

COSTLY SUPPLY CHAIN DISRUPTIONS

*Intelligent software helps
increase visibility and
resilience*

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SPECIALIZATION AND GLOBALIZATION HAVE RESULTED IN A WORLD of highly complex supply and demand networks. These world-spanning networks allow corporations to tap regional know-how and resources to offer cost advantages. During the recession that resulted from the financial crisis of 2008, numerous cost saving programs optimized supply chains and reduced slack wherever possible. When the tide turned and economies began to recover, the increased efficiency led to record profits for manufacturing firms. But such efficiency comes at a cost: Complex and tightly coupled systems such as modern supply chains are extremely vulnerable to internal and external shocks.

The earthquake and subsequent tsunami that struck Japan in early 2011 was such an event. The country is essential to the world economy because companies that produce high-tech components and end products for multiple industries cluster there. After the catastrophe, automotive plants worldwide suspended production due to missing parts from Japan. Japan-based Toyota was hit particularly hard, with factories on several continents standing still and domestic production plummeting by half.

Toyota's competitors, General Motors and Volkswagen, seized this chance and superseded Toyota as the world's largest car manufacturers. Later in 2011, massive flooding in Thailand halted the production of a vast majority of the world's hard disk manufacturers. During this time computer chips piled up in Intel's warehouses. After all, original equipment manufacturers had no use for the chips without the complementing hard disk drives needed to complete and deliver their computers.

Considering these examples and many others, the World Economic Forum (WEF) has highlighted supply chain disruptions and vulnerability as one of four emerging risk issues that will affect the world's economy and society during this decade. The WEF considers supply chain vulnerability to have an impact potential as high as systematic financial risks, food security or energy supply.

Disruption footprint

In order to investigate how corporations effectively and efficiently can manage supply chain disruptions, we surveyed 110 companies from Germany, Switzerland, the United Kingdom and the United States. We asked managers how their organizations are affected by supply chain disruptions and what measures they apply to prevent them. The annual sales of the corporations surveyed ranged from \$126 million to more than \$60 billion, with a mean of \$4.6 billion. Forty-six of them have annual revenues above \$1 billion.

Their logistics expenses averaged 7.8 percent of their sales. They employed from 56 to more than 120,000 people, with a mean of 11,769. The respondents represented eight industries: automotive, chemicals, life science and healthcare, consumer goods, energy and utilities, engineering and manufacturing, retailing and technology. We first asked our respondents to specify the level of complexity and coupling within their supply chain.



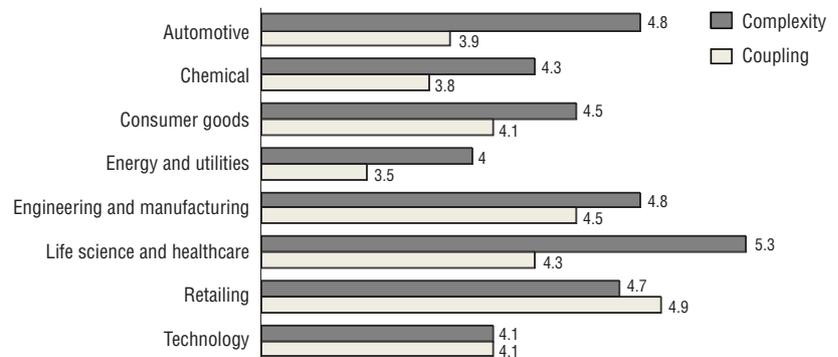
Figure 1 illustrates their responses. A scale value of one indicates no complexity/coupling is present in the corresponding supply chain, whereas a value of seven indicates a high degree of complexity/coupling. Supply chain complexity is driven by a large number of involved parties and their interconnectedness. Coupling represents the level of direct connectedness between supply chain elements. Time, inventory or redundancy buffers provide slack to compensate for smaller disruptions and can decouple supply chain elements. Companies in the life sciences and healthcare sector declared a high degree of complexity, which is triggered mainly by strict regulatory rules. Not surprisingly, automotive was in second place, and engineering and manufacturing organizations followed. Just consider the amount of suppliers needed to build a modern car or highly specialized industrial equipment.

The retail sector showed the highest level of coupling in its supply chain. Given low margins and short product shelf lives, this again seems intuitive. The runner-up is the engineering and manufacturing sector, where businesses follow make-to-order practices with tight schedules. In third place is the life sciences and healthcare sector, which is driven by defined shelf lives and the need for accredited suppliers.

Regardless of their industries, 85 percent of the respondents stated that they suffered significant losses due to supply chain disruptions in 2012. They experienced 11 supply chain disruptions that totaled an average loss of \$3.4 million. The majority of these harmful events are cumbersome but not dreadful. However, for 14 of the businesses, one single disruption event caused costs in excess of \$500,000. For two enterprises, the losses for a single event skyrocketed up to double-digit million

SUPPLY CHAIN CHARACTERISTICS

Figure 1. Complexity/coupling scores range from one to seven, with one indicating no complexity/coupling in the supply chain and seven indicating a high degree of complexity/coupling.



MONEY DOWN THE DRAIN

Figure 2. Supply chain disruption frequency and costs across industries during 2012

Company size (employees)	Disruption frequency	Total costs (thousand US\$)
Less than 1,000	8	427
1,000 to 10,000	9	3,901
Greater than 10,000	17	6,734
Average	11	3,420

dollar numbers. In the worst case, respondents reported impacts exceeding \$100 million.

Even for major corporations, such costs have devastating effects on their performance goals. Heavy disruptions especially affected the life sciences and healthcare sector, and businesses in the automotive industry experienced losses above \$1 million. The results are summarized in Figure 2.

The respondents indicated that on average their companies dedicate 1.8 percent of their total logistics budget to managing risk in their supply chains. In absolute numbers, this translates to spending \$2.3 million on proactive risk management measures, such as data, tools and consulting services that monitor supply chain risk. A median of seven specialists are in charge of managing risk in the respondents' supply chains.

Supply chain risk: The knowledge gap

When preparing for potential supply chain disruptions, the initial step consists of identifying and assessing relevant risks. This important stage defines the scope of subsequent risk measurement activities and influences the success of any risk management effort.

A diligent risk assessment includes identifying the sources of these risks along with evaluating them. These steps are tricky, as executives and companies can step into numerous pitfalls. Wrong assumptions about the characteristics of the supply chain or its inherent risks can lead to fatal blind spots, the same problems that come from a lack of experience or information. Less dangerous, but with direct negative impact on financial performance, are overcautious

actions that cost money without providing benefits.

In many cases, organizations have allocated budgets and defined both processes and responsibilities in supply chain risk management. To a great extent, the responding companies used internal resources, such as internal experts or their own software tools, to assess supply chain risks. These measures have the advantage of relying on in-depth knowledge of the assessed supply chain and the promise of highly customized solutions. However, because they lack a view from the outside, they may arrive at idiosyncratic and biased results. Also, complex supply chains that span the globe demand professional and elaborate tools. Although a good deal of professional advice is available in this field, the survey respondents rely on only a moderate level of such external resources.

In a bid to understand why these companies are reluctant to use professional tools in this area, we asked what features such tools should offer. Respondents said their desired features included a calculation of risk scores, resilience ratings, a visualization of the supply chain and a multitier view. Beyond this, they are interested in operational risks and less in information about natural disasters and socio-political risks. This flaw is demonstrated by the examples in the beginning of this article, where such disruptions caused major problems. Figure 3 summarizes their wishes on a scale of 1-to-7, with one indicating no relevance and seven indicating high importance.

Experts have developed software tools that meet the needs of managers to support the risk management process with a holistic and unbiased view of the supply chain. Dedicated methodologies allow end-to-end assessments of supply chains. Visualizations of the supply

WORRIES FOR 2014

Business interruption and supply chain risk topped the list of concerns for 2014 in a survey of more than 400 corporate insurance experts from 30 countries.

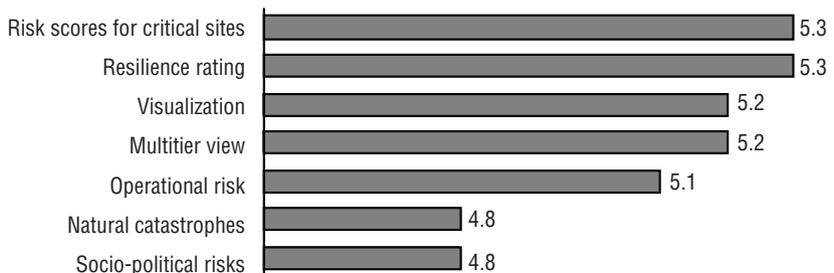
Allianz Global Corporate & Specialty, which insures businesses worldwide, conducted the survey. Forty-three percent of those surveyed listed business interruption and supply chain risk. Natural catastrophes were No. 2 at 33 percent, and fire/explosion was third at 24 percent.

Breaking the answers up among industry sector, engineering and construction listed natural catastrophes first (40 percent), business interruption and supply chain risk second (35 percent), and market stagnation or decline third (33 percent). Manufacturers worried mostly about business interruption and supply chain risk (60 percent), then natural catastrophes (42 percent), followed by fire/explosion (36 percent).



WHAT WE WANT

Figure 3. Respondents desired a number of features in software tools designed to analyze supply chain risks.



chain are combined with data sources that cover a multitude of risk categories. This allows managers to evaluate risks surrounding each supply chain element. Since corporate-specific risk information is not available from public sources, data has been enriched by online surveys from internal supply chain professionals. As a result, the resilience of each element, and hence of the entire supply chain, can be determined.

Without appropriate tools, a diligent supply chain risk assessment is tedious and costly. This may be the reason the answers from the respondents indicate that businesses suffer from a knowledge gap when it comes to assessing risks in their supply chains. For these respondents, the majority performs major supply chain risk assessment projects on a biannual basis, but they consider an annual risk assessment to be the optimal fit for their information needs.

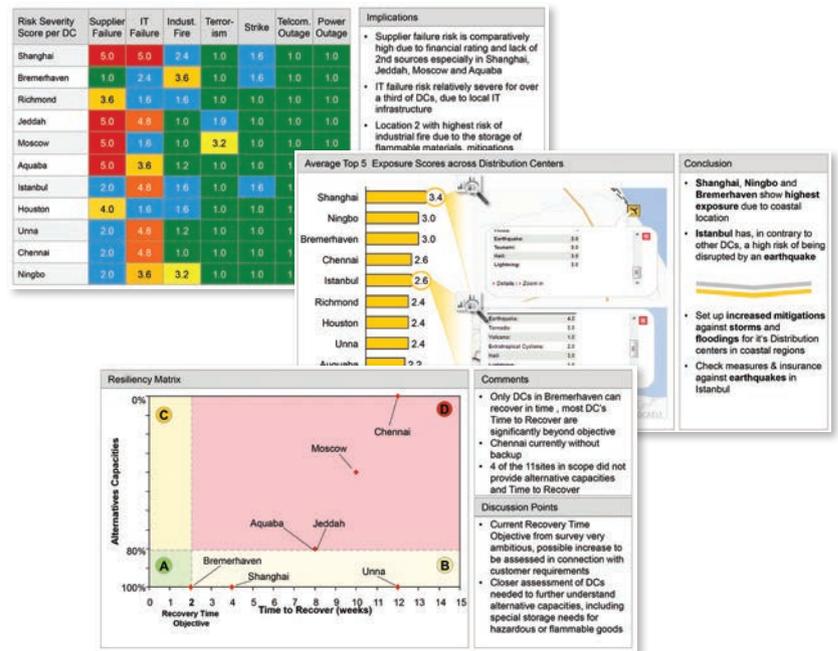
Increased visibility – enhanced flexibility

Once risks have been identified and evaluated, measures can be applied to deal with them. Not all classic risk management strategies are appropriate in the context of supply chain risks. For example, vertical integration or redundancy is not always suitable for modern enterprises because such solutions increase costs and tie up resources outside of core competency areas. Contingent business interruption insurance only can provide ex-post financial relief. But insurance cannot prevent nor minimize damage, nor can it restore lost reputations or compensate for lost customers who turned to competitors.

Many sources of supply chain disruptions lie outside the boundaries of any organization. This allows managers to have only a limited influence. Thus, it becomes even more important to develop measures to detect and react

A TOOL OF INFORMATION

Figure 4. Software to assess supply chain risks would calculate risk scores for critical nodes.



to looming supply chain disruptions in a timely manner. To speak in terms of an anecdote, if a longshoremen's strike is threatening to block a port, quickly rerouting the shipment to another container terminal can enable the launch of the long-awaited next generation of mobile devices on time. In other words, increased flexibility is the way of choice for building resilience in a supply chain context.

Timely, precise information is one key source of increased flexibility. The use of Internet-enabled technologies, like big data or social media, offers astonishing new methods to gather real-time data worldwide. This allows programmers to set up supply chain monitoring tools that constantly track supply chain risks in real time.

We asked the respondents what they think an ideal tool for doing this would look like. They pointed out that high usability is especially important. This can be achieved through comfortable online portals that initiate real-time alerts and support mobile devices. The respon-

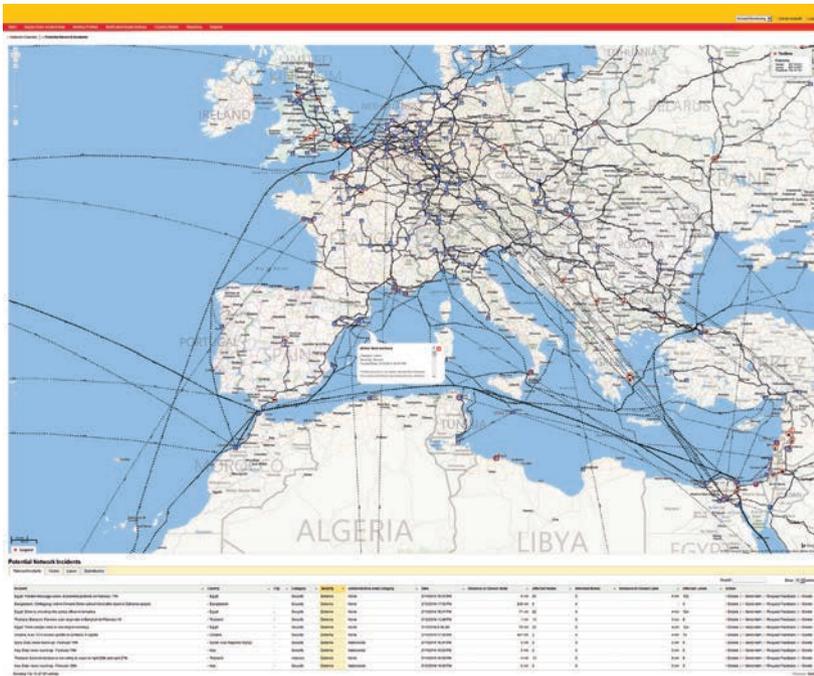
dents also indicated that seamlessly integrating into existing IT infrastructure is important. As far as relevant risks, they emphasized transportation disruptions, such as road, railway or port closures, but also operational issues like fires.

Intelligent software tools can fulfill these needs. They obtain and analyze real-time incident data. Customized solutions notify supply chain managers about relevant incidents and include in-depth information about the events and their resulting consequences for the supply chain.

Figure 4 depicts the output of frequently found features associated with intelligent risk assessment software tools. It presents estimated recovery times in a global supply chain after an incident and provides suggestions for alternative capacities. Risk scores for critical nodes of the supply chain are calculated automatically, and distribution centers that have a high risk exposure are presented to the decision maker.

GLOBAL MONITORING

Figure 5. Supply chain risk monitoring tools should have Web interfaces that allow filters to customize real-time incident monitoring.



Mitigation measures derived from this analysis support fast and sound decision making.

Figure 5 presents a Web interface to monitor the supply chain risk exposure of an organization in real time. Numerous filters can be applied to the visualized supply chain, allowing managers to focus on relevant facts. Pop-ups show detailed information about identified incidents, and colors indicate the state of the supply chain nodes. Many tools can be customized to interact with ERP and transportation management systems.

Incident-triggered workflows ensure an immediate notification of relevant personnel. This information enables managers to rearrange unaffected resources rapidly, increasing the resilience of the supply chain. This increased flexibility can lead to a competitive edge, especially when your business rivals are affected by the same incident. In such cases, these tools can help

your enterprise sustain production and sales, while rivals fail to deliver and lose market share.

Today's intricate supply chains are exposed to numerous natural and man-made risks that can influence delivery performance, increase transportation and manufacturing costs, and turn away clients in the long run. Since building up redundancies to prevent supply chain disruptions contradicts the common goal of cost efficiency, the answer to supply chain risks must be increased flexibility. Beyond flexible contracts and reactive suppliers, corporate officials must improve their understanding of what risks their supply chains are exposed to.

Risk assessments along the entire supply chain answer this information need. Contingency plans derived from holistic risk assessments allow enterprises to react appropriately to looming disruptions, enabling smooth operations even when a trade lane is

blocked or a facility disabled. The last step in building resilience via flexibility consists of permanent real-time monitoring of supply chain risks. This allows for swift reactions to incidents before the situation gets out of hand. Intelligent software tools can support decision makers in these tasks, leading to increased supply chain resilience. ❖

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