

Researcher's Risk Exposure Index (REI) used by the UN Office for Disaster Risk Reduction

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"From Superstorms to Factory Fires: Managing Unpredictable Supply-Chain Disruptions," published recently in the Harvard Business Review, describes a method developed by MIT professor David Simchi-Levi, founder of the MIT Forum for Supply Chain Innovation, to manage unpredictable supply chain disruptions. This method helps prioritize the financial impact of risk through the Risk Exposure Index (REI), enabling companies to focus mitigation efforts on the most important suppliers and risk areas. The method was implemented successfully at Ford Motor Company.

But the REI methodology is beginning to influence thinking beyond the corporate supply chain world, as demonstrated in a recent article published by the United Nations Office for Disaster Risk Reduction, "Flood Risks and Impacts Future Research Questions and Implication to Private Investment Decision-Making for Supply Chain Networks."

This paper investigates the disruptions on the global economy through supply chains, in order to propose what components should be considered to measure supply chain risk. In particular, it takes a deep look at Thailand's 2011 flood, as this was the most notable example of disruptions both on specific industries and the whole economy. Since the prolonged floods affected the primary industrial sectors in Thailand—the automotive and electronics industries—the impact on the whole economy was devastating.

REI assesses potential disruption costs based on Time to Recovery

The authors utilized the REI methodology, which assesses a cost induced by a potential disruption based on the Time to Recovery (TTR) for each level or node, and the resulting Financial Impact (FI). They mention that there are several aspects of TTR that can be taken into account. One of them is the time taken to resume operations, even partly, if a facility has been stopped—a major indicator of resiliency that has frequently gained attention in the business world. Time to return to the "pre-disaster" level of production can also be an important indicator of the real impact of disruption.

The study analyzes how the TTR from the Thai floods for the automotive and electronics industries differed with each company, and was largely dependent upon the extent of the damage suffered at the factories in question.

For automotive companies, the analysis showed that Toyota required 42 days to resume operations, while Nissan resumed operations in just 29 days. In contrast, Honda, whose factory at Ayutthaya was inundated, required 174 days to resume its production cycle due to the extensive nature of the damage to its facility. The [financial impact](#) also varied by company: Toyota lost 240,000 cars, more cars than it had lost to the Japanese tsunami, while Honda lost 150,000 cars, and Nissan lost 33,000 cars.

Nissan recovered more quickly than other auto companies because it had dissolved the Keiretsu system, diversified sources of supply, and globalized its procurement system. Also, Nissan had a higher inventory to prepare for increasing sales. In contrast to Nissan, whose plants were not inundated, Toyota lost almost the same amount of operating profit as

Honda even though Toyota's three assembly plants were not inundated and Honda's plants were. This shows that damage to critical nodes such as an assembly plant, inventory management strategies and the degree of a firm's reliance on suppliers, translates into damages across supply networks.

The electronics sector was also severely impacted by the floods. Before the 2011 floods, Thailand produced approximately 43 percent of the world's hard disk drives (HDDs). Western Digital, which produced one-third of the world's HDDs, lost 45 percent of its shipments because their factory in Bang Pa-in Industrial Estate, Ayutthaya was inundated. The Toshiba factory, one of the four major makers of HDD, was also inundated. Toshiba was able to execute alternate production in the Philippines. While factories of Samsung and Seagate Technology, the other two makers of the four major manufactures, were not inundated, they were forced to reduce production due to the lack of parts from suppliers who were impacted.

The TTR results for the electronics companies also varied: Western Digital partly restored the production after 46 days of stoppage. Toshiba, which has a factory in Nava Nakorn Industrial Estate, needed 114 days to restore operations. HDD shipments from the industry's five major manufacturers declined severely in the fourth quarter of 2011 to 123.3 million units, which was down 30 percent from 175.2 million units the quarter before. The effect of the lost electronic parts production rippled across the global economy. The lack of HDDs increased the price of desktop HDD by 80-190 percent and mobile HDD by 80-150 percent.

This clearly shows that the world economy is closely interconnected through a [global supply chain](#) network and the indirect damage of disasters now easily affects the consumer market on a global scale. It also illustrates the importance of understanding the REI of industry supply chains before an event happens. While each event is hard to

predict, the impact of natural disasters on the supply chain is increasing.

However, the potential impact on each firm that is exposed is different, depending on how well they understand their exposure, how well they are prepared, and how they respond to the risks. Designing supply chains in a more resilient way will ultimately reduce risks to the [global economy](#).

The MIT Forum for Supply Chain Innovation is a community composed of academics and industry members whose support allows forum researchers to provide customer-focused solutions to design and manage the new supply chain. The Forum has pioneered a deeper understanding of the [supply chain](#) and its relationship to corporate strategy and has broad support from a wide cross-section of industry.

In June 2012, the MIT Forum launched the Manufacturing Technology Advisory Board in response to Forum members' request for technology transformation guidance. The board consists of MIT academic and research leaders with major technology providers and industry leaders to collaborate on key issues around U.S. manufacturing.

More information: The background paper on disaster risk reduction is available online: [www.preventionweb.net/english/.../en/bgdocs/Haraguchi%20and%20Lall,%202012.pdf](http://www.preventionweb.net/english/en/bgdocs/Haraguchi%20and%20Lall,%202012.pdf)

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