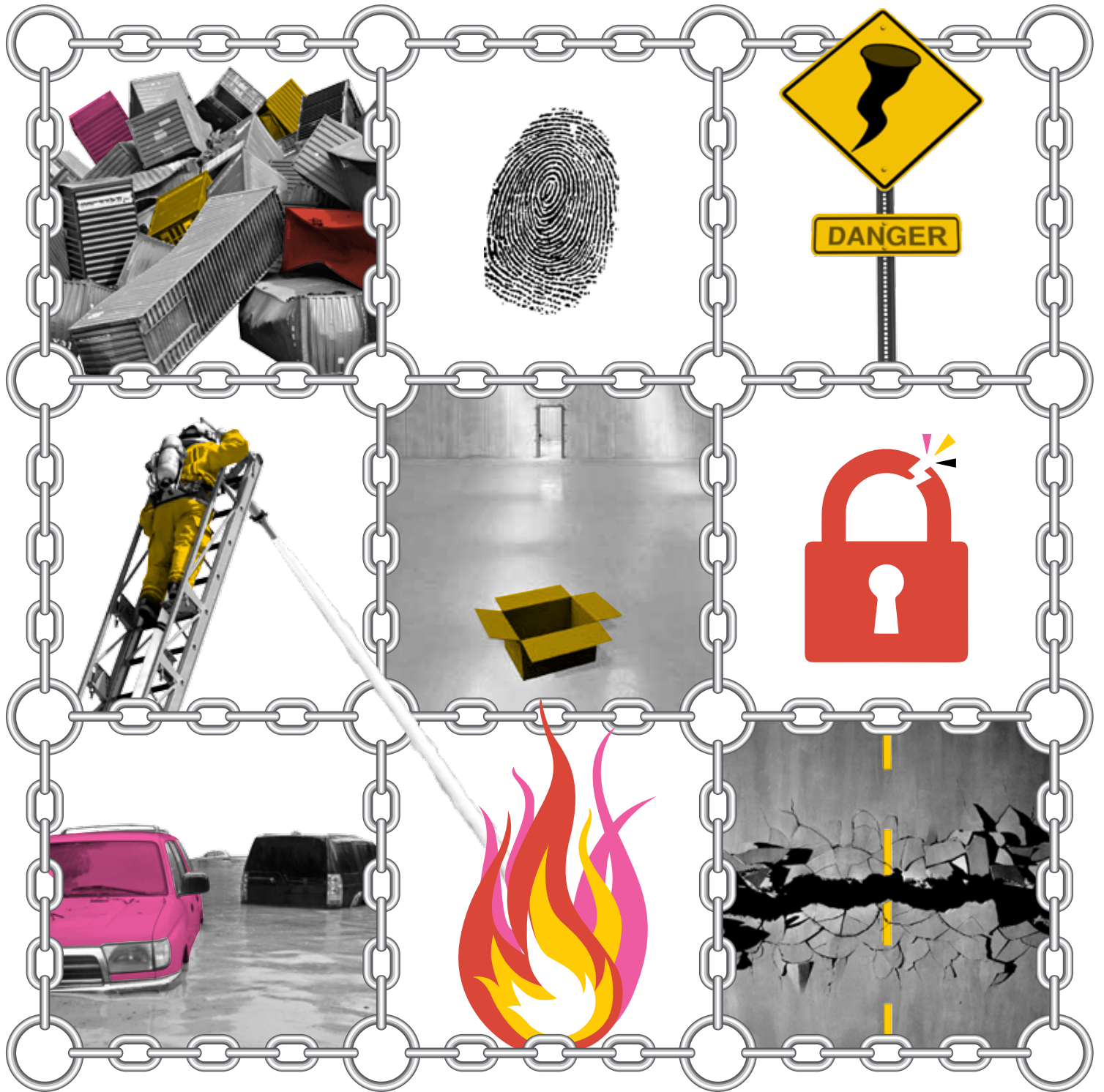


# INSIGHTON:



# RISK & RESILIENCE



*“What doesn’t destroy, strengthens.”*

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after Friedrich Wilhelm Nietzsche



**BILL MEAHL**

Chief Commercial Officer, DHL

A plane crashing on an elevated highway in Taipei. Highly unusual weather patterns across the world. Months-long strikes and delays at major U.S. ports. A 7.8 earthquake in Nepal. Streams of refugees and migrants crossing Europe on foot. This is just a small selection of issues from 2015. Our world is full of risk, and at any time we should expect the unexpected.

Where business is concerned, a risk can be as small as a single missing part – one with the power to stop an entire production line. So understanding risk of supply chain disruption and developing contingencies is an increasingly critical management priority.

Supply chains are crucial for all organizations – and the more global, the more complex. A disruption in a single node of the supply chain can have wide-ranging implications. So how do we deal with risk in the supply chain? How do we prepare for

the unexpected and safeguard the steady flow of goods, ensuring they arrive at their destination on time and in pristine condition, no matter where in the world?

In this *InsightOn:* report we explore risk in its many facets. We take a look at the potential impact of various types of risk on business and industry sectors – and we examine solutions. What does it take for a business to be resilient? How can business leaders be better prepared and take a strategic approach?

We have talked to experts across a wide spectrum in an effort to offer insights which can help you develop smarter strategies for dealing with risk, building resilience, and giving your business a leading edge.

Sincerely,

A handwritten signature in black ink that reads "Bill Meahl". The signature is written in a cursive, flowing style.



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## » INTRODUCTION

Two explosions at a chemicals storage facility in Tianjin, China leave a crater where the warehouse once stood and damage buildings two kilometers away.



# RISKS AND OPPORTUNITIES

The modern economy runs on interconnected global supply chains, but with distance and complexity come new types of risk.

**O**n the evening of Wednesday August 12, 2015, a fire started in a chemicals warehouse in the Chinese port of Tianjin. Unaware that the site contained large quantities of unlicensed and highly dangerous materials, local emergency services attempted to quell the blaze with water. This triggered two huge explosions that devastated the facility and much of the surrounding area.

The human cost of the disaster was significant. At least 159 people were killed and around 800 injured. The physical damage was wide-ranging, too. Analysts estimate that the larger of the two Tianjin explosions was equivalent to the detonation of 21 tonnes of TNT. The blasts left a crater at the warehouse site, and damaged buildings up to two kilometers away.

The economic impact of the event reached much further. Tianjin is Northern China's largest port, and one of the world's busiest. Around 8,000 new cars stored at the port were destroyed,

and manufacturers including Toyota, John Deere, and GlaxoSmithKline were forced to suspend operations at nearby facilities. Companies across China faced delays and disruption to raw material supplies, from oil to iron ore, and had to look for different export routes to get products to customers overseas.

The explosions' cost to insurers is expected to reach \$1.5 billion, with uninsured losses several times higher. At the time of writing, the disaster's long-term implications were still emerging. While day-to-day operations had largely resumed a month after the accident, port operators and customers were still struggling to manage knock-on effects, which range from air and water pollution to the loss of records stored in port buildings destroyed by the blast.

## PART OF A PATTERN

While events like Tianjin are thankfully rare, significant supply chain disruptions are not. In late 2014 and early 2015, industrial action at ports on the West ►►

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**\$1.5** BILLION

The cost to insurers of the explosion in the Chinese port of Tianjin

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**\$7.0** BILLION

The cost to U.S. retailers of West Coast port delays in 2015

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*Supply chain risk has been a major unintended consequence of two significant trends in recent decades: globalization and lean production.*

Coast of the United States forced vessels to wait for days for loading and unloading operations. The delays are estimated to have cost U.S. retailers as much as \$7 billion, from a combination of lost sales and the need to reroute products. The U.S. agricultural sector estimates that the problems reduced its own exports by \$1.75 billion a month, and for a while McDonald's customers in Japan were restricted to small portions of fries as the dispute delayed shipments of frozen food from the U.S.

And it isn't just big, headline-grabbing events that hit companies and economies hard. Sometimes, even relatively small problems can ripple out to affect businesses across the world. In 2014, companies in the aerospace, medical, and other sectors had to scramble for

## NATURAL DISASTERS OF 2011



# \$380 BILLION

The global economic impact of natural and man-made disasters in 2011

alternatives after a combination of unexpectedly high demand and scheduled maintenance at a key plant created shortages of polyetherimide (PEI) – a high-performance plastic material. Increased supply chain risks have been the major unintended consequence of two of the most significant business trends of recent decades: globalization and lean production. Driven by the quest for lower manufacturing costs or access to specialist capabilities, the increasing willingness of companies to





Freight drain: More than 1,600 shipping containers are lost at sea every year.

source materials and components from around the world has greatly increased the potential points of supply chain weakness, especially as some key production sites are now located in regions more vulnerable to natural disasters.

And supply chains have also increased their vulnerability. Short product life cycles and the desire to conserve working capital encourages companies to keep inventories and buffer stocks as low as possible. It's an approach central to the Japanese philosophy of "just-in-time." When supply chains are running smoothly, this way of working has proved incredibly successful: cutting manufacturing costs, improving companies' ability to respond to market shifts, and simplifying quality control. But when problems do occur, there is far less slack available, leaving companies with less time to react before the impact of problems reaches their customers.

Another significant characteristic of many modern supply chains is lack of transparency. Companies don't always know the routes and transport modes their suppliers use, where products are

along those routes, or where suppliers get their own components and materials. When Toyota was forced to rebuild its supply chain after the 2011 Tohoku earthquake, managers were surprised to discover just how many parts relied on the same few suppliers far upstream. "We thought [our supply chain] was pyramid-shaped, but it turned out to be barrel-shaped," said one official.

For a while, it looked as if supply chain vulnerability might threaten to undo some of the key advantages of globalization and lean manufacturing. Today, that seems less likely. The increasing recognition of the importance of supply chain risk is driving a revolution in its management. This report examines that revolution. It shows how the type and severity of the risks faced by companies is changing, and how leading organizations are developing and applying an armory of new tools and techniques to manage and mitigate those risks. Finally, it reveals the other benefits of a proactive approach: how resilient, flexible supply chains help companies to seize emerging opportunities for competitive advantage, wherever they occur. ■

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OF MORE THAN  
**400**

companies surveyed in 2015

**74%**

said they had suffered at least one instance of supply chain disruption in the previous year

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# THE EVOLVING LANDSCAPE OF RISK

Supply chain risks are changing, so should companies' response to them, argues Dirk Schäfer of Munich Re.

Supply chain risks can be as varied and diverse as the industries they affect. As we look at the changing landscape of risks, however, three areas stand out. First, there are quality risks, arising from the failure of products or components to meet the necessary performance specifications. Second, there are natural catastrophe risks – from earthquakes, volcanoes, and extreme weather events. Third, there is the fast-changing world of cyber risks, arising both from accidental failures in IT systems and from criminal interference with them.

As companies seek to understand and plan for these risks, it is important for them to differentiate clearly between major and minor incidents, to understand the difference between the characteristics of various risk types, and to recognize the factors that can cause risk profiles – especially “man-made” risks – to change over time.

## QUALITY ISSUES

The impact of quality issues in the supply chain can range from minor to extremely severe. Quality risks also have other challenging characteristics: they

*The impact any event might have on a supply chain can be expected to change over time.*

can be very hard to detect in a timely manner, and they can turn very quickly into reputational risks.

The quality risks in any particular supply chain are highly dependent on the maturity of the product. New product introductions, new technologies, and new supply chain entrants can all significantly increase risks. The economic cycle also has an effect. In times of economic depression, companies are sometimes forced to sacrifice quality in order to reduce costs.

In some industry sectors, quality risks have become a primary priority for senior leaders. In the pharmaceutical industry, for example, one of the most critical risks is the so-called “regulatory shutdown,” imposed by regulators such as the U.S. Food and Drug Administration in response to quality issues.

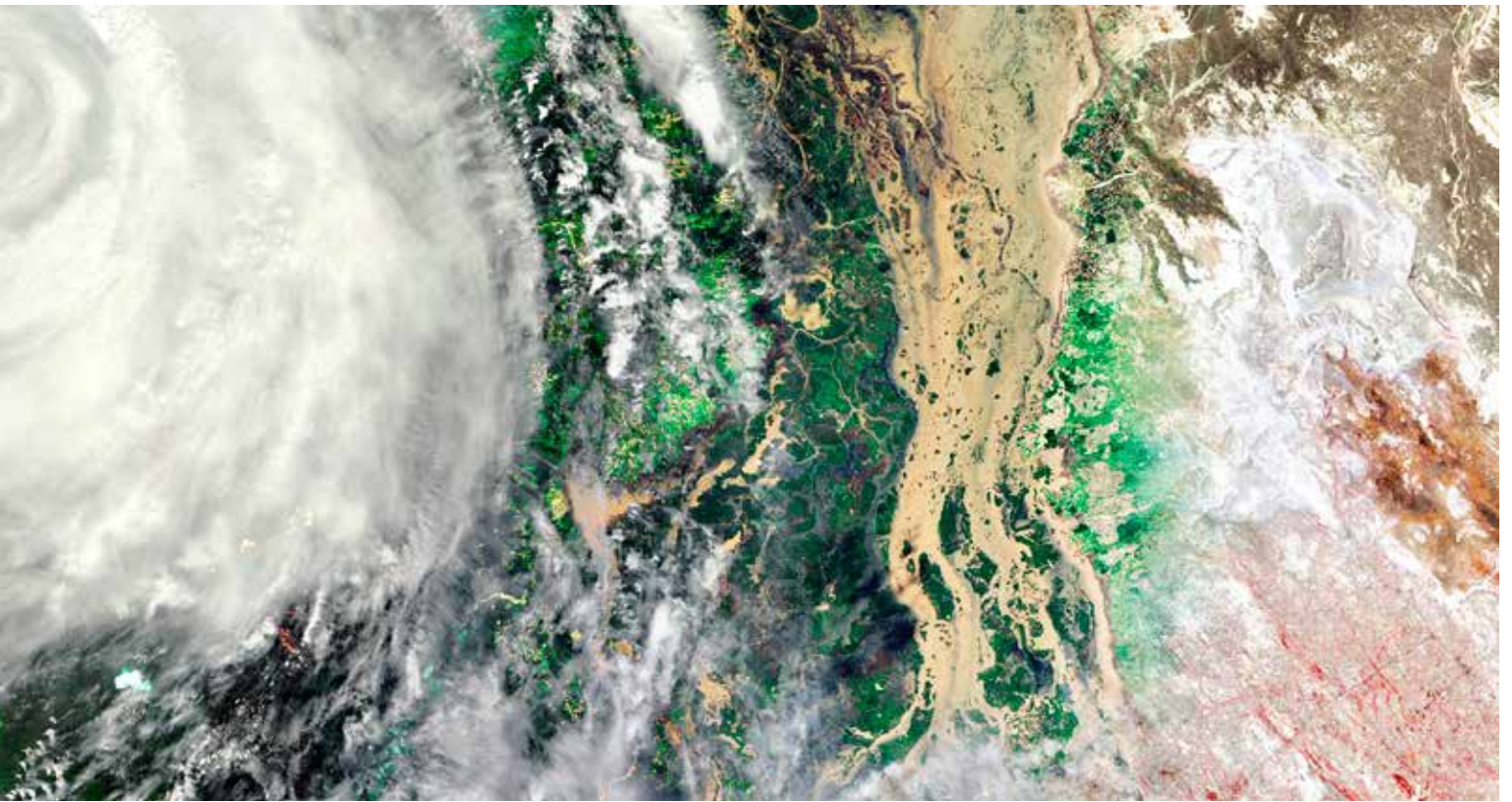
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3.5%

The fall in Japan's GDP following the 2011 Tohoku earthquake

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## NATURAL CATASTROPHES

For manufacturing companies, it is natural catastrophe risks that have served to focus the most attention on supply chain risk in recent years – notably the Thailand floods and the Tohoku earthquake, both in 2011. These risks had a significant impact on various industries, especially the automotive and electronics sectors, where they clearly demonstrated the fragility of existing supply chains.

Historical data gives us a good understanding of the likelihood of natural catastrophe events in any particular region. Munich Re has extensive loss databases for various risk classes, for example, which have been developed and honed over the years, including a consistent global data set for 12 relevant natural hazards over the last four decades. This extensive knowledge base, combined with risk modeling developed in-house, helps us carry out national and global risk evaluations, spatial analyses, and claims overviews.

In some cases, such as earthquakes, the probability of these events remains constant; others are changing. Climate change is likely to have an effect on the

frequency of severe tropical storms, for example. The potential impact of these trends on the probability of weather-related events is analyzed and considered in our models, but naturally, this is still an evolving area.

Natural catastrophe risk should be a key consideration in supply chain design. Companies should consider the natural catastrophe risk exposure of current or potential supplier facilities as they establish their supply chains. Since suppliers of the same component types tend to cluster together, it may require special effort to ensure that plants selected for backup supply are not located in the same area as the primary supplier facility.

## CYBER RISKS

The cyber risk area has faced the biggest change in recent years, hard on the heels of the rapid growth in digital communication and the increasingly interconnected nature of products, companies, and supply chains. The rise in the frequency of severe cyber attacks has been staggering, and it can be expected that this will increase even further in the future. ►►

## MUNICH RE

Munich Re operates in all lines of insurance. It had premium incomes of \$53 billion in 2014, and has almost 43,000 employees worldwide. Munich Re is one of the data providers for DHL's Resilience360 platform.  
[www.munichre.com](http://www.munichre.com)

## DIRK SCHÄFER



Dirk Schäfer is a Senior Risk Analyst in the Special Enterprise Risks unit at Munich Re, where he is responsible for the development of new insurance products, including supply chain risk cover. A frequent speaker and author on insurance topics, he is also Head of the RMA (Risk Management Association) Working Group on Supply Chain Risk Management.

# 29

The number of global production disruptions triggered by the flooding of one automotive plant

*For any company seeking to improve its supply chain risk management capabilities, the first step should be a focus on transparency.*

## STRUCTURAL EFFECTS

The impact that any event might have on a supply chain can also be expected to change over time. Several important trends observed in many industries are likely to increase the severity of that impact:

- **OUTSOURCING** – more outsourcing generally means a higher risk of disruption as well as an increase in quality-related risks as more activity falls outside the direct control of the end product manufacturer
- **SPECIALIZATION** – companies increasingly tend to focus on certain tasks where they have a competitive advantage. This necessarily leads to increased outsourcing of other tasks, and can increase their exposure to particular disruptive events
- **DIGITIZATION** – makes supply chains more vulnerable to cyber threats
- **INCREASINGLY HOMOGENEOUS STRATEGIES AND BUSINESS MODELS** mean events are likely to affect many players in a given sector, making it hard to find alternative sources of supply in the event of disruption, for example
- **INTENSITY OF COMPETITION** – generally increases the urge to prioritize cost minimization compared with resilience

While these trends tend to make supply chains more and more efficient, they also bring with them the increased risk of disruption. We see a clear trade-off between the minimization of cost in the short term and resilience.

## COST IMPACT

In big natural disasters it is particularly difficult to separate the supply

chain component from overall loss numbers. However, it makes sense to look at the overall numbers of two of the most prominent events of recent years, and at their impact on one industry – auto manufacturing. The overall insured losses of the Tohoku earthquake in Japan were estimated at \$35 billion, but with economic losses at \$235 billion (the most expensive natural catastrophe ever). Japan's GDP fell by 3.5% in Q1 of 2011. In the month following the earthquake, Toyota reported that its domestic production tumbled by over 74%, mainly due to power shortages, damage to factories, and lack of parts supply compared with the same month in 2010. Honda announced an 81% reduction in production over the same period.

Economic losses for the Thai floods in 2011 were estimated by the World Bank at THB1.4 trillion (\$45.7 billion), which makes the floods one of the top five costliest natural disaster events in modern history. Supply shortages that were caused by the floods led to lost production of 260,000 vehicles in the case of Toyota – 3.4% of its annual production target for that year. For Honda, the flooding of its main manufacturing plant in Thailand triggered 29 global disruptions in car production due to the lack of parts. Production was halved at plants as far away as the United States and Canada – full production could only be resumed as late as April of 2012.

## RESPONSE

The most advanced companies have developed a holistic view on supply chain risk management. This means that the strategies and targets of the procurement and risk management division are intertwined; ideally there is only one organizational unit responsible for supply chain risk





## SUPPLY CHAIN RISK AND THE INSURANCE SECTOR

Supply chain risk-related scenarios are growing in importance for insurance organisations like Munich Re. Especially important is the assessment of supply chain impact on contingent business interruption-related accumulations.

The insurance industry in general is working on solutions for this problem. One promising area of development is the use of supply chain risk software tools. Such tools both create the transparency that allows companies to reduce their exposure to supply chain risk, and allow insurers to assess exposures and accumulations in a better way.

management. In the optimal scenario, risk management perspectives are embedded in the purchasing process, and supply chains are designed with an explicit risk management focus.

Obviously, such an approach has to be supported by IT tools that enable companies to perform a thorough supply chain risk analysis as well as supply chain risk monitoring. The use of explicit supply chain risk management software can help compa-

essary physical supply chain risk management measures and business continuity management processes.

The picture is far from consistent, however. While the most advanced companies use supply chain risk management software, and have even adjusted their incentive schemes in order to implement this holistic view of supply chain risk management, there are still companies that have barely started with

*In the optimal scenario, risk management perspectives are embedded in the purchasing process.*

nies identify and assess risks. It also gives them the opportunity to react rapidly in the case of an event. In addition, leading companies have identified and implemented the nec-

the topic of supply chain risk management, and still follow the strategy of minimizing costs while ignoring the inherent risks of such an approach.

## GETTING FROM HERE TO THERE

For any company that is seeking to improve its supply chain risk management capabilities, the first step should be a focus on transparency. It is necessary to have a detailed knowledge of the most critical exposures in order to design adequate responses. And to react quickly, it is also really important to receive rapid information when an event has actually happened.

In addition, we believe that companies should be aware of their Achilles' heels so that they are able to focus on the important parts of the supply chain. In that context, companies should begin with their most profitable products (on an absolute basis). As it is easily possible to become lost in an ocean of details, it makes good sense to concentrate on those products where supply chain disruption would have the biggest financial impact. ■



# IF SOMETHING CAN GO WRONG, IT PROBABLY WILL

All supply chains face risks, and the more complex and global those supply chains, the greater their exposure. This page highlights some key risks, and looks at their effects on particular supply chains in recent years.



## PIRACY

Since 2005, **more than 149 ships have been captured and ransomed**, and many more attacked, by pirates off the Somali coast. A 2013 World Bank report estimated the annual economic cost, including the effect on trade of anti-piracy measures, at \$18 billion.

## CARGO THEFT

The Transportation Asset Protection Association estimates that there are **three major incidences of cargo theft every day** in Europe alone. The average value of these thefts in 2014 was more than \$220,000, and in 15 cases thieves stole goods worth more than \$1.1 million.



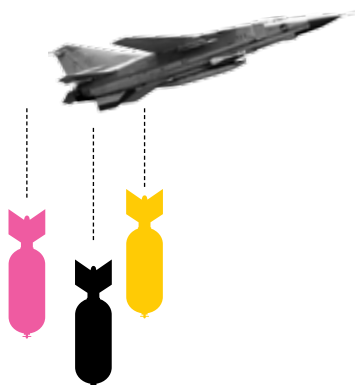
## CURRENCY VOLATILITY

The **steep devaluation of the Venezuelan Bolivar** is estimated to have cost U.S. companies nearly \$3 billion in profit in the second quarter of 2015. Some have been forced to write off the value of their assets in the country.



## EARTHQUAKES

The **2011 Tohoku earthquake** in Japan was the costliest natural disaster in history, with an estimated economic impact of \$235 billion. The 9.0 magnitude earthquake and subsequent tsunami killed 16,000 people and severely damaged the country's industrial infrastructure, including several nuclear power plants.



## WAR AND TERRORISM

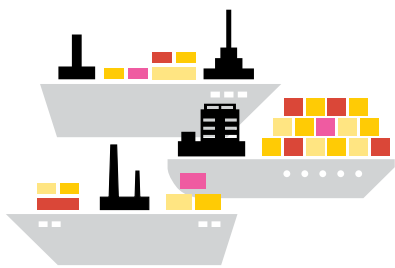
The **port of Hodeidah in Yemen** was shut down in August of 2015 after it was bombed by Saudi aircraft as part of a campaign against militants. The port was a major route for humanitarian aid going into the region.

## IT AND TELECOMMUNICATIONS FAILURES

According to a survey by the Business Continuity Institute, **information and communications technology outages** are the most common cause of supply chain disruption, affecting more than half the companies surveyed.



# STUFF HAPPENS



## PORT CONGESTION

A ten-day shutdown at ports on the U.S. West Coast in early 2015 is estimated to have cost the U.S. economy \$2 billion a day. The dispute also drove up supply chain costs, as importers were forced to switch to routes between Asia and the U.S. East Coast via the Panama Canal, using smaller, costlier vessels.

## CYBER ATTACK

Cyber criminals are increasingly attacking industrial infrastructure as well as conventional computer networks. In 2014, the U.S. Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) responded to 245 incidents reported by asset owners and industry partners. The attacks focused on assets in the energy and manufacturing sectors.

## SUPPLIER TROUBLE

Automotive supplier Hella had to reconfigure parts of its supply chain this year, following the failure of a Chinese supplier of plastic components. The company says the disruption cost it \$55 million. Meanwhile, both Boeing and Airbus had to delay deliveries earlier in the year after capacity problems at a seat supplier.



## HURRICANES

Hurricane Katrina, which struck the U.S. in 2005, was the costliest natural disaster in U.S. history, with an economic impact estimated at \$108 billion. Hurricanes, storms, and tornadoes were the cause of nine out of the ten costliest disasters in the country.



## SEVERE WEATHER

Even relatively localized weather events can be costly and disruptive. In 2013, for example, hailstorms outside Volkswagen's Wolfsburg headquarters damaged around 28,000 cars awaiting delivery to customers.

## GEOPOLITICAL DISRUPTION

The activity of migrants attempting to cross from mainland Europe to the United Kingdom has created average delays of nine hours at the port of Calais. In 2014, shippers traveling through Calais paid \$10.5 million in fines following the discovery of stowaways in their cargo.

UNITED KINGDOM

CALAIS

FRANCE



Earthquake aftermath: WFP supplies arrive in Nepal, May 2015.



# THE FORMIDABLE LOGISTICS OF RELIEF

A sophisticated approach to supply chain risk and resilience underpins the activities of the world's largest humanitarian relief organization, says Adrian van der Knaap of World Food Programme.

In 2014, the United Nations World Food Programme (WFP) provided help to 80 million people in 82 countries around the world. That requires a formidable logistics capability. WFP distributed 3.2 million tonnes of food, of which 1.9 million were shipped by sea, with the remainder sourced in or close to destination countries.

At any given day, WFP's 2,500 logistics staff operate a network of 650 warehouses and an average of 5,000 trucks, 20 ships, and 70 aircraft. While many of these transportation assets are owned by third parties, the organization also runs its own fleet of more than 800 trucks, supported by 35 fleet workshops. WFP's logistics capabilities are relied upon by numerous other humanitarian organizations.

It operates the UN Humanitarian Air Service, for example, which carried more than 240,000 passengers and nearly 4,000 tonnes of cargo to 258 destinations last year. It is also lead agency in the Logistics Cluster, a group of humanitarian organizations that work together to ensure an efficient and effective logistics response in emergency situations.

Adrian van der Knaap is the Chief of Transport, based at WFP's headquarters in Rome, Italy. While WFP manages its global sea and air operations from its headquarters, staff on the ground handle the day-to-day management of landside transport activi-

ties in the many countries it operates. "Our role at headquarters is to provide support to the field when they need it, and to develop policies and provide normative guidance to staff on the ground," van der Knaap explains.

## FAST RESPONSE CAPABILITIES

Dealing with large-scale humanitarian disasters requires a remarkably agile supply chain. "In cases of sudden onset emergencies, like the recent earthquake in Nepal, we aim to be operational on the ground within 48 hours," says van der Knaap. "That doesn't just mean getting people there to evaluate the situation. We need to be up and rolling with goods and storage units in place and transportation arranged to get supplies where they are needed most."

Fast response capabilities like that don't happen by accident. They are the result of years of analysis, refinement and capacity development. Take Nepal, for example. "In every region we operate, we conduct gap analyses to see what we need to do to speed up our response in the event of an emergency," explains van der Knaap. "In Nepal, this analysis suggested that the lack of an operating hub in the country would be problematic, so we set one up at Kathmandu airport." That new hub was completed just a few months before this April's earthquake, and its availability made a ►►

One year:

**3.2** MILLION TONNES

of food to

**80** MILLION PEOPLE

ADRIAN VAN DER KNAAP



Adrian van der Knaap is Chief of Transport and Deputy Director of the Logistics Division for the World Food Programme (WFP). His previous roles at WFP include Head of Logistics in the Democratic Republic of Congo, Eritrea, Ethiopia, Angola and Sudan as well as Head of the Sub-Office in Gulu, Uganda and Juba, Sudan. From 2002 to 2006, he led the United Nations Joint Logistics Centre in Rome.



## THE WFP IN FIGURES

2,500   
logistics staff

650   
warehouses

5,000   
trucks

20   
ships

70   
aircraft

[www.wfp.org](http://www.wfp.org)

significant difference to WFP's ability to respond to the disaster.

WFP's work doesn't just involve WFP staff and infrastructure, however. Large-scale relief efforts necessitate a highly collaborative approach, and the agency spends a lot of time building networks involving governments, humanitarian agencies and commercial organizations.

"If we know that a country has national food reserves, we will make agreements to access those in the event of a disaster," says van der Knaap. "In the Asian Tsunami of 2004, for example, those pre-existing agreements helped us to get much faster access to supplies."

WFP has similar agreements to access extra personnel from partner organizations to provide support for major disasters, and it also invests considerable effort developing third-party capabilities. This includes training national government agencies in emergency logistics best practices, to be better placed to provide a coordinated response if required. The reality of a humanitarian disaster situation is that, however strong the pre-existing plans, considerable improvisation will be required to respond to the changing situation on the ground. In these circumstances, WFP's logistics activities rely on a highly decentralized approach that give its front-line teams considerable freedom of action.

"We have special separate procurement rules for transportation, which give our front-line teams substantial delegation of authority to contract what they need without needing to come back to headquarters for approval," says van der Knaap. It's an approach that dramatically improves agility, while rigorous post-factum compliance work ensures that purchasing decisions stay within the rules.

## LEARNING FROM RELIEF

In addition, WFP continuously incorporates its lessons learned from past emergency responses when planning for those in the future, which is important for stronger disaster preparedness. "In Nepal, for example, we faced delays getting permission to overfly neighboring countries to bring in aid," says van der Knaap. "So now we are doing the work to get access agreements in place up front, not just for Nepal but for other landlocked countries around the world."

Moving forward, a priority area for WFP includes innovative solutions to meet growing challenges. For instance, in recent years there has been a shift towards aid in the form of cash or vouchers, so people can buy food from the local supply chain rather than relying on in-kind donations from abroad. "I think of it as the ultimate





Chain reaction: Pakistani workers prepare relief supplies in 2014.

outsourcing approach,” says van der Knaap. “We are still delivering food aid, but no longer using our resources or those of a direct contractor.”

However, implementing the new approach required a radical change in processes, people, and culture. And

to the Ebola crisis in West Africa, for example. This task required the development of new skills, like the construction of field hospitals and treatment centers in remote regions. It was an opportunity to demonstrate WFP’s capacity and expertise as a provider of logistics services. Despite

*The WFP logistics organization relies on a highly decentralized approach that gives its front line teams considerable freedom of action.*

it continues to have significant implications for the logistics organization. “We need to evaluate the entire food supply chain in the region to ensure that it will be able to support the local demand,” van der Knaap says. And in some cases, like Darfur in Sudan, the WFP uses “hybrid” supply chains, with aid switching from cash and vouchers in the dry season to direct food deliveries when rains bring the local supply chain to a halt.

As fast as it creates innovative solutions to existing challenges, WFP faces new ones. In 2014, WFP supported the international response

to a challenging environment, WFP highlighted its ability to find solutions as needed by the Ebola responders.

WFP uses its expertise as a supply chain service provider to support the humanitarian community and government partners as and when required. In this context, WFP also builds the capacities of National Disaster Management Organizations (NDMOs) and National Disaster Management Authorities (NDMAs), by offering tailored trainings, augmenting logistics infrastructure, sharing supply chain expertise, and strengthening internal processes, for example. ■



## NEW TOOLS

The WFP uses new technology to improve the efficiency and effectiveness of its logistics. GPS devices monitor its truck fleets, and it even uses mobile phones to deliver aid directly in the form of electronic food vouchers.



## PREVENTION WORKS

The WFP understands preventative measures. If roads are cut off by seasonal rains, airlifting food costs up to eight times as much as truck delivery. Investing in constructing better roads pays back in future transport savings.

# HUMAN FACTORS

Criminal activity threatens supply chains in many different ways. It is Jim Yarbrough's job to assess those threats.



**N**ot every supply chain disruption is an accident. The high financial value of many shipments makes them a tempting target for thieves. And global cargo flows provide a useful mechanism for the movement of illicit goods – and people – across national borders. Greed can even encourage legitimate supply chain participants into illegal activities, whether that means breaching customs regulations, ignoring environmental and safety rules, or adopting poor labor practices.

All these actions can have serious repercussions for the companies involved in affected supply chains, ranging from significant financial loss to severe and long-term reputation damage. Understanding the nature and magnitude of these kinds of supply chain risks is a fundamental part of Jim Yarbrough's role as director of BSI Supply Chain Solutions' Global Intelligence Program.

"Supply chain crime has a much lower profile than many other forms of crime or terrorism," he explains. "But its financial impact on the companies involved can be significant." In the

pharmaceutical or high-tech industries, for example, a single truckload of product may be worth hundreds of thousands of dollars. And a company doesn't have to lose that shipment to lose its value. "If a load of pharmaceutical products or foodstuffs is compromised by stowaways, it may no longer be suitable for use and will have to be destroyed." Similarly, terrorist groups around the world frequently steal or destroy cargoes, either to fund their wider operations or to disrupt the regional economy and discourage international companies from operating locally, he adds.

## PICTURE ON THE GROUND

BSI's intelligence program is built on data from many different sources, explains Yarbrough, but at its heart is "feedback from our hundreds of staff around the world who spend their time on the ground in different locations conducting audits and assessing the performance of different supply chain participants." While the primary purpose of such audits is to help companies improve their own compliance and business perfor-

## BSI SUPPLY CHAIN

BSI Supply Chain Solutions is the leading global provider of supply chain intelligence, assessment compliance, and risk management software solutions. Its mission is to help corporations, governments, and associations identify, manage, and mitigate global supply chain risks and maintain world-class governance, risk, and compliance programs. BSI is one of the data providers for DHL's Resilience360 platform.

[www.bsigroup.com](http://www.bsigroup.com)

mance, the sanitized and aggregated data helps BSI to build a picture of overall supply chain risks in different regions and industry sectors.

BSI supplements this data with feedback from suppliers and an analysis of thefts and other criminal activities around the world. "Our analysts look at thousands of incidents every month," he explains. "Our aim is to separate activity targeted at supply chains from things such as street crime, to build a macro-level picture of supply chain threats."

Collecting that data is a significant challenge, he adds, since both the quality of data-gathering infrastructure, and the willingness of governments to make data publically available, vary significantly by region. It is possible to get a detailed picture of supply chain incidents in some regions, such as the EU. In other regions, very little hard data is available, and BSI makes use of neural network modeling techniques to create risk estimates based on regions with similar economic and demographic characteristics.

## UNDERLYING TRENDS

The outcome of all this analysis is risk assessments by region, industry, and threat type. But even more significantly, says Yarbrough, BSI is continually updating its data sets, which allows it to identify underlying trends. "Take South Africa, for example, which is an area that already has a high level of truck theft. When we look at that data, we can see a strong correlation between a slowing in GDP growth and a rise in the number of thefts, so we can warn our clients of the need to increase their vigilance if the economy slows." As another example, Yarbrough cites cargo theft in Germany, which was once concentrated in the west but has recently become much more prevalent in former East Germany, too.

If there is one overall finding that arises from BSI's work on security, says Yarbrough, it is the importance of developing supply chain-specific models of security threats. "There are a number of existing models for the assessment of threats against national security or travel security in a region, but when we look at threats to supply chain security, we often see a very different picture." Yarbrough cites the United Kingdom as an example of this phenomenon: a country generally very safe for travelers, but with a high incidence of cargo theft.

Ultimately if there is one thing that would make Yarbrough's work easier, he says, it would be a more widespread recognition by companies and authorities of the unique nature of supply chain crime. "Supply chain crime slips under the radar," he says. "It is less newsworthy, but often has a higher value than other kinds of crime. It needs to be categorized differently, and we need better reporting of incidents, especially in emerging regions." ■

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**\$3.9** MILLION

Value of a single pharmaceuticals shipment lost due to cargo contamination by stowaways

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**\$40,000**

of clothing was stolen from a moving truck in China in 2015

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## ASSESSING RISK

BSI also provides global risk data and analysis around Corporate Social Responsibility (CSR), and Business Continuity (BC) risks, such as unsafe working conditions, labor rights violations, natural disasters, and strikes. This work requires a different approach, notes Yarbrough, relying less on analysis of specific incidents and more on the assessment of underlying conditions, impact, and frequency. "We will look at whether a country has minimum wage laws or allows workers the right to unionize and protest, for example," he says. "And we'll look at how well these laws are enforced." More than with supply chain crime, however, CSR and BC risks depend on the activities, procedures, and locations of the specific suppliers a company chooses. "We can alert our clients to the conditions existing in an industry or region," he explains. "Then it's up to them to ensure they are hiring the right people to audit their suppliers, and that those auditors are asking the right questions."

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JIM YARBROUGH

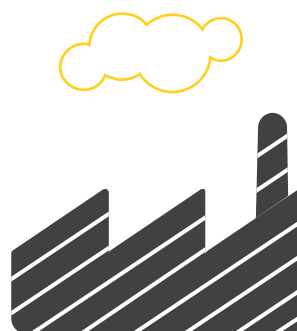


Jim Yarbrough is Director, Global Intelligence Program at BSI. He leads BSI's team of intelligence analysts, and assesses the potential threat of supply chain disruption for governments and a number of Fortune 500 companies. He manages the quantitative assessment of over 20 separate variables that threaten global supply chains, and provides threat assessments related to security, corporate social responsibility, and business continuity.



# RESPONSES TO RISK

The characteristics of different sectors have a significant impact on their supply chain risk profile – and on the approaches used to mitigate those risks.





## AUTOMOTIVE

As inventor of the lean production philosophy, the automotive industry adheres most strictly to the principles of just-in-time delivery and low inventories. At the same time, the development of global vehicle platforms and the use of modularization strategies to increase the commonality of components between product lines has extended some of those lean supply chains over great distances, exposing them to the risk of transportation disruptions.

Meanwhile, as it responds to rapidly rising demands from fast-growing economies, the industry is increasingly adopting a nearshoring or “produce where you sell” strategy, establishing manufacturing facilities in or adjacent to key markets and encouraging suppliers to set up in proximity. This approach helps to control transportation costs and risks, but has created new challenges for the sector, including increased exposure to natural disasters and the challenge of limited or fragile infrastructure, from transport links to power supplies.

A global profile also requires the industry to comply with the diverse regulatory requirements of different markets and production locations, bringing with it the associated risks of non-compliance. The

regulatory environment faced by automakers is also an increasingly stringent one. Pressure from governments and consumers has increased the number of product recalls in recent years, with several major manufacturers facing high-profile recall events.

A single missing component can stop a production line. At \$10,000 to \$100,000 per minute, the high cost of production line stoppages has contributed to the automotive sector’s willingness to invest in risk management strategies. But the industry’s focus on lean production, together with the recent memory of the pain that was caused by overcapacity in the 2008 recession, means that automakers favor supply chain agility and production flexibility over buffer stocks and redundant capacity.

As a result, automakers have pioneered the use of advanced risk management approaches, including detailed network risk analysis and increased flexibility inside assembly plants. To mitigate the impact of supply disruptions, the industry makes use of multimodal transportation solutions to balance speed and cost. Affected parts can be temporarily switched to a faster transport mode to keep assembly lines supplied until normal service is resumed.



## ENERGY

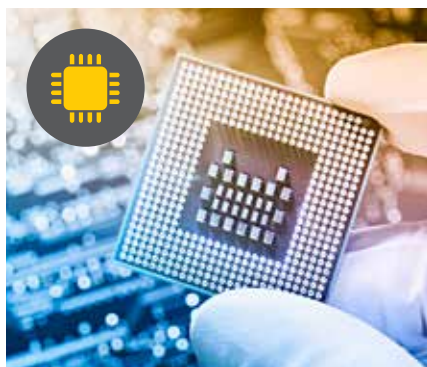
As oil and gas companies look for new resources in ever more remote parts of the world, they are stretching the capacity of their supply chains. The impact of risks caused by customs delays, port congestion, or bad weather are amplified by the extremely high cost of operating exploration and production equipment in remote locations, for example, since any loss of operating time to a supply chain failure is very high indeed. And when problems do occur, limited infrastructure or logistics capacity in remote regions mean that companies often have few alternative supply options.

Compounding these challenges, the energy industry is at the mercy of global economic and geopolitical shifts. The dramatic fall in the oil price over the last 18 months has forced the industry to reconsider investment portfolios, putting some projects on hold and searching for deep cuts in the operating costs of existing assets. Meanwhile, local political upheavals can create significant challenges on the ground, sometimes requiring operators to extract equipment and personnel at short notice when trouble begins to flare up.

Recent events, from the Tianjin port explosion to the 2010 Gulf of Mexico oil spill, stand as clear demonstrations of the impact that safety failures can have, and the energy and chemicals industries operate under great pressure to comply with environmental and health and safety standards. They also need robust emergency response procedures in place. And the need to transport large quantities of both personnel and equipment at extremely short notice in response to emergency situations can place limited transportation infrastructure under even greater pressure.

The energy sector – particularly the upstream part of the business, which bears the brunt of political and economic volatility – is responding to its supply chain challenges by taking an increasingly integrated approach. Operators are bundling supply chain services to improve visibility, and increasingly centralizing control of their supply chains, especially in emergency response situations. They are ramping up contingency planning, too, ordering equipment early, raising safety stock levels, and staging critical equipment in or near emerging regions in preparation for forecast demand.





## TECHNOLOGY

Technology companies operate in a particularly demanding supply chain environment. The sophisticated components that make up today's mobile phones, laptop computers, and IT infrastructure are sourced from specialist suppliers spread right across the world. Technology companies also have to contend with product life cycles measured in months rather than years, and with highly volatile consumer demand. Their markets are prone to disruption by new products, new product categories, and new market entrants. Cost pressure is relentless too, with customers expecting products to get cheaper even as they become more powerful and feature-rich. Finally, sales channels are getting more complex. Companies must serve customers online, through traditional retail stores, and increasingly through hybrid routes such as "order online, collect in store" services.



## ENGINEERING AND MANUFACTURING



## LIFE SCIENCES AND HEALTH CARE

In such a fast-moving and highly competitive market, technology players have sought to improve their responsiveness by reducing inventory levels wherever they can. Inevitably, however, this strategy increases their exposure to delays and disruption in the supply chain. As a result, leading technology firms have made the management of supply chain risk a strategic priority. To avoid supply chain disruption, they are looking for more effective ways to promptly predict and identify any changes and irregularities in the supply chain and the external environment. Technology companies are also planning ahead, establishing priorities for the management of different types of risk. To better predict risks, some

companies are starting to use Internet of Things (IoT) capabilities that enable a new level of self-awareness and communication between technology devices and their ecosystem.

To respond to issues that do occur, technology companies are working to improve collaboration, risk sharing, and value alignment with all supply chain partners. They are trying to establish flexible supply chain networks, too, a strategy that also helps to speed new product introductions and meet spikes in customer demand. To make these strategies work, they need tools and processes that show the exact status of materials and products in the end-to-end

supply chain, and enable multi-channel forward and reverse flows. As they build the capabilities to meet their existing challenges, technology companies face new ones, too. Stringent end-of-life reuse and recycling regulations, for example, can lengthen the supply chain many years beyond the point of product delivery. In addition, technology companies are now required to collaborate with customers to protect products and services from cyberattack. Malicious hardware and software cannot be allowed to enter the supply chain at the materials, manufacturing, or transportation stages. This can broaden the supply chain risk management challenge to encompass customers as well as suppliers.

In recent years, the Engineering and Manufacturing sector has been rocked by rising volatility. The price of key commodities, from iron ore to agricultural products, has seen violent swings and significant shifts in both supply and demand with currently extremely low price levels. For companies making the equipment that is used to extract, process, and transport these materials, that has meant equally dramatic changes in fortune.

As one of the most global of all industries, this sector is also particularly exposed to the rigors of nature, and to the threat of geopolitical disruption, from political instability and local protectionism to all-out war. Recent events such as the

conflicts in Ukraine and Yemen have shown all too clearly how such problems can arise in unexpected areas as well as known trouble spots.

Heavy engineering assets have long life spans, too. A commercial airliner or mining machine can operate for 20 to 40 years, requiring a regular flow of replacement parts and upgrades throughout its life. For manufacturers, the support of products in service can account for up to a third of revenues and a significant share of profits, while operators need the right parts in the right place at the right time to keep their expensive assets running. An airplane on the ground waiting unexpectedly for spare parts can cost its operator more than \$100,000 per hour, for example.

Even when things are running relatively smoothly, companies operating globally face rising complexity. As regulatory regimes worldwide develop and mature at different rates and in different ways, companies must comply with trade and environmental regulations, industry standards, and changing customer expectations.

Manufacturing companies are also looking to improve the responsiveness of their existing supply chains with an emphasis on flexibility by developing leaner and optimized inventory processes. Improving information flows is also a priority, with a focus on improved forecasting capabilities, extensive contingency planning, and the use of risk intelligence tools.

Pharmaceutical supply chains have a number of unique characteristics that affect the nature and severity of supply chain risks in the sector.

First, while their upstream supply chains tend to be relatively simple, with few plants and a small number of suppliers, they are often concentrated, with one or two main plants supplying the whole world's demand for some key products – an obvious choke point.

Second, the industry has highly stringent logistics quality requirements. Bio-pharmaceutical products, for example, which are expected to account for nearly half of the value of the top 100 global pharmaceutical products by 2020, require temperature management and control,

often in a narrow range, throughout the entire supply chain from manufacturer to patient – a supply chain with multiple providers from truckers and carriers through forwarders and agents to distributors and pharmacies, and one that serves increasingly remote areas of our globe.

Third, the high value and “lifestyle” nature of pharmaceutical products has contributed to counterfeiting, making supply chain security and product identification key concerns in the sector.

These complexities have driven the life sciences sector to develop highly refined logistics approaches with dedicated infrastructure and cold chain services managing the ambient temperature at key

steps of the supply chain, specialized thermal packaging, and advanced technologies including near-real-time or just-in-time (JIT) temperature logging and monitoring to identify temperature excursions during transportation and enable intervention.

At the same time, high inventory levels are being reduced and, increasingly, total cost approaches are being developed, including cost of transportation, thermal packaging, customs, taxes, working capital, cost of non-availability of product, storage, and returns, as well as the cost of quality and the risk of theft, loss, and damage. Smart manufacturers and providers also operate adequately differentiated supply chains for specific products, geographies, and channels.

# SEVEN SUPPLY CHAIN STRATEGIES

To get supply chain risk under control, companies need to make changes right across the value chain. Here are seven key areas of focus.



**A**s the impact of risk on global supply chains has grown, organizations have worked hard to develop strategies to manage those risks. The best approach for any one organization will inevitably depend upon numerous factors – from the nature of its products and production processes to its financial strength. But the most successful approaches do share some common attributes.

## » GAIN A DEEPER UNDERSTANDING OF THE RISKS

Many companies start their efforts to manage risks by trying to understand them: at its simplest, a risk assessment attempt to quantify the probability of a risk and its financial impact.

This two-dimensional approach has its place, and can be useful in helping companies to identify high-priority risks in their supply chains. But to be really meaningful, these analyses should capture a richer picture of risk characteristics.

Consultancy Accenture, for example, encourages companies to add four further dimensions to their supply chain risk assessments: the difficulty of detecting the risk up front, the lead time available between detection and the impact of the risk, the cost of recovering from a risk event, and investment required to put mitigation strategies in place.

## » TAKE A NETWORK-CENTRIC PERSPECTIVE

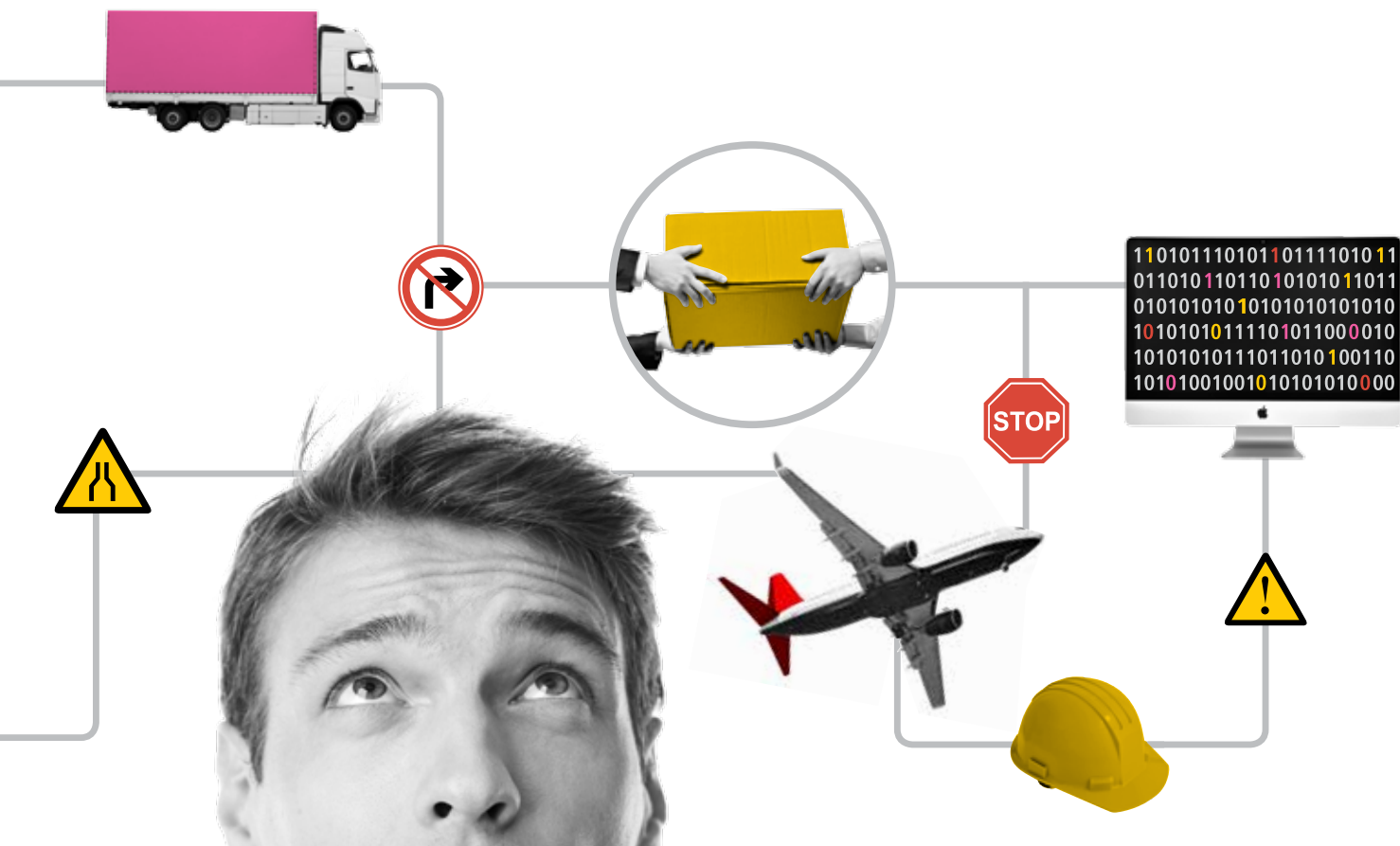
Supply chain risks can't be fully understood without considering the network they affect. At its simplest, that is intuitively obvious. A company needn't spend too much time watching for disruptions at suppliers of simple commodity parts and materials, for example, if they can switch seamlessly to an alternative source in the event of disruption. The right calls need to be made with care, however. Delays in one transport lane may be of little concern in a region with a rich infrastructure and

plenty of spare capacity, but they quickly become critical if – as is the case in some emerging market locations – few alternatives are available. Similarly, disruptions in the availability of tiny, inexpensive parts can be critical if products cannot be shipped without them.

Network characteristics play such a critical role in supply chain risk that some risk management models focus on them alone, making no attempt to quantify the probability or magnitude of specific risk events. (See our interview on page 30 for discussion of one such approach.)

## » MAKE STRONG BUSINESS CONTINUITY MANAGEMENT THE FOUNDATION

Successful supply chain risk management programs are based on strong business continuity management (BCM). According to the Business Continuity Institute, 82% of companies with effective BCM in place say that



their programs have demonstrably mitigated the impact of disruptive events. Companies with the best supply chain risk management programs extend their BCM strategies outside the wall of the organization. They expect key suppliers to have their own BCM programs in place, and they conduct regular checks and audits to ensure they are.

#### » USE ALL AVAILABLE DATA

Organizations with an earlier, clearer view of potentially disruptive events in their supply chains can respond more effectively to them. Leading companies develop processes for the systematic collection and analysis of supply chain risk data. The best make use of multiple data sources – from external data providers, public sources such as social media, customers, and suppliers as well as their own staff – and they invest in smart tools to sift through that data in order to spot potential issues early. The very best organizations integrate the use of this data into their every-

day operations management – for example, increasing target inventory levels at national and regional distribution centers as customs delays increase waiting times at border crossings.

#### » COLLABORATE WITHIN AND BEYOND THE ORGANIZATION

Clear communication and effective collaboration is vital if companies are to spot, avoid, and respond to supply chain risks. That means strong collaboration within the organization. Leading companies often set up cross- ▶▶

*Supply chain risks can't be fully understood without considering the characteristics of the network they affect.*

*The best companies configure their entire value chains to promote resilience, using strategies like dual sourcing and postponement techniques.*

functional war rooms or control towers to manage supply chain disruptions. It also means close collaboration with customers and suppliers.

When management consultancy PwC asked more than 200 companies what they felt to be the most important enablers in supply chain risk management, alignment between supply chain partners was considered a top priority by the largest number of respondents, closely followed by internal alignment and effective information sharing.

### » BUILD IN RESILIENCE

A rapid, well-coordinated response is essential when supply chain disruption strikes, but the effectiveness of that response is decided by steps the organization has put in place months or years earlier.

The best companies configure their entire value chains to reduce risk and promote resilience, with the use of strategies like dual sourcing for critical components, flexible product designs that permit component

substitution, or postponement techniques that allow inventories of unfinished products to be allocated to different end uses according to need. Leaders build resilience into their logistics processes in the same way.

# 82%

of companies with effective BCM say their programs have demonstrably mitigated the impact of disruptive events

Segmented transportation modes allow them to ship products faster to high-priority customers in normal operations, for example, while creating alternative routes when problems

## CREATING RESILIENT NETWORKS

### AN INTERVIEW WITH PROFESSOR DAVID SIMCHI-LEVI

To mitigate rare events with serious consequences, companies should focus on the characteristics of their networks. David Simchi-Levi, Professor of Engineering Systems at Massachusetts Institute of Technology (MIT), has spent decades in industry and academia helping companies find better ways to manage their supply chains, improve the flexibility of their operations, and make use of analytical techniques to optimize aspects of

their businesses. One focus in recent years has been supply chain risk.

#### **Professor Simchi-Levi, what made you want to look at supply chain risk?**

It's an interesting area, in part because it is so hard to do. Many companies have ways to deal with everyday risks, but dealing with "unknown unknowns" such as geopolitical events or natural disasters is much more difficult.

#### **What are the typical mistakes companies make when thinking about these low-probability, high-impact risks?**

Some organizations ignore the issue altogether; others find it difficult to know where to focus their efforts. You could review every supplier, and assess their strategies to

cope with severe disruption, but if you have 6,000 or 7,000 suppliers, by the time you've finished everything is likely to have changed. Many companies instead look at their largest suppliers by spend, only to find that problems at a much smaller supplier had the potential to severely disrupt their operations.

#### **Is there a better way?**

We developed an alternative approach focused on the ability of the supply network to recover from disruption. We ask how long it would take any node in a company's supply chain to recover from a severely disruptive event.

If a company has two production facilities in different regions, for example, it may be able to switch on new capacity quickly



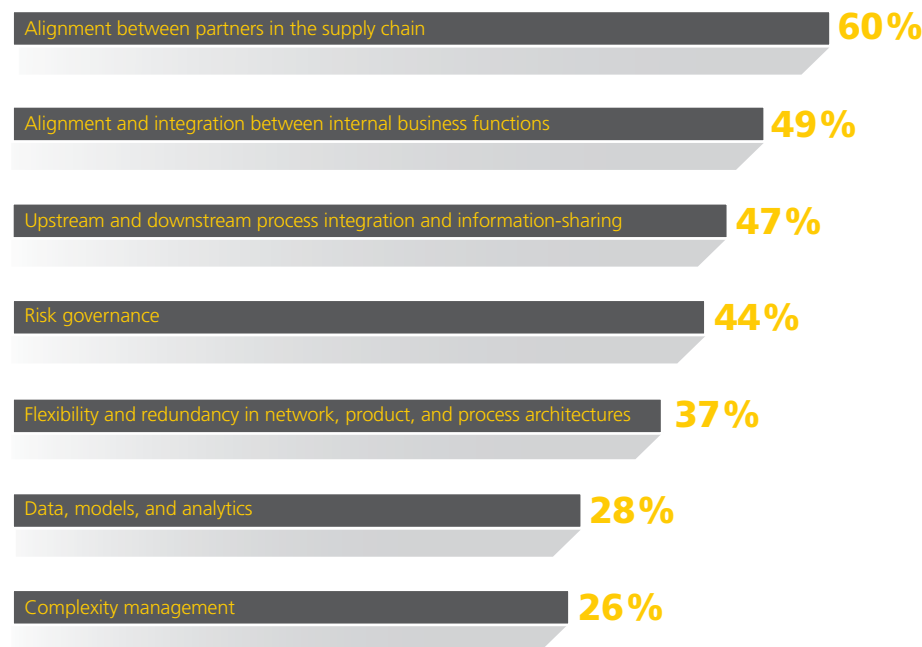
strike. In the PwC survey mentioned above, the impact of disruptive events on a range of commercial metrics was significantly lower for companies with strong overall risk management capabilities that also invested in supply chain flexibility.

## » CREATE THE RIGHT CULTURE

Finally, leading companies recognize that strong supply chain risk management is as much about culture as it is about processes. They work hard to ensure that employees focus on risk reduction alongside their cost, quality, and delivery targets.

They drive commitment to supply chain risk programs with strong support from senior management. And they reward their staff for measures that prevent supply chain disruption from occurring, not just for heroic work to fix problems that have already happened. ■

## THE MOST IMPORTANT ENABLERS OF EFFECTIVE SUPPLY CHAIN RISK MANAGEMENT



if a problem happens at one of them. If it only has one site, recovery could take months. By modeling an organization's supply chain using this "time to recover" measure, companies are able to see where disruption in the supply chain is likely to create the most severe problems.

### Has your approach evolved over time?

Our original approach did have one particular drawback, which is the difficulty in getting realistic data on how long it will take suppliers to rebuild their operations after disruption.

Suppliers have a clear incentive to claim that their disaster recovery strategies will be more effective than they actually are. To get around that, we developed a second metric – "time to survive" – which looks at how

long it would take a failure in any one node to have implications for the company's wider operations. If the loss of a particular node for one day starts to disrupt production, you know that you have a problem. But if there is enough excess capacity in your network to cope without that node for 40 weeks, it will be less of a priority.

### How can companies make use of the time-to-survive concept?

This metric creates two opportunities. It allows companies to concentrate supply chain risk management efforts on the most critical nodes in their supply chain, and it reveals others where there may be opportunities to capture cost savings – for example, by reducing excessive levels of in-process inventory.

PROFESSOR  
DAVID  
SIMCHI-LEVI



David Simchi-Levi is a Professor of Engineering Systems at Massachusetts Institute of Technology and Chairman of OPS Rules, an operations analytics consulting company, and Opalytics, a cloud analytics platform. His research focuses on developing and implementing robust and efficient techniques for operations management. He has published widely in professional journals on both the practical and theoretical aspects of supply chain and revenue management.

# UNDERSTANDING RISKS, BOOSTING RESILIENCE

Tobias Larsson describes an innovative service that allows companies to visualize supply chain risk across their networks, and to improve the way they manage it.

**W**hat businesses learned from 2011 was that supply chain risk can hit in unexpected places. An earthquake of 9.0 on the Richter scale struck Japan on March 11. It and the subsequent tsunami destroyed towns, transportation links, and industrial infrastructure, and triggered meltdowns at the Fukushima Daiichi nuclear power plant. Later that year, extensive flooding in Thailand affected production at more than 900 factories producing components for the automotive and high-tech sectors.

In the following months, companies worldwide struggled with shortages of key components and materials. For many, these issues came as a surprise. Affected products were often sourced from the second or third tiers of complex supply chains.

Recognizing the challenge of achieving better visibility of supply chain risks, those 2011 incidents spurred a research effort at DHL's Customer Solutions and Innovation. Its aim was to create tools that would give companies a better understanding of the risks faced by their own supply chains, and improve their ability to monitor and respond to potentially disruptive events as they happen. The result was Resilience360, a

unique supply chain risk management solution built on three sophisticated products: a continuous assessment of supply chain risk and resilience, a real-time incident monitoring solution, and dedicated logistics control towers that can actively respond to incidents and manage business continuity.

## RISK ASSESSMENT

The Resilience360 risk assessment process maps every node in a supply chain – down to third- and fourth-tier suppliers. DHL supply chain risk experts evaluate the risk level at each node with proprietary tools, including country-level risk maps and DHL's unique Supply Chain Risk Exposure Index (see page 32). Then they build a picture of network resilience, based on the criticality of parts supplied, the availability of alternative sources or buffer stocks, and detailed surveys of supplier risk mitigation plans.

## INCIDENT MONITORING

Supply chain risk management works best when companies have the earliest possible notice of potentially disruptive incidents. The Resilience360 real time monitoring platform tracks multiple categories of risk events throughout

the world. Once an organization has built a model of its supply chain, sites across the network will receive immediate alerts of potentially disruptive incidents.

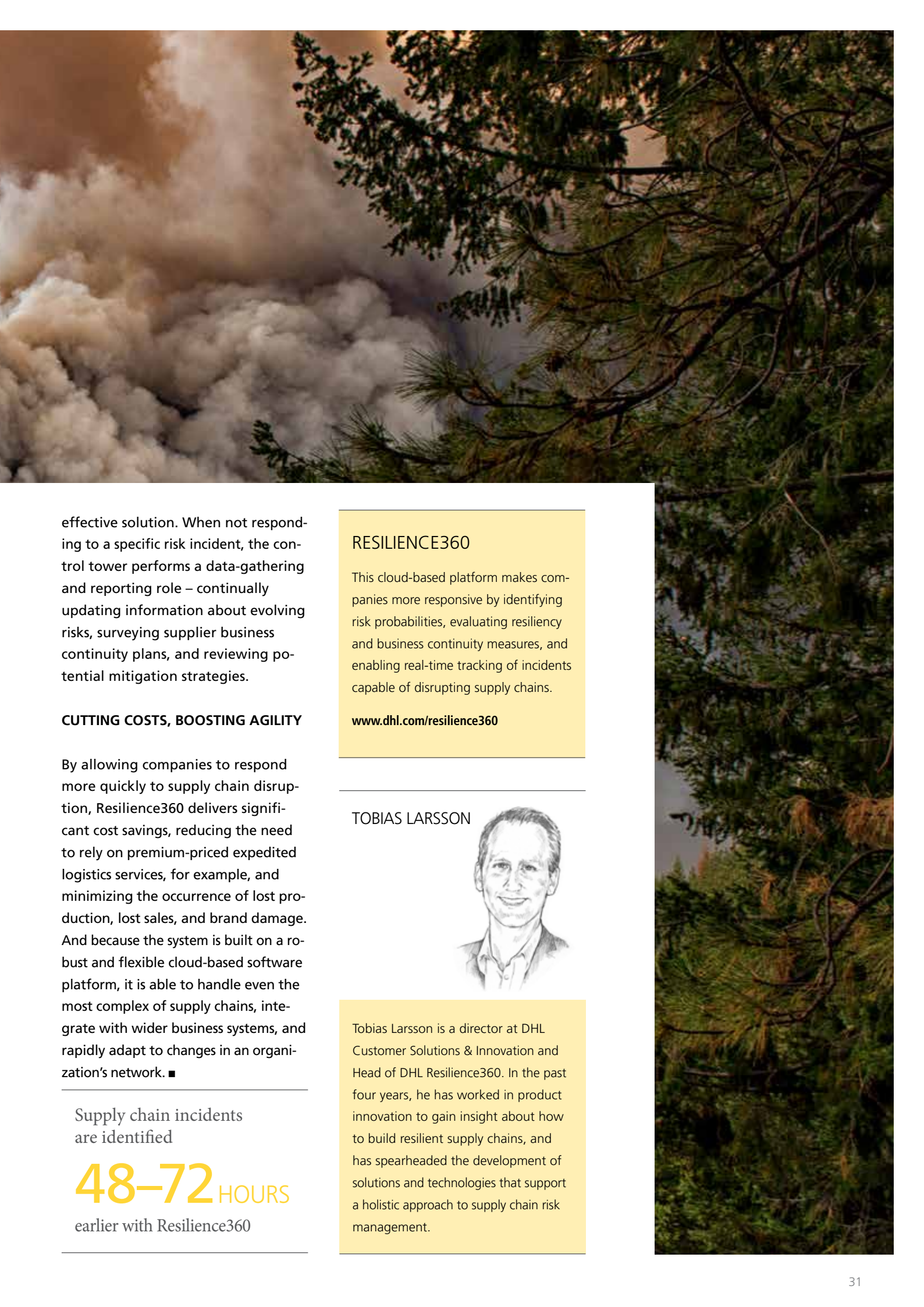
Early warning makes it possible for companies to seek feedback from supply chain partners, and quickly take mitigating actions, like sourcing components from backup suppliers. The tool logs feedback from individual sites too, keeping an up-to-date picture of the current state of the entire network, and helping managers coordinate cross-network responses to major incidents.

## RISK RESPONSE

The final element of the Resilience360 service is a dedicated logistics and risk control tower that evaluates the potential impact of supply chain disruptions by interacting with the supply chain partners of the customer. Further, it identifies mitigation strategies, such as alternative transportation modes or different routes, and manages their execution in collaboration with stakeholders.

With Risk Response, companies get a complete picture of available options in the event of disruption, ensuring they pick the most robust and cost-





effective solution. When not responding to a specific risk incident, the control tower performs a data-gathering and reporting role – continually updating information about evolving risks, surveying supplier business continuity plans, and reviewing potential mitigation strategies.

**CUTTING COSTS, BOOSTING AGILITY**

By allowing companies to respond more quickly to supply chain disruption, Resilience360 delivers significant cost savings, reducing the need to rely on premium-priced expedited logistics services, for example, and minimizing the occurrence of lost production, lost sales, and brand damage. And because the system is built on a robust and flexible cloud-based software platform, it is able to handle even the most complex of supply chains, integrate with wider business systems, and rapidly adapt to changes in an organization's network. ■

Supply chain incidents  
are identified

**48–72** HOURS  
earlier with Resilience360

**RESILIENCE360**

This cloud-based platform makes companies more responsive by identifying risk probabilities, evaluating resiliency and business continuity measures, and enabling real-time tracking of incidents capable of disrupting supply chains.

[www.dhl.com/resilience360](http://www.dhl.com/resilience360)

**TOBIAS LARSSON**



Tobias Larsson is a director at DHL Customer Solutions & Innovation and Head of DHL Resilience360. In the past four years, he has worked in product innovation to gain insight about how to build resilient supply chains, and has spearheaded the development of solutions and technologies that support a holistic approach to supply chain risk management.



# THE SUPPLY CHAIN RISK EXPOSURE INDEX

One of the key features of DHL's Resilience360 product is an advanced metric that helps companies understand, measure, and compare risk across their networks. Jan Speich explains how it works.

A key challenge in any supply chain risk management effort is the requirement to consider and compare diverse sources of risk. An organization must monitor risks across multiple categories, from exceptional weather to political unrest.

To ensure mitigation efforts are allocated most efficiently, it also needs to decide which of those risks pose the greatest threat to its network. To help companies achieve this goal, DHL has developed a unique measurement methodology, which underpins our Resilience360 system.

The DHL Supply Chain Risk Exposure Index aggregates data on more than 20 different supply chain risks. We obtain that data from own logistics networks and from numerous external data providers, including insurance companies, government agencies, and social media monitoring.

The use of automated feeds allows us to continually update risk data on fast-changing risk categories such as

terrorism threat or labor relations issues, while other categories, like earthquake or hurricane risk, are built on extensive historical datasets. Detailed geocoding means that the risks facing the customer's network are defined down to the street address of each individual node.

## COMPARING RISK IMPACTS

To compare the significance of different risk categories, we first normalize data on the likelihood of supply chain disruption from each risk. We then combine the probability of occurrence with a weighting measure of the likely financial impact of each risk, which is taken from historical data on insurance liabilities, combined with input from industry experts.

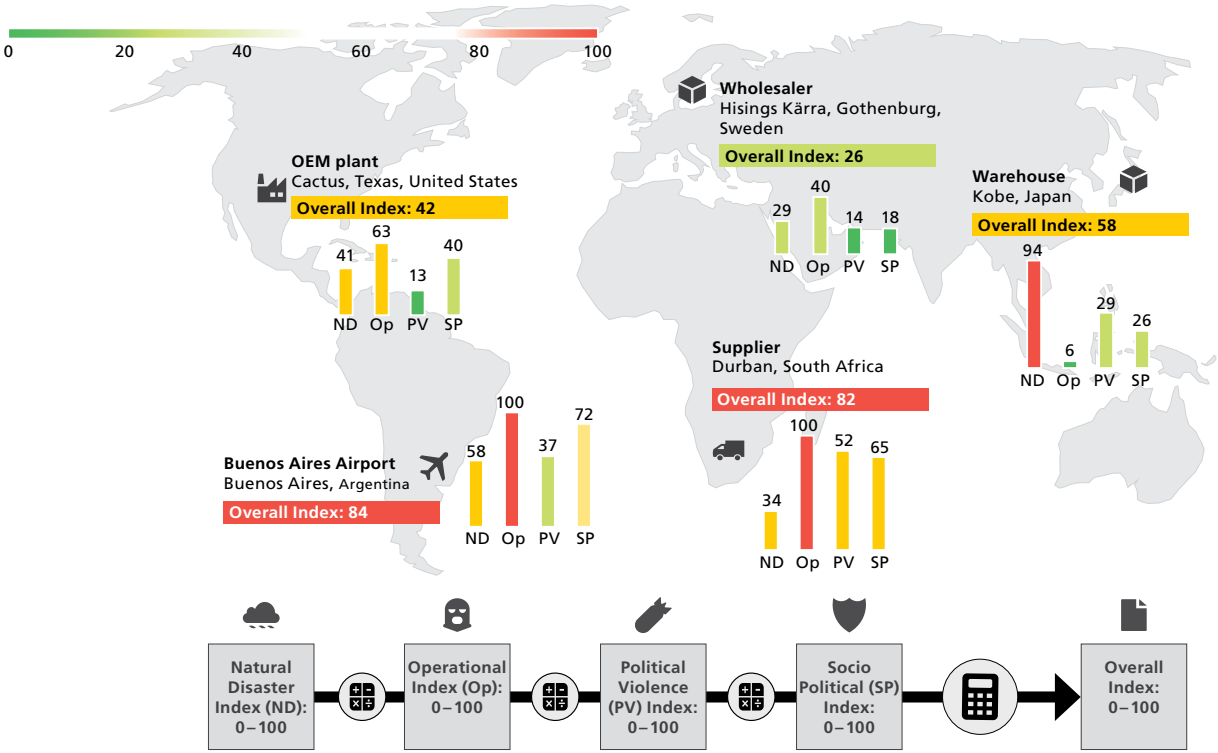
This provides us with a like-for-like comparison of the likely commercial impact of each type of risk at any customer node. These weighting factors can be tuned according to the specific characteristics and concerns of particular customer supply chains.

We have developed a specific methodology to aggregate exposure to different risks. Compared to a simple arithmetic mean, our approach has the advantage that risk spikes in individual categories are clearly revealed in the aggregate scores. This allows users to quickly identify particular risk hot spots in their networks.

To build a comprehensive picture of supply chain risk, multiple layers of aggregation are used to produce Risk Exposure Indices for four main categories of risk – natural disaster, operational risks, political violence, and sociopolitical risks – as well as overall exposure at individual supply chain nodes and the risk exposure characteristics of entire customer supply chains.

## RISK LEVELS AT A GLANCE

In use, the Supply Chain Risk Exposure Index gives customers a simple, yet rich initial view of overall supply chain risk. Aggregate measures give them an at-a-glance picture of



This infographic shows a snapshot of the Risk Exposure Index for five example locations.

overall risk levels in their networks, and allow them to quickly drill down to identify key areas of risk by geography and risk type. This can be achieved without relying on auditing and surveys, which can leave room for subjectivity or a lack of transparency on the part of a supply chain partner.

EVOLVING STRATEGIES

As companies evolve their supply chain risk management strategies, the model can be further tuned to account for mitigation efforts at particular nodes.

The approach can also be used to simulate alternative network configurations, allowing companies to consider the risk impact of proposed future developments. For example, in the total cost analysis of a supplier or a hub location, the customer can weigh the cost saving of a particular location in a low-cost manufacturing country against a possible increase on the Risk Exposure Index. ■

JAN SPEICH



Jan Speich is Senior Manager of Resilience360 at DHL Customer Solutions & Innovation. He has worked on numerous supply chain risk assessment, monitoring, and management projects on behalf of major companies in sectors including automotive, chemicals, and fast-moving consumer goods.

THE C-PRICE

Leading companies, mainly in the automotive industry, are considering what is known as the “C-price” when sourcing components from a supplier. The “A-price” represents the cost of the component, and the “B-price” means the logistics cost for bringing that component to the factory. The C-price represents the probable cost of failure or disruption. This failure or disruption is associated with costs such as production outage, premium logistics cost, charters, abnormally high buffer stock, higher monitoring and management costs or, in the worst case, reputational loss. Companies can establish a range of the likely minimum to maximum of these C-price costs across the supply base by looking at historical data. The Resilience360 Risk Exposure Index can help them to dimension the C-price for individual suppliers, and act as a “tie-breaker” when the A and B-prices are similar.



# ENSURING CONTINUITY

With exposure to risk on the increase, business continuity planning means better tools and a holistic approach, says Joe Robinson of Abbott Laboratories.



Ensuring business continuity has always been a strategic priority for health care company Abbott, but it was the devastating New York terrorist attacks of September 11, 2001 that really pushed risk management up the corporate agenda. For the past three years, this activity has been the responsibility of Joe Robinson, Director of Global Crisis and Business Continuity Management. Here he talks about the company's approach.

**Mr. Robinson, what are the major risks that affect Abbott's global supply chains?**

Natural disasters account for the majority of major impact events in our crisis planning, followed by political instability and social unrest. After that there are any number of risks that could disrupt our ability to deliver to our customers. In practice, we need to respond to a potentially disruptive event almost every week.

**How is the nature of those risks evolving over time?**

With the exception of cyber-security issues, which are becoming more severe all the time, the changing nature of risks is less important than changes in our exposure to those risks and their potential impact. In recent years, our business has become much more focused on emerging markets. In these regions there is less

infrastructure in place, which means more vulnerability to potentially disruptive events, and more steps required to manage those risks.

**Talk us through Abbott's risk management strategy.**

We take a two-pronged approach to risk management. For major crisis events we have a "One Abbott" approach that is applied across all global businesses and markets. That starts with a risk analysis of every region in which we operate. We take our footprint in the region – the number of employees, our revenue, and the location of critical facilities such as manufacturing and distribution operations or data centers – and we combine that with an analysis of the risk of major disruptive events to give us an overall risk score. If that risk score passes a certain threshold, we create a crisis action team in the region. That team is responsible for drawing up an appropriate action plan, which includes prioritizing critical customers, distributors, and products as well as planning for various scenarios. We provide training for local managers in crisis handling, and we conduct an annual exercise to test their response capabilities.

The second prong is a business continuity management strategy, which is the responsibility of each of our divisions.

They create a continuity plan based on the overall strategy of their business. For example, at one division that plan is built around continuity of supply of one critical product, so it focuses on the suppliers, manufacturing facilities, and distribution infrastructure for that product. Others might have plans built around a critical facility or a key commercial relationship.

**Have you ever had to put a crisis management plan into action?**

Yes. As just one example, we recently completed a program to consolidate product for the Australian market into a single distribution facility – as it happens, run by DHL. We knew that facility was critical for the Australian market, so we had already run an exercise simulating the effects of a fire at the site.

Then the region was hit by some really severe weather, and an unprecedented buildup of hail caused part of the roof of the facility to collapse. Because the building was not immediately accessible, it was hard to carry out a quick assessment of the damage to our inventory. The local crisis team activated, and they worked with our corporate response teams to rapidly find alternative sources for key products.

In the end, DHL was quickly able to get the facility back up and running,



## ABBOTT

Founded in 1888 by Chicago physician Dr. Wallace C. Abbott, Abbott Laboratories has grown into a global health care organization with sales of more than \$20 billion and 73,000 employees in 150 countries.

The company develops, manufactures, and sells adult and pediatric nutrition products, branded generic pharmaceuticals, medical devices, and laboratory diagnostic systems. Today, around 70% of Abbott's sales come from outside its native United States, and half are in emerging markets.

[www.abbott.com](http://www.abbott.com)

and as they kept the temperature-controlled storage operating despite the structural damage, our product impacts were a lot lower than we first feared.

### **How is Abbott's crisis management response evolving over time?**

When we first started making crisis management plans, they were largely focused on our manufacturing facilities, but over time we have come to recognize that our supplier chain and distribution infrastructure are equally important. Our planning is now much more holistic, and it takes its direction from the leadership of each business.

We've also invested in better tools. Crisis plans used to be big, unwieldy paper documents that were hard to use and difficult to update. Now we have a dedicated software system that manages everything from keeping plans up to date to ensuring formal handoffs between different individuals and response teams.

### **You are also using the Resilience360 tool. Why did you make that part of your risk management approach?**

We use Resilience360 to get a better understanding of the risks affecting our entire supply chain. Before, if there was a major disruptive event in

a particular region, we had to check with our purchasing people to see if there were any suppliers affected. Now we can maintain a supplier database in the system, and it automatically informs us of any event that might affect them.

The system is also being used by the people responsible for supply chain risk management within the purchasing functions of some of our businesses. They can use it to get a quick understanding of the historical risks in areas where potential suppliers are located. They can use that knowledge to inform decisions about whether to single-source or secure a backup supplier from another region.

### **Finally, do you think the importance of risk management is appreciated by the wider organization?**

It's possible to think about business continuity merely as a compliance function, but that is a horrible way to look at it. To run an effective risk management program, you really need to understand the needs of the business, and you have to be able to define the value that risk management brings to it. In essence, ensuring that the business can continue to run is what its leadership should be doing every day. Business continuity planning is about putting a context and a process around that effort. ■

## JOE ROBINSON



Joe Robinson is Director, Global Crisis and Business Continuity Management for Abbott Laboratories. He is responsible for leading the development of business continuity plans for Abbott's operations, including the company's global supply chain, and ensuring effective crisis management when a disruption occurs. Joe is an active member of the Supply Chain Risk Leadership Council and a Certified Business Continuity Professional.



# THE LEADING EDGE

The Lead Logistics Partner (LLP) approach is helping companies with complex supply chains to manage risks and reduce supply chain costs. An interview with Paul Dyer.

The supply chain has always been an outsourced activity. Few manufacturing companies have the need, skills, or inclination to operate their own dedicated fleets of trains, ships, or even trucks. They find it cheaper and more efficient to rely on capacity rented from specialist providers to get parts to their factories and finished product to their customers. In recent years, however, some companies have taken a further step. Rather than just outsourcing the operational aspects of their supply chains, such as transportation or warehousing, they collaborate with carefully chosen third parties on the strategic elements, too – from network design to inventory allocation decisions.

## BENEFITS OF THE LLP APPROACH

Known as the Lead Logistics Partner (LLP) approach, the concept emerged in the European automotive industry as a response to the challenge of managing complex automotive supply chains with hundreds of suppliers in dozens of countries. According to Paul Dyer, President, Global Automotive and LLP at DHL Supply Chain, companies in a number of other sectors, from aerospace, construction equipment, and oil and gas to consumer goods, now also recognize the benefits of the approach.

“Wherever companies find they are no longer achieving sufficient

performance improvements from their traditional sourcing-based approach to logistics, and where they want to improve visibility, control, agility, and compliance in their supply chains, the LLP approach can offer significant advantages,” he says. “We also see a lot of interest as companies move from a regional to a global approach to their logistics operations, and as they tackle the rising complexity that comes with entry into emerging markets.”

By their nature, LLP arrangements are highly customized to suit the needs of individual businesses, but Dyer explains that the approach typically incorporates four key elements: design, management, operations, and continuous improvement (see box, above right). “Critically, the lead logistics partner has to support these elements with the right talent and appropriate IT infrastructure,” he adds. At DHL, for example, supply chain control towers are staffed by personnel with deep industry experience, and run using Supply Chain Integrator, a modular suite of proprietary IT tools developed specifically to handle complex supply chains.

## LLP AND RISK MANAGEMENT

The complete visibility, tight control, and continual re-evaluation of the supply chain inherent in the LLP approach provide significant risk management advantages. “The Resilience360 tool is fully integrated



into our LLP operations,” says Dyer. “It provides key support for us in the design, management, and continuous improvement of our services, by helping us to understand and identify risks in near real time, and to make and implement appropriate contingency plans for our customers.”

## CONTINGENCY PLANNING

For important product flows, the dedicated control towers used to manage customers’ supply chains may have “two, three, or four” contingency plans in place, says Dyer, in preparation for a number of possible disruptions. When problems occur, their close monitoring of the status of individual shipments and of the overall network allows these plans to be implemented rapidly to minimize their impact on customer production. Indeed, for Resilience360 customers, DHL’s supply chain control tower concept is extended to include dedicated Risk Control Towers, which are used to execute the Risk Response element of the platform (see page 30).

Operational agility is vital, but often it is strategic decisions, taken in close



## ELEMENTS OF LLP

**Design** – Continuous review and optimization of the supply network in response to changing conditions and evolving business needs.

**Manage** – Dedicated control towers oversee the entire supply chain, providing full visibility and control.

**Operate** – Coordination of best-of-breed logistics services from a range of providers. Transfer of best practices and enforcing of standardized processes.

**Continuously improve** – Absolute transparency on total logistics costs. Constant evaluation of network design and operations for cost reduction and performance improvement opportunities.

cooperation with the end customer, that make the decisive difference to supply chain resilience. “As our customers make their sourcing and manufacturing network decisions, we work alongside them to model freight costs, identify risks, and estimate their likely impact,” says Dyer. This highly collaborative approach is important, he says, since the network’s vulnerability depends on a host of factors including design, inventory levels, lead times, and logistics modes.

For example, the limit on inventory levels at automotive plants is frequently not the cost of the parts, but the available storage space at the plant, notes Dyer, “So if you are bringing parts from, say, Turkey to the United Kingdom, you might be able to reduce the impact of transportation disruptions by holding some buffer inventory at an intermediate location in France.”

### STRATEGIC COLLABORATION

Ultimately, Dyer says, it is the close, strategic collaboration between customer and service provider that

makes the LLP arrangement work so well. “While the LLP approach may involve us taking some formerly in-house supply chain activities into our own service centers, we also put our people into the customer’s facilities, where they work alongside customer supply chain, manufacturing, and procurement personnel.”

That arrangement, combined with contractual agreements that emphasize long-term value improvement for the customer’s business, helps drive supply chain performance to new levels, both in everyday operations and in exceptional circumstances. ■

# 20%

of Fortune 500 companies  
outsource with LLP partners

PAUL DYER



Paul Dyer is President, Global Automotive & LLP, DHL Supply Chain. He is responsible for DHL Supply Chain’s Automotive sector across the globe, in addition to being Managing Director for the Automotive business in the United Kingdom and Ireland, and the LLP product across Europe. Dyer is responsible for shaping the long-term growth and strategic global direction of the Automotive sector, which comprises 230 operations around the world with over 25,000 Automotive supply chain colleagues.

[www.dhl.com/llp](http://www.dhl.com/llp)



# SCHMITZ CARGOBULL EXPANDS SUPPLY CHAIN VISIBILITY

Trailer assembly: One of Cargobull's eight production facilities

Schmitz Cargobull AG is Europe's leading manufacturer of semi-trailers and trailers, with an annual turnover of \$1.7 billion. A family-run German company, it attributes success to its comprehensive brand strategy, consistent quality standards, and established reliability. Today it operates globally, and requires optimal network transparency to handle longer, more complex supply chains.

With DHL Resilience360, Schmitz Cargobull improved supply chain visibility, and is now better able to protect on-time delivery.

## CUSTOMER OBJECTIVES

Following rapid expansion, Schmitz Cargobull needed better supply chain visibility, right down to component level – a challenge in a sub-sector of extremely short lead times. The sector also features high demand volatility, and trailer customers can typically change their order right up to the

point of production. Some custom-built items must be produced within just 18 hours.

Schmitz Cargobull also wanted a detailed global view of daily events that might impact production. Its supplier base is in 19 countries, inputting to eight production facilities, and there are drop-off points for finished trailers in 25 countries. Supply chain visualization was essential for a comprehensive disruption management system.

## MONITORING PLATFORM

The DHL Resilience360 team provided Schmitz Cargobull with an interactive, multi-tiered global map of its end-to-end supply chain. Search and filter capabilities allow executives to monitor products, parts, and materials. A supply chain incident monitoring platform provides 24/7 near-real-time alerting on disruption anywhere in the world, and allows Schmitz Cargobull to disseminate relevant information quickly.

The platform enables Schmitz Cargobull to react to incidents before they become problems. Emergency shipments can now be planned, so business never falters and orders remain on time. DHL has also created more than ten new solution features to meet Schmitz Cargobull's specific needs, including a customized view that connects sites and products according to the customer's organizational structure.

## CUSTOMER BENEFITS

Schmitz Cargobull has achieved end-to-end supply chain visibility at production component level with a significantly lowered manpower investment. And proactive alerting has enhanced its capability to fulfill delivery promises. Resilience360 has also enabled improved efficiency by monitoring first-tier and protecting second-tier suppliers. Schmitz Cargobull also benefits from improved demand forecasting at supplier materials level, while visualization helps to reduce logistics costs. ■

# PROBABLE OUTCOMES

Evaluating the return on risk management investments calls for a probabilistic approach, says Prof. Michael Huth.

Michael Huth, Professor of Business Administration and Logistics at Hochschule Fulda University of Applied Sciences, specializes in the study of attitudes and approaches to risk management in logistics. We asked him how those attitudes are changing, and how companies can measure the benefits of increasingly sophisticated risk management strategies.

**Professor Huth, why is supply chain risk management such an important topic today?**

A few years ago, only a small percentage of companies managed their supply chain risks in a structured manner.

Today, that is becoming a more common approach. This is due to a number of trends in supply chain management, including ongoing globalization, increased personalization of products, shorter product life cycles and a higher demand for fast and flexible supply chains.

**How should companies think about the ROI of their risk management efforts?**

It is important to look at risks in the right way. Very often, managers think of a risk in “yes-no” pictures: a risk might occur, or it might not occur. However, a risk is actually a probability distribution of consequences. An event might have no consequences at all, it might have minor consequences, or it might have disaster-like outcomes.

If you follow that approach, then supply chain risk management changes the probability distribution of possible consequences. Risk management actions, such as establishing a second warehouse remote from your primary manufacturing location, have implications on the probability or the

consequences of a risky event – or both. If it changes the probability distribution of possible outcomes with suitable risk management measures, a company changes the amount of equity required to hedge possible risks, and that reduces the cost for this capital. Thus, supply chain risk management has – by its risk-reducing actions, and by their impact on the probability distribution – an immediate effect on the cost structure of a company.

**Is there evidence that supply chain risk management pays off?**

What can be stated from empirical studies is that companies with a mature risk management in place exhibit greater financial stability. Maturity in this context can be specified by a number of criteria – for example by the consistency and the sophistication of the methods in use as well as by the scope of the risk management. As research shows, companies with a mature risk management have a much higher return on equity performance in comparison to companies with a low-level risk management.

The same is true for another indicator. Again, research results demonstrate that return on assets is much higher at companies with a highly developed risk management in comparison to those companies where risk management is on a low level.

**How would you advise companies trying to balance operational efficiencies, like single sourcing, with improved risk management?**

To put it in a nutshell: Follow a total cost approach. This is what leading companies do. They do not only look at cost implied

by their business activities, and neither do they solely try to minimize risk-related cost. Instead, they calculate total cost – and thus integrate both aspects of the trade-offs you describe. This can lead to the conclusion to continue to follow single-sourcing, or it can lead to setting up secondary facilities. However, if you follow that approach, you eliminate – or at least reduce – the trade-offs between business and risk management objectives. ■

PROFESSOR  
MICHAEL HUTH



Michael Huth is Professor of Business Administration and Logistics at Hochschule Fulda University of Applied Sciences in Germany. He has conducted research into the interdependencies between risk management and supply chain management for the past 18 years. Today, he conducts regular empirical surveys to document the status of risk management in the logistics industry, and teaches supply chain risk management topics to students and companies.





# RISK AND RETURN

Investment in more resilient supply chains doesn't just reduce the impact of disruptive events. It also helps boost overall business performance.

Is it worth the cost? That's the first question facing any manager considering changes intended to tackle risks and increase resilience in the supply chain. It can be a tough one to answer. While the payback from efforts to boost sales or cut manufacturing costs is easy to measure, the value of supply chain risk management can be less clear. If the result of a successful risk reduction program is that nothing goes wrong, it can even be difficult to show that it was smarter management that made the difference.

The picture is changing, however. As companies count the cumulative cost of large and small supply chain disruptions, more and more of them are making the strategic decision to improve supply chain resilience. Those that do so often enjoy unexpected benefits, finding that the capabilities they build give them a host of other operational advantages, even if they are not tested by a major natural disaster or failure of supply chain infrastructure.

## BUSINESS AS USUAL NOT THE NORM

Supply chain disruption is both more common and more costly than many companies realize. Since 2009, the Business Continuity Institute has surveyed hundreds of organizations about the prevalence and impact of disruptive events in their supply chains. In 2015, 74% of those asked said they had experienced at least one disruptive event in the previous year. The report's authors note, however, that only one quarter of the companies surveyed had systems in place to collect and analyze incidents of supply chain disruption, suggesting that this figure may be an underestimate.

Where companies do suffer disruptions, they are costly. Participants in the BCI survey report a range of negative impacts, including loss of productivity, higher costs, and reductions in revenue. Of those surveyed, 14% estimate that the total cost of supply chain disruption was greater

than \$1.1 million in 2015, and 9% of them say they experience losses of \$1.1 million or more from a single disruptive event.

## LIKE RIPPLES ON A POND

For some companies, the use of expensive premium freight to overcome supply delays and glitches has become a painful cost of doing business, accounting for up to 1% of revenues. The experience of DHL Resilience360 customers suggests that, of the 20% of these delays caused by external influences, around 5% can be identified and avoided by means of modern risk management tools. For a \$11 billion company, that could mean savings of \$1.1 million a year.

Like ripples on a pond, the effect of supply chain disruptions can spread well beyond the original event. More than 60% of companies surveyed by consultancy PwC in 2013 said that supply chain disruption

had hit their overall performance indicators by 3% or more in the previous year. Some effects, from negative impact on brand perception to falling investor confidence, can be severe and long-lasting. If customers can't get the product they want, when they want it, they will quickly switch to a competitor's product. Often they don't switch back, which can cost customers, and their shareholders, dearly. One U.S. university study found that the announcement of a major supply chain disruption led to significant falls in both stock prices and dividend payments, reducing shareholder returns by 40% over the two years following the event.

#### ACCENTUATING THE POSITIVE

Companies that get supply chain risk management right can often gain advantage by jumping into gaps left by their less agile competitors. After the 2011 Japan earthquake and tsunami, for example, a shortage of silicon wafers hit the global semiconductor industry. Intel, which had a sophisticated risk management approach in place before the disaster, was able to contain disruption effectively and maintain production volumes. It reported a revenue increase of 22% in the months after the disaster, while competitors like TI saw sales drop by 10% or more.

Smarter supply chain risk management is a very effective insurance against the costly and long-lasting damage that disruptions can cause. But if they are built into an organization's everyday operations, good risk management practices can provide plenty of other benefits, too. Once companies understand and control the real risks in their supply chains, they can often reduce costly buffer stocks.

When one consumer goods company conducted a risk assessment of a key distribution lane using DHL's

Resilience360 tool, for example, it was able to reduce logistics lead time by 30%, and to cut buffer stocks by the same amount. Evidence from surveys suggests that, on average, resilient supply chains carry 14% less buffer stock than their more fragile counterparts.

Ensuring critical components are available from more than one source can increase flexibility in the event of "positive" challenges, since there is more spare capacity to meet unexpected peaks in demand. An ongoing relationship with more than one supplier can also benefit procurement efficiency, helping companies negotiate more favorable prices or allowing them to switch volumes between suppliers in different regions in response to currency locations or changes in those suppliers' underlying costs.

#### FLEXIBLE STRATEGIES HELP

Flexible manufacturing strategies, such as postponement or multi-product production facilities, similarly help companies to meet everyday demand volatility as well as supply issues. Some companies in the food and beverage sector now routinely adjust product formulations depending on the price and availability of different ingredients.

Greater transparency and clearer communication can also lead to upside opportunities as well as helping in the management of problems. A fuller picture of an organization's second and third-tier suppliers, for example, can reveal that the end customer has opportunities to obtain components or materials at an advantageous cost, thanks to its scale or existing commercial relationships. Or companies may find that their own specifications or ordering practices are driving up suppliers' costs, creating opportunities to improve end-to-end processes and share the savings. ■

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# 60%

of companies say supply chain disruption hit performance indicators by 3% or more

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# 40%

The average fall in total shareholder return following a major supply chain disruption

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#### RISK MANAGEMENT SELLS

As more companies recognize the strategic value of effective supply chain risk management, they are increasingly including supplier risk management capabilities in their procurement requirements. According to surveys by the Business Continuity Institute, one of the fastest-changing areas of practice over the past five years is an increase in the number of companies requiring their suppliers to demonstrate that they have a business continuity program in place. The number of companies requiring supplier business continuity management certification to a recognized standard has almost doubled, rising to 39.6% between 2009 and 2013. For many supply chain participants, therefore, strong, documented risk management practices are becoming as important a part of doing business as compliance with internationally recognized quality or environmental standards.

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## REPRESENTED BY

Prof. Dr. Christof Ehrhart  
EVP Corporate  
Communications & Responsibility

Anita Gupta  
SVP Global Media Relations

## PROJECT LEAD

Dr. Diane Rinas

## EDITOR-IN-CHIEF

Michelle Bach  
michelle.bach@dhl.com

## WRITER

Dr. Jonathan Ward

## DIRECTOR / HEAD OF RESILIENCE360

Tobias Larsson  
DHL Customer Solutions & Innovation  
tobias.larsson@dhl.com

## DESIGN

Honiggelb

## ILLUSTRATOR

Janina Kossmann  
Bernd Schifferdecker

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Axel Springer SE  
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Christopher Brott  
Sebastian Müller  
Lena Rimmel  
Dave Rimmer

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## INTRODUCTION: RISKS AND OPPORTUNITIES

[http://www.chinadaily.com.cn/m/tianjinport/2013-03/25/content\\_16342899.htm](http://www.chinadaily.com.cn/m/tianjinport/2013-03/25/content_16342899.htm)  
<http://www.wsj.com/articles/tianjin-explosions-to-affect-supply-chains-for-months-report-finds-1441742989>  
<http://www.wsj.com/articles/port-delays-starting-to-damage-businesses-1424136797>  
<http://www.theguardian.com/world/2014/dec/16/mcdonalds-japan-running-out-of-fries>  
<http://www.wsj.com/articles/SB100014240527023044327045773498832927625686>  
<http://www.plasticsnews.com/article/20141204/NEWS/141209937/companies-scramble-in-wake-of-ongoing-pei-resin-shortage>  
<http://www.japantimes.co.jp/news/2011/05/20/business/manufacturers-expect-lasting-quake-impact/#.Vfflj7TYCGI>  
<http://www.thebci.org/index.php/bci-supply-chain-resilience-2015>

## RISK TRENDS: IF SOMETHING CAN GO WRONG, IT PROBABLY WILL

<https://siteresources.worldbank.org/INTAFRICA/Resources/pirates-of-somalia-main-report-web.pdf>  
[http://www.tapaemea.com/fileadmin/public/downloads/TAPA\\_cargo\\_crime\\_annual\\_report\\_2014\\_press\\_release.pdf](http://www.tapaemea.com/fileadmin/public/downloads/TAPA_cargo_crime_annual_report_2014_press_release.pdf)  
[https://ics-cert.us-cert.gov/sites/default/files/Monitors/ICS-CERT\\_Monitor\\_Sep2014-Feb2015.pdf](https://ics-cert.us-cert.gov/sites/default/files/Monitors/ICS-CERT_Monitor_Sep2014-Feb2015.pdf)  
<http://www.wsj.com/articles/costliest-u-s-natural-disasters-1401488111>  
<http://www.latimes.com/business/la-fgw-japan-quake-world-bank-20110322-story.html>  
<http://www.ibtimes.co.uk/volkswagen-cars-wolfsburg-germany-auto-emen-hailstorm-498148>  
<http://www.thebci.org/index.php/bci-supply-chain-resilience-2015>  
<http://news.elementum.com/the-real-cost-of-the-west-coast-port-strike-pt.-1>  
<http://www.hella.com/hella-com/Company-17-09-2015-10914.html?rdeLocale=en>  
<http://www.bloomberg.com/news/articles/2015-06-22/airbus-sends-engineers-to-zodiac-to-help-supplier-quell-delays>  
<http://www.reuters.com/article/2015/07/30/us-usa-venezuela-currency-idUSKCN0Q42LK20150730>  
<http://bsi-supplychainsolutions.com/en-US/>  
<http://worldmaritimeneeds.com/archives/169287/port-hodeidah-bombed-in-saudi-led-airstrikes/>

## SEVEN SUPPLY CHAIN STRATEGIES

<http://www.bci-files.com/BCIBusinessCaseforBCMMarch2010FULLREPORT.pdf> P.4  
PwC and the MIT Forum for Supply Chain Innovation  
Making the right risk decisions to strengthen operations performance ([https://www.pwc.com/gx/en/operations consulting-services/pdf/pwc-and-the-mit-forum-for-supply-chain-innovation-making-the-right-risk-decisions-to-strengthen-operations-performance\\_st-13-0060.pdf](https://www.pwc.com/gx/en/operations consulting-services/pdf/pwc-and-the-mit-forum-for-supply-chain-innovation-making-the-right-risk-decisions-to-strengthen-operations-performance_st-13-0060.pdf))

## RISK AND RETURN

<http://www.thebci.org/index.php/bci-supply-chain-resilience-2015>  
[http://www.wilfridlaurieruniversity.ca/documents/17398/scm\\_glitches\\_and\\_shareholder\\_risk.pdf](http://www.wilfridlaurieruniversity.ca/documents/17398/scm_glitches_and_shareholder_risk.pdf)



*“The time to repair the roof is when the sun is shining.”*

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John F. Kennedy



