruptions in the [supply chain](#) can have severe consequences for an unprepared venture. Think of a milk processor without a supply of milk,

or a car manufacturer without a supply of engine parts. This can have immediate effects downstream in the network, as well as knock-on effects on other businesses dependent on the network for survival. When such [disruption](#) occurs on a massive scale, the economic fallout can be catastrophic and widespread. The possible scale of loss prompted Rick Goh and his team at A*STAR's Institute of High Performance Computing to start looking at ways to measure supply chain risk.

"When a man-made or natural disaster, or disruption is happening somewhere, a company may not capture the impact to its production line as the disruption may apply to its second or third tier suppliers directly, rather than to its first tier partner," says Goh. "We wanted to capture the propagation of supply chain disruption risks far beyond their immediate connection to a focal company, which may reach to the company later on but they usually realize that it is too late when it comes to them due to the loss of time across the supply chain network."

A better understanding of how disruption-caused losses propagate through a company's supply chain network could help companies improve their supplier network structure. However, this is difficult to do in practice and rarely subjected to quantitative analysis. Goh and his team wanted to develop a more reliable measure that can capture the key factors contributing to sensitivity or resilience to disruption across a multi-tier supply chain network.

"Beyond only looking at the propagation effects from one [company](#) to another, in our study, we also consider individual companies' resilience capability to overcome the disruption risks and manage the situation internally," says Goh.

By tracking the propagation of a production pause through a network of nodes using generalized mathematical models of both perfect tree and randomly constructed networks, the researchers showed that risks in a

supply chain network are determined by both the resilience of companies and the structure of the supply [chain network](#), and that mapping out and understanding these risk factors is essential to [risk](#) minimization.

"The modelling confirms that having multiple redundant suppliers, both direct and indirect, will help cushion, or even remove, any impact on one's own production, and may help prevent chained domino-effect disruptions," concludes Jesus Felix Bayta Valenzuela, first author of the study.

More information: Jesus Felix Bayta Valenzuela et al. A Network-Based Impact Measure for Propagated Losses in a Supply Chain Network Consisting of Resilient Components, *Complexity* (2018). [DOI: 10.1155/2018/1724125](#)

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