



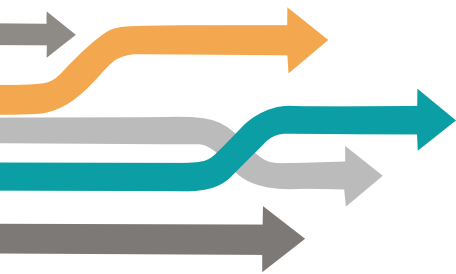
UNDERSTANDING RISK TO IMPROVE RESILIENCE IN THE GLOBAL SUPPLY CHAIN

September 2014

Sponsored by:



UNDERSTANDING RISK TO IMPROVE RESILIENCE IN THE GLOBAL SUPPLY CHAIN



Analyses of recent large catastrophes reveal a number of common triggers of global supply chain disruptions, which has led to a growing consensus on supply chain risk management best practices.

Executive Summary

With supply chains often extending across the globe, resilience is now recognized by many corporate decision-makers as a priority. A growing number of executives also understand that supply chain risk management is not only a necessary defensive measure, but also can be a source of sustained competitive advantage.

Analyses of recent large catastrophes reveal a number of common triggers of global supply chain disruptions, which has led to a growing consensus on supply chain risk management best practices. Additionally, significant new analysis on country-specific supply chain vulnerabilities provides support to decision-makers in choosing suppliers, planning international expansion and identifying vulnerable customers.

Introduction: Risk Management and the Modern Global Supply Chain

In the not-too-distant past, supply chain risk management did not exist to any significant degree. As recently as 2009, an academic study described “risk management and supply chain management resilience” as “emerging disciplines.”¹

Today, as supply chains have grown longer, more complex, and often more fragile, resilience has become a key strategic concern for many executives. Catastrophes such as the Tohoku earthquake and tsunami, the 2011 Thailand floods, Icelandic ash clouds, and Superstorm Sandy highlighted vulnerabilities in global supply chains. More recently, the tragic Rana Plaza factory fire in Bangladesh destroyed a significant supplier of garments to major retailers.

A growing number of executives also recognize that effective supply chain risk management can be a source of sustainable competitive advantage.

These catastrophes and other recent events have led many companies to reassess their supply chain vulnerabilities and to increase their investment in risk management. This increased awareness of supply chain risk was highlighted in a recent Accenture survey of more than 1,000 companies across 10 industries. The survey revealed that more than three quarters of companies consider supply chain risk management to be important or very important to their operational strategy, and twenty-five percent plan to boost spending on supply chain risk management by at least twenty percent within two years.²

A growing number of executives also recognize that effective supply chain risk management can be a source of sustainable competitive advantage. According to PwC, companies can find “competitive advantage by shaping a supply chain resilience strategy focused on sustained performance.... Companies that focus on supply chain resilience cohesively react to adverse events faster than the competition to take market share and outperform, resulting in an average 7% higher stock performance.”³

An effective supply chain risk management program can both minimize disruptions and enable a quicker recovery once a disruption occurs. Businesses can enhance supply chain resilience through a combination of product design (using more easily-sourced or exchangeable parts), process engineering, supplier and vendor selection, logistics, and effective contingency planning. Many experts now agree on a general framework of supply chain risk management best practices.

Supplementing the still-growing body of knowledge on supply chain risk is important new analysis into country-specific characteristics by Oxford Metrica. The analytics and advisory firm identified and evaluated a list of approximately three dozen potential contributors to supply chain risk to select the key drivers that would combine effectively into an annual index. The outcome of this initiative is an annual index of 130 countries and territories – the *FM Global Resilience Index*⁴ – with each territory ranked according to its relative resilience to supply chain disruption. Understanding these variables can aid in decisions about where to locate offshore manufacturing facilities, provide fact-based criteria for selecting suppliers, and identify the potential vulnerabilities of overly relying on key customers in certain regions. Used in conjunction with established risk management strategies, these location-based factors can streamline and simplify key risk management decisions while improving supply chain resilience.

Advanced information technology and a robust transportation infrastructure enable companies to select suppliers offering the best quality at the lowest price wherever in the world they may be located.

Supply Chain Risk

Global supply chains are now the norm in most industries. Advanced information technology and a robust transportation infrastructure enable companies to select suppliers offering the best quality at the lowest price wherever in the world they may be located. Global supply chains, however, often have more points of vulnerability, and it can be more difficult to manage safety, on-time delivery, flexibility, responsiveness, and sustainability. Major disruptions can cascade across entire industries, and can even have a measurable impact on the world economy. The 2010 Icelandic volcano eruption, for example, resulted in cancellation of 48 percent of European air traffic over eight days, with an impact that stretched as far as Kenya, whose economy lost an estimated \$3.8 million per day.⁵

Common causes of supply chain risk include:

- **Accumulation of assets:** Asset accumulation in one location, or even in one region, is a key source of vulnerability. Auto manufacturers, for example, had about 14,000 cars being prepared for delivery to dealers stored on docks and in other flood prone areas when Superstorm Sandy struck.
- **Accumulation of suppliers:** A large number of the suppliers for a particular product located in the same geographic region can be a source of vulnerability. Geographic clusters of Tier 1, Tier 2 and even Tier 3 suppliers are increasingly common as parts manufacturers seek to capitalize on pools of knowledgeable workers and shorten and streamline their own supply chains.
- **Global sourcing:** The use of foreign suppliers often is a decision made in the interest of cost, but sometimes materials are only available from foreign sources. Often these suppliers are located in emerging economies prone to catastrophes and political instability.
- **Lack of redundancy:** Building redundancy into processes is a core risk management strategy, but often one that is neglected in efforts to lower costs. Relying on a single supplier can be a recipe for a supply chain disaster. An explosion and fire at a factory in Germany, for example, left the entire global automotive industry with a shortage of an essential resin.⁶ Additionally, a characteristic of the just-in-time inventory model is minimizing inventory – i.e. reducing redundancy. A disruption to the supply chain could mean that materials on hand are quickly exhausted, bringing manufacturing to a standstill.

Where suppliers are located and where parts or finished products are stored can enormously influence vulnerability, and consequently relative supply chain resilience.

- **Offshore operations:** Often, financial returns are improved when manufacturing or other operations are relocated to lower cost emerging economies. Many of these locations, however, are prone to catastrophes, political unrest, and terrorism, among other adverse conditions.
- **Tier 2 and Tier 3 suppliers:** The complexity of some supply chains can make it difficult to identify all suppliers – especially Tier 2 and Tier 3 suppliers. Failure to understand a Tier 1 supplier's business and its supply chain can be a source of unanticipated disruptions. In 2009, GM found it was faced with potential supply chain disruptions because some of its Tier 2 suppliers were financially distressed as a result of late payments from cash-strapped Tier 1 suppliers. The automaker embarked on a program of direct payments to the second tier companies.⁷

These common causes of supply chain risk all have a territorial component. Where suppliers are located and where parts or finished products are stored can enormously influence vulnerability, and consequently relative supply chain resilience. For example, the fact that, in 2011, 25 percent of computer hard drives were manufactured in a narrow geographic region of Thailand was inherently a source of vulnerability, but the risk was significantly amplified by the fact that the country is prone to typhoons, flooding and, as it turns out, political instability.⁸

Oxford Metrica's recent analysis on behalf of FM Global first identified the most commonly cited causes of supply chain disruption. This yielded an initial test-bed of 38 different contributors to supply chain risk. For an index to be useful, it has to be simple, so the challenge was to reduce the test-bed to a more manageable number of variables without losing the powerful relationship with supply chain disruption. Each variable was screened by a number of practical and statistical criteria for inclusion in the index.

In practical terms, quantitative (or quantifiable) data had to be available on a reliable, consistent and annual basis, and from credible sources. The resultant index uses data from independent third-party sources such as the International Monetary Fund, the World Economic Forum, and the U.S. Energy Information Administration, as well as from an internal FM Global benchmarking algorithm that measures the risk quality of commercial properties.

In addition, the data had to satisfy certain statistical criteria. For example, the selected drivers should be independent of one another. If they are correlated, then a particular driver

After extensive back-testing over several years, nine core drivers made it through the process.

is being over-weighted unintentionally. Also, the resultant index must be volatile enough to change each year, but stable enough so as not to produce wild swings from year to year.

After extensive back-testing over several years, nine core drivers made it through the process. Oxford Metrica identified these key drivers of supply chain disruption as components of three higher level categories, or factors: economic, risk quality, and characteristics of the supply chain itself. Each of the three higher-level factors comprises three drivers:

Economic Factor (representing political and macroeconomic influences):

- **GDP per capita** Gross domestic product divided by total population. This is a measure of the strength of an economy and a country's economic ability to recover following catastrophe.
- **Political risk** An assessment of a country's vulnerability to political instability by unconstitutional or violent means, including terrorism.
- **Oil intensity** Vulnerability to an oil shock: oil shortage, disruption, or price hike.

Risk Quality Factor (based on FM Global's RiskMark database):

- **Exposure to natural hazard** Extent of exposure to at least one natural hazard: earthquake, wind or flood.
- **Quality of natural hazard management** The level of commitment to natural hazard risk improvement given the inherent natural hazard risks in a country.
- **Quality of fire risk management** The level of commitment to fire risk improvement given the inherent fire risks in a country.

Supply Chain Factor (factors relating to the supply chain itself):

- **Control of corruption** The perceived impact of corruption, both petty and grand forms.
- **Infrastructure** The perceived quality of general infrastructure, including transport, telephony and energy.
- **Local supplier quality** The perceived quality of local Tier 2 and Tier 3 suppliers.

Calculations of the nine drivers were equally-weighted to score and rank the 130 countries and territories, creating an annual index that compares countries by their relative resilience to supply chain disruption. Norway, Switzerland and Canada top the list of the countries most resilient to supply chain disruption, while the Dominican Republic, Venezuela and Kyrgyzstan

Identifying, quantifying and prioritizing sources of vulnerability are the first steps in supply chain risk management.

are ranked least resilient. Because of wide differences in exposure to natural disasters, the United States is divided into three zones: Eastern, Western and Central. Only the Central Zone ranked in the top ten for resilience. China too is divided into three zones, given the country's size and geographic diversity.

This index provides insights into the vulnerabilities of existing suppliers and customers, as well as information to support decisions about choosing new suppliers. It also can provide important input into merger and acquisition deliberations, and decisions about expansion into new territories.

Supply Chain Risk Management

Identifying, quantifying and prioritizing sources of vulnerability are the first steps in supply chain risk management. Once the sources of vulnerability have been mapped and prioritized, the next steps are to identify the most effective mitigation and risk transfer activities relative to the specific sources of vulnerability, organize those activities into a cohesive risk mitigation action plan, and then implement, monitor, and make adjustments to the plan.

Over the past decade, a general consensus has emerged around best practices for supply chain risk mitigation. Commonly-recommended actions include:

- Avoid single source suppliers.
- Use financially secure suppliers when possible.
- Utilize suppliers with strong risk management practices.
- Diversify suppliers, preferably in different geographic regions.
- Identify alternative suppliers.
- Increase redundancy.
- Identify substitute materials if possible.
- Transfer some of the risk via insurance.

These various risk management actions are largely applicable regardless of where a supplier is located, but country-specific risk factors can have a material impact on the effectiveness of almost any chosen action. Selecting locations for one's own facilities or suppliers in countries less prone to natural catastrophes or political instability, for example, can significantly lessen the risk of supply chain failure, regardless of which other risk management steps are taken.

Alternatively, understanding the country-based risks of suppliers can influence decisions about risk management strategies

Alternatively, understanding the country-based risks of suppliers can influence decisions about risk management strategies. If, for example, all of a company's suppliers of a particular material are clustered in a vulnerable country, it may be to a manufacturer's advantage to redesign the product using other materials, diversify the geographic spread of such sites if possible, or to have an inventory of critical materials or components to provide a buffer in the event of a supply chain disruption.

Conclusion

Increasingly, supply chain risk management is acknowledged as a core contributor to corporate performance and profitability. What was once solely a concern of the logistics or supply chain department is now receiving attention at the executive management and even the board level of many organizations.

In large part due to the impact of natural catastrophes such as the Tohoku earthquake and tsunami in Japan and the 2011 floods in Thailand, many corporate decision-makers now recognize the need to invest in supply chain resilience to avoid potentially ruinous disruptions to their businesses. A growing number of business leaders also recognize the strategic importance of effective supply chain risk management, and view supply chain risk management as a source of competitive advantage.

Supply chain resilience benefits from the application of standard risk management frameworks to identify and prioritize weaknesses. Additionally, risk management experts now widely concur on supply chain risk management best practices. These best practices can both help avert disruptions and provide a foundation for a rapid recovery if a disruption occurs.

The Oxford Metrica analysis into location-based supply chain resilience provides important new insights into supply chain risks that complement and enhance established risk management practices. The product of the analysis, the *FM Global Resilience Index*, provides organizations that outsource suppliers, have international operations, or have international customers, with an evidence-based foundation for developing and implementing supply chain risk management strategies.

As with any significant risk management decision, the benefits of mitigating risk must be balanced against the costs.

The *FM Global Resilience Index* provides guidance on the most risky and least risky countries based on the potential for supply chain disruptions. Of course, it may not be possible, or even desirable, to select suppliers located only in low-risk locations. As with any significant risk management decision, the benefits of mitigating risk must be balanced against the costs. Armed with information on country-specific risk factors, however, decision-makers are better equipped to make more informed choices concerning suppliers and the risk they pose. Additionally, a country-based assessment of supply chain risk streamlines the process of identifying vulnerabilities across the entire supply chain – from second and third tier suppliers through key customers, and including a company's own facilities. This enables executives to strategically prioritize supply chain risk management and investment efforts, and provides valuable input into decisions concerning potential acquisitions and expansion into new territories. ■

¹ Serhiy Y. Ponomarov, Mary C. Holcomb, “Understanding the concept of supply chain resilience”, Emerald 20, (2009) http://www.emeraldinsight.com/case_studies.htm/case_studies.htm?articleid=1789993

² Accenture, Press Release, “Supply Chain Risk Management Now a Priority for Most Business but Only Elite Leaders Generate a Return on their Investments in Excess of 100 percent, Accenture Research Finds,” (June 24, 2014), <http://newsroom.accenture.com/news/supply-chain-risk-management-now-a-priority-for-most-businesses-but-only-elite-leaders-generate-a-return-on-their-investments-in-excess-of-100-percent-accenture-research-finds.htm>

³ Supply chain resilience, PwC <http://www.pwc.com/us/en/risk-management/supply-chain-resilience.jhtml>

⁴ <http://www.fmglobal.com/resilienceindex>

⁵ Iceland volcano cloud: The economic impact, BBC News <http://news.bbc.co.uk/2/hi/8629623.stm>

⁶ IHS, Economics and Country Risk, “Explosion at Evonik Factory May Have Serious Knock-On Effect for Global Car Production,” (4/17/12), <http://www.ihs.com/products/global-insight/industry-economic-report.aspx?id=1065966710>

⁷ “GM tosses lifeline to Tier 2 suppliers,” Automotive News Europe <http://europe.autonews.com/article/20090316/COPY/303169980/gm-tosses-lifeline-to-tier-2-suppliers>

⁸ The impending hard drive shortage -- and possible price hikes, InfoWorld <http://www.infoworld.com/article/2621076/storage-drives/the-impending-hard-drive-shortage----and-possible-price-hikes.html>