THE CHANGING FACE OF SUPPLY CHAIN RISK MANAGEMENT

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Previously, Geraint worked as a journalist and editor, spending more than a decade covering the global procurement community. He was the founding Editor of CPO Agenda, an international business review for procurement leaders launched in the spring of 2005. Before that, he spent five years as Editor-in-Chief of Supply Management, the UK’s biggest circulation procurement magazine.

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EXECUTIVE SUMMARY

Companies today face a wider range of threats to the smooth running of their supply chains than ever before. They include volatility in material pricing and customer demand, disruptions as a result of supply shortages, quality problems, terrorist incidents, factory fires, natural disasters and other physical events, as well as breaches of social and environmental regulations or expected standards of ethical conduct. Volkswagen’s recent crisis brought on by its cheating of emissions tests shows how quickly a company can be damaged financially in the world of social media and 24-7 news.

Risk management has therefore become a more important part of supply chain’s remit during the past decade. Emerging risks the profession will need to focus on in the next 10 years include:

• **Natural resources** – China’s slower growth has brought down the cost of key commodities like oil and steel, but this trend could go into reverse just as quickly as capacity is removed from the system.

• **Regulation and responsibility** – rule governing issues like conflict minerals are become more pervasive, subjecting firms to stringent traceability requirements into the sub-tiers of their supply chains.

• **Climate change** – cyclones, flooding and drought are among the weather-related risks that appear to be getting more frequent and intense as the planet’s temperature rises.

• **Cyber attacks** – media coverage focuses mainly on customer privacy, but the theft of companies’ intellectual property and physical damage to plants and networks are also real dangers.

• **Social and political unrest** – mass migration, protests about unequal wealth distribution and the prospect of rising unemployment as more jobs are automated are just a few of the many potential flashpoints.

Leading supply chain organisations have become more proactive and systematic in the way they identify, assess and mitigate such risks. Detailed supply chain mapping and the use of big-data analytics are two key components, bringing greater visibility and more objective decision making into play. Monitoring real-time data, including from unstructured sources such as social media, as part of an early warning system on both everyday operational glitches and infrequent catastrophes, is helping companies like IBM, Cisco and Raytheon to anticipate problems before they become news.

Predictive analytics, whether applied to sales forecasts, inventory models or supplier delivery performance, is increasing the demand for data scientists and mathematicians, some of whom work within a growing number of dedicated supply chain risk teams. Another developing trend is bringing data analytics, people, processes and technology into a full-time risk command centre or control tower. Pioneers like Flex, Dyson and Caterpillar are using these to monitor threats and disruptions of all kinds across their global supply networks.

While mostly the preserve of larger companies with deeper pockets today, such capabilities illustrate how the discipline of supply chain risk management is changing – and what it may look like for many more organisations in the future.
INTRODUCTION

Jeff McGyver leant back in his chair and took a long pull on his e-latte vaperstick. It had been a relatively quiet week for the team at VysTech’s RiskHub command centre and most of his dozen or so colleagues had already gone home for the night. There had been the usual daily catalogue of shipment delays, component shortfalls and inventory issues across the company’s global supply network, of course. But these had mostly been flagged and then dealt with automatically by the company’s AI-enabled megaframe.

Indeed, the most eventful moment in Jeff’s week had been when his Apple iCar 3 stopped suddenly to avoid a child’s CyberHound pet companion that had inexplicably hovered into the street. He cursed quietly to himself, remembering how the jolt had woken him from his in-commute power nap with 15 minutes of journey time still to run.

Just then, the holographic wall in front of him lit up. A gentle ping, a bit like the one that signalled an incoming videogram on his old Samsung Galaxy S20, alerted him to the fact that the computer had detected an imminent class-4 disruption at a tier-2 production facility. Jeff waved his hand and pulled up the details on a floating screen in front of him. Scanning quickly through the latest social intelligence, he learnt that the plant was about to be invaded by a group of robot-rights activists and that, as one of VysTech’s few remaining sole-sourced sub-suppliers, this incident demanded manual intervention. How marvellously old fashioned, he thought, as he summoned up a digital confab with the firm’s local managers and settled in for a busier than expected evening…

A SHIFTING LANDSCAPE

This story may be a work of fiction, but it represents the direction of travel in the evolving discipline of supply chain risk management. Companies today face a wider range of threats to the smooth running of their business operations than ever before. Extended global supply chains, a reliance on thousands of suppliers (many unknown and unseen), lean inventory and production systems, and increasing pressure to meet customer demands at speed are just some of the reasons why even a small problem somewhere in the network can have a magnifying ripple effect downstream.

In addition, new levels of transparency brought about by the explosion in social media and digital news means that it’s not only physical supply chain disruptions that can wreak havoc with companies’ financial performance. Reputational damage arising from environmental transgressions, labour rights abuses and other corporate responsibility issues can be equally, if not more, severe.

Supply chain professionals are on the front line of this shifting landscape. Whether the issues are physical or reputational, involve everyday operations or infrequent catastrophes, and require short-term action or long-term thinking, risk management has become a far more important part of supply chain’s responsibilities than it was 10 years ago. This report looks at how supply chain risk management is changing, and how advances in data analytics and technology promise to deliver unprecedented visibility and actionable intelligence in the future.
EMERGING RISKS FOR SUPPLY CHAIN STRATEGISTS

In SCM World’s recent Future of Supply Chain survey, we asked practitioners how concerned they are about a selection of different risks over the next three years. In each case, they could answer “major concern”, “minor concern” or “not a concern”. Commodity price volatility heads the list by some distance, with almost 6 out of 10 respondents very concerned about the medium-term cost outlook for key materials and just 5% unconcerned. Almost half are equally worried about safety and quality risks, and regulatory issues, while component supply shortages and shipping disruptions continue to be major concerns for a significant minority of companies (see Figure 1).

In terms of both the level of concern and order of importance, these five categories of risk are largely unchanged from the results of our previous annual research. This serves to underline the importance of supply chain’s fundamental role in securing supply, complying with safety, quality and legal standards, and moving products efficiently along the value chain. What’s different this year is the higher proportion of survey participants who have major concerns about geopolitical and data security risks: 30% in the case of the former, 39% for the latter.

Russia’s flexing of its muscles in Ukraine and, more recently, Syria and the growing influence of ISIS Islamic extremists in that country and elsewhere in the Middle East are examples of the former; while a rise in the number of cyber attacks on companies instigated by Chinese and other hackers has undoubtedly raised concerns about the latter. Conversely, the number of supply chain professionals very worried about natural disasters (17%) has fallen somewhat as memories of the events in Japan and Thailand in 2011 continue to fade.

TAKING THE LONG VIEW

Looking out further than a three-year horizon, to the next decade and beyond, what are the main developing trends and associated risks that supply chain strategists need to factor in to their sourcing, manufacturing and distribution network plans? In order to provide some answers to this question, it’s worth stepping back for a moment and considering the bigger picture.

Each year for the past 10 years, the World Economic Forum has published its annual Global Risks report. Based on a survey of almost 900 business leaders, academics and policy makers around the world, it evaluates the likelihood and potential impact of 28 economic, environmental, geopolitical, societal and

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<thead>
<tr>
<th>Biggest risk concerns</th>
<th>% of respondents expressing ‘major concern’ over next three years</th>
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<tbody>
<tr>
<td>Commodity price volatility</td>
<td>59</td>
</tr>
<tr>
<td>Safety/quality issues</td>
<td>46</td>
</tr>
<tr>
<td>Legal/regulatory issues</td>
<td>46</td>
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<tr>
<td>Supply shortage of materials/components</td>
<td>40</td>
</tr>
<tr>
<td>Data security/IT incidents</td>
<td>39</td>
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<tr>
<td>Shipping/logistics disruptions</td>
<td>38</td>
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<tr>
<td>Geopolitical incidents</td>
<td>30</td>
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<tr>
<td>Breach of IPR/counterfeit products</td>
<td>25</td>
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<tr>
<td>Supplier financial health</td>
<td>25</td>
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<tr>
<td>Production disruptions (e.g., strikes, fires)</td>
<td>21</td>
</tr>
<tr>
<td>Natural disasters</td>
<td>17</td>
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Source: SCM World Future of Supply Chain survey 2015 n=920
technological risks over the next decade. The results for 2015 show that the most critical include not only war and terrorism, but also water crises, failing to meet climate change targets, social instability and cyber attacks. Extreme weather, natural disasters and data theft are also ranked as highly likely to occur, albeit with below-average impact (see Figure 2).

While the scope of the WEF’s report is clearly much broader than supply chain risk, it notes that “the complexity and fragility of [global supply chain] interlinkages make them vulnerable to systemic risks, causing major disruptions. These comprise natural disasters, including those related to climate change; global or regional pandemics [eg, Ebola]; geopolitical instability, such as conflicts, disruptions of critical sea lines of communication and other trade routes; terrorism; large-scale failures in logistics; unstable energy prices and supply; and surges in protectionism leading to export/import restrictions.”

### The global risks landscape 2015

Natural resources. Although 2015 has seen big falls in the price of oil, metals and many soft commodities, the experience of wild cost swings over the past eight years or so, combined with uncertainty about how lower economic growth rates in China and other developing economies will play out, and the profit-squeeze impact on future production capacity, explains why supply chain professionals remain extremely concerned about the cost and availability of key raw materials.

Greg Fredericksen, Chief Procurement Officer of Oshkosh Corporation, a US-based manufacturer of heavy trucks and equipment, says that lower steel and aluminium prices are currently easing material pressures for his company, which buys plenty of both. But he questions how long this situation can last, with big producers like ArcelorMittal and Tata Steel shutting plants in Asia and Europe. Such uncertainty makes it difficult to plan ahead, he says. “You don’t know what’s going to happen.”

Earlier this year, SCM World surveyed more than 600 practitioners about the challenges they anticipated around natural resources in the next decade. The data shows that in the case of materials and minerals, cost is the biggest issue for all industry sectors (see Figure 3). The same is true for energy, which ranked first overall in terms of natural resource challenges for supply chain strategy. As with raw materials, this is despite lower oil and gas prices today as a result of weaker global demand and continued high levels of output from major producers like Saudi Arabia. But a slew of announcements from big energy companies about capital projects being mothballed – including Shell’s withdrawal from the Arctic – leave open the prospect of a reversal in the next few years.

Regulation and responsibility. The volume, scope and complexity of rules governing how businesses operate continue to multiply, whether they cover global trade, employee health and safety, corruption, the environment or any other number of issues. Failure to comply with these national and international laws can be hugely damaging, both financially and reputationally. The recent scandal surrounding Volkswagen’s use of software to cheat emissions tests shows how quickly a large, well-respected and long-established company can be brought to its knees if it fails to manage regulatory risk appropriately.

The higher level of concern about regulation of raw materials among hi-tech companies shown in Figure 3 can be attributed, at least in part, to stringent traceability requirements around “conflict minerals” (tin, tantalum, tungsten and gold) – so called because many of the mines from which they are extracted are linked to armed groups operating in the Democratic Republic of Congo. The Dodd-Frank Act in the US has forced companies

![Material and mineral concerns](image-url)

3 | Material and mineral concerns

% of respondents saying issues are ‘extremely challenging’, selected industries

- Cost
- Shortages
- Regulations

Source: SCM World Resource Economics survey 2015

n=240
like Intel and Apple to be transparent about where these materials are sourced from within their supply chains. And draft legislation is pending in Europe too.

Traceability has also become a big issue in the food industry. The case of palm oil highlights the fact that companies don’t necessarily have to break actual laws to fall foul of media and public opinion these days. They are expected to hold to high standards of behaviour in sustainability and ethical integrity regardless, and the ever-growing universe of bloggers, tweeters and other social-media-connected activists are quick to point the finger of blame when an opportunity arises. This, in turn, often spurs politicians and regulators to introduce new laws or tighten existing ones further.

**Climate change.** Global warming, and the changing weather patterns associated with it, is arguably one of the most serious long-term risks facing supply chains – and not just those in agriculture. Floods, droughts, storms, unexpectedly large snowfall and other adverse events have caused significant problems for multiple industries in recent years, leaving many supply chain practitioners with a perception that the intensity and frequency of weather-related disruptions is getting worse.

The senior director of logistics and trade at one hi-tech company says 2015 has seen “an onslaught of bad weather” that has affected its operations in Taiwan, China and Japan. The company has drawn up a special cyclone response plan in conjunction with its logistics partner to safeguard valuable inventory at its distribution centres, with measures that include boarding up windows and covering shelves in plastic. “I would never have imagined doing these things a few years ago,” he says.

One of the main culprits, the current El Niño weather pattern, is forecast to be one of the most severe in decades. Its effects, which are likely to last well into 2016, include not only cyclones, but also forest fires in Indonesia that have shrouded Singapore, Malaysia and other parts of south-east Asia in smoke and smog, reducing air quality levels; cargo load restrictions in the Panama Canal; and damage to coffee and cocoa plantations, according to Bloomberg.

Ahead of the United Nations Climate Change Conference in Paris this December, a group of 10 food company CEOs, including Paul Polman of Unilever, Kendall Powell of General Mills and Grant Reid of Mars, recently published an open letter to world leaders urging them to take meaningful action to counter rising temperatures. And they pledged to “re-energise our companies’ continued efforts to ensure that our supply chain becomes more sustainable”, through greater use of renewable energy, energy-efficient transport and the protection of water supplies.
Food & beverage firms, along with those in pharmaceuticals, chemicals, agriculture, mining and apparel, are the most concerned about future water shortages, according to SCM World’s resource economics survey (Figure 5). Unlike energy or raw materials, it is the availability of water when and where it is needed, whether as a product ingredient or a production input, rather than its cost, which is the main driver of supply chain risk.

Cyber security. Revelations of fresh cyber attacks have become almost a daily occurrence. Media coverage of these tends to be dominated by the theft of customers’ credit card details and other personal information, whether from banks like JPMorgan Chase, internet giants like Yahoo and PayPal or retailers like Target and Home Depot. But for supply chain organisations, there are two other sources of risk that are set to increase as cloud computing grows and billions of machines, sensors and other electronic devices are wirelessly connected via the “internet of things”.

The first is the theft of intellectual property in the form of engineering drawings, sales plans, bills of materials, manufacturing processes and other trade secrets. Obtaining this type of sensitive data months ahead of a new product launch is gold dust for Chinese and other counterfeiters. And it is supply chain people who are often responsible for the flow of such data to contract manufacturers and other suppliers.

PwC’s most recent global survey of information security found a 56% increase in IP theft compared with 2014, and a 22% rise in external business partners as the sources of compromise. PwC partner Quentin Orr argues that “theft of digital intellectual property will become a greater concern as more manufacturing companies adopt 3D printing. The reason? 3D printers employ files that provide explicit instructions on how to design a product or part, and when and how to use them.”

The second threat is from hackers interfering with physical assets, whether consumer products or industrial plants and infrastructure. In July, Wired magazine published an account of how two hackers were able to take control of a Jeep Cherokee as it was driven along an interstate near St Louis, remotely manipulating everything from its radio and windshield wipers to its brakes and accelerator pedal. Last year, a steel mill in Germany owned by ThyssenKrupp was hacked into, resulting in “massive” damage when a blast furnace could not be shut down properly, according to the country’s Federal Office for Information Security.

This was only the second confirmed case of a cyber attack causing actual physical damage (the first being the infamous Stuxnet virus used by the US and Israel to sabotage centrifuges at a uranium enrichment plant in Iran in 2007-08). However, a recent report by the
London-based think-tank Chatham House revealed that the global nuclear industry had been subjected to 50 attempted intrusions, and suggested it was harbouring a “culture of denial” about the threat posed by cyber hacking. Attacks on other parts of the energy network, as well as to transport infrastructure, also have the potential to seriously disrupt global supply chains in the next few years.

**Social and political unrest.** TV news bulletins in Europe have been dominated in recent months by images of tens of thousands of Syrian and Libyan refugees flooding into Turkey, Italy, Germany and other countries as a result of civil war in the region. As well as constituting a major humanitarian crisis, the mass movement of migrants has also disrupted the continent’s supply chains – for instance, by forcing the closure of the Channel Tunnel between France and the UK, resulting in miles-long tailbacks of stationary lorries.

A white paper on emerging risks published by the Supply Chain Risk Leadership Council in 2013 lists a range of other issues, which, while somewhat removed from the everyday business of ensuring operational efficiency, nevertheless ought to be monitored closely over the longer term. These include the struggle for democracy, symbolised by the Arab spring; violence between rival drug cartels in Mexico; gender imbalances in China and India; and protests in both developed and developing countries about the unequal distribution of wealth.

Rising unemployment, as a result of automation, including the loss of many white-collar jobs that were previously immune, could exacerbate this risk. So too could growth in the world’s population, which the UN forecasts will rise from 7.3 billion today to 9.7 billion in 2050 – an increase of one-third. By 2030, 60% of people are expected to live in urban areas, including more than 40 megacities each needing to meet the requirements of over 10 million people.

“Looking forward,” the SCRLC paper states, “a reasonable person should expect that [the] continuing rise of global social and economic inequity will create increasing frustration and uprisings by a disaffected underclass.” Supply chain practitioners, it continues, “must consider how these inequities might impact their supply chain operations, particularly if sourcing from or operating in countries with known social inequities and a history of public backlash that could erupt in an instant”.

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ANTICIPATING DISRUPTIONS BEFORE THEY HAPPEN

Major disruptive events during the past decade, such as Hurricane Katrina in 2005, the global financial crisis of 2008, the devastating earthquake and tsunami in Japan and flooding in Thailand in 2011, the horsemeat scandal in Europe in 2013 and last year’s labour dispute at US west coast ports, have forced supply chain organisations to take risk management more seriously. Crude attempts to transfer risk upstream into the supply base or to rely simply on firefighting if a crisis happens are no longer sufficient given the many sources of potential risk, the speed at which disruptions can unfold and the requirement to limit the financial and reputational impact on the business.

In a report published last year, we described how leading companies such as Cisco Systems, Ford and IBM have adopted a more systematic approach to supply chain risk management. This starts with a rigorous process to identify and assess the key sources of potential disruption across their extended networks, continues with efforts to quantify their likely impact, and extends into appropriate mitigation strategies and recovery plans that address specific areas of vulnerability. In other words, it’s a proactive approach that seeks, wherever possible, to anticipate problems and line up solutions before bad things happen.

PROACTIVE AND DATA DRIVEN

Most supply chain professionals understand the need for this. When SCM World asked a sample of more than 550 back in June about the skills and capabilities their functions needed to be successful, 87% said “proactive risk management” was either important or very important. However, there is a sizeable gap between this recognition and actual levels of capability today. Just 36% of the same group of respondents believe their supply chain organisations are well or very well equipped to manage risk proactively – a gap of 51 percentage points. Even among hi-tech companies, which are particularly susceptible to disruptions because they tend to be heavily outsourced and have shorter product lifecycles, the gap is 30 points.

A key enabler of systematic, proactive supply chain risk management – and one of the main ways in which the discipline is changing, as we will see in the next section – is the use of sophisticated data analytics. This is important, explains Brian Squire, Professor of Operations Management at Bath University, to improve the predictability of disruptions and to reduce response times. Humans tend to under- or overestimate the probability of risks causing disruption – especially those...
like natural disasters that are extremely difficult to predict, but attract huge media attention when they happen. Reducing the effect of these biases improves the accuracy of decision making, he argues.

Professor David Simchi-Levi, Co-Director, Leaders for Global Operations, at the Massachusetts Institute of Technology, who has developed a quantitative model for identifying a company’s riskiest suppliers, says the development of objective support systems “provides an opportunity for executives to start changing the way they think about supply chain decisions, not only using their intuition – that’s clearly important – but to combine intuition with analytics”7.

Again, as Figure 6 shows, there is a capability gap here too. Almost all practitioners – and especially those in retail and consumer packaged goods – believe that data-driven decision making is important (overall, it ranked as the third most critical capability after cross-functional and external collaboration). But only a slim majority say their supply chain functions are well equipped with either the data or the analytical skills at the moment.

### Capability gaps

<table>
<thead>
<tr>
<th>Advanced skills &amp; capabilities for supply chain</th>
<th>% of respondents</th>
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<tbody>
<tr>
<td>Proactive risk management</td>
<td>87</td>
</tr>
<tr>
<td>Data-driven decision making (ie. using analytics)</td>
<td>93</td>
</tr>
</tbody>
</table>

Source: SCM World Talent Survey 2015

Closing these gaps and building an organisation that is able to sense and respond to the kind of risks described above in a more proactive way requires, as with any other supply chain transformation initiative, investment in people, process and technology. The good news is that there is plenty of innovation taking place in the risk management domain today, and these developments are already helping some of the early adopters to steal a march on their competitors.
Getting transparency of the many suppliers, factories, distribution centres, transport links and other nodes that make up an extended supply chain is a necessary first step in building an effective risk management capability. While most companies have good visibility of their own operations and those of significant production suppliers today, things typically get more blurry as you look further upstream. Since it is in these sub-tiers that supply disruptions often start, it’s vital to develop a deeper picture of these dependencies, at least for the most critical purchased materials, components and finished products.

In the last five years, a growing number of companies – particularly those that have suffered financially from sub-tier failures, such as Boeing and Toyota – have started to map their supply chains in greater detail. This is neither a quick nor easy task and requires strong trust and communication with tier-1 partners, as the holders of data about their own suppliers, not just contractual obligations.

With at least a rough supply chain map in place, step two is about having access to good quality data. This includes not only transactional data in ERP systems and data warehouses – orders, deliveries, inventories and so on – but also semi-structured and unstructured “big data” that exists both inside and outside of the enterprise and which comprises around 80% of all new business information produced each day. These sources include e-mails, audio files, geo-location data, blog posts and Twitter feeds (see Figure 7).
Aerospace and defence company Raytheon developed a platform called Supplier Insight, which combines structured and unstructured data to provide what David Wilkins, Vice President of Contracts and Supply Chain, describes as “rapid, data-driven decision making”. As well as tracking suppliers’ financial stability and performance against a number of key metrics, “if there’s a wildfire, hurricane or earthquake that may affect our suppliers’ ability to provide what we need, we know about it immediately”, he explains.

EARLY WARNING SIGNALS

In his new book on supply chain resilience, Professor Yossi Sheffi, Director of the MIT Center for Transportation and Logistics, argues that the quicker companies are able to detect potential disruptions, and the longer the lead times between detection and negative impact, the greater their chances of mitigating the effects. This means it’s essential to have access to real-time rather than batch data on a wide range of events, including adverse weather, factory fires, labour disputes, terrorist threats or regulatory changes.

Monitoring news channels and websites is one way of picking up these early warning signals, although this can be a resource-intensive and daunting prospect, particularly when many original sources are in foreign languages. In addition, highly relevant but locally based events often go unreported by mainstream media. For these reasons, companies are increasingly opting to use specialist information services like NC4’s Risk Center to get up-to-the-minute alerts across their global supply networks.

SCM World’s recent Future of Supply Chain (FoSC) survey found that a third of firms claim to use real-time alerts for risk mitigation purposes (whether generated from internal sources or external providers). A fifth are currently in pilot mode, while a quarter plan to use them in the next three years (Figure 8). Hi-tech and logistics firms, and those with annual revenues over $25 billion, are the most likely to be using real-time alerts today, according to our data.

The real trick, however, is to bring all three of these elements – supply chain maps, multiple data sources (including social media) and real-time alerts – together to provide an automated and visual early warning system. For this capability, a small but growing number of supply chain organisations have turned to a new generation of software vendors that offer these features through a cloud-based, mobile-enabled platform. They include:

- Supply Risk Solutions (Cisco, GE, Rolls-Royce, Texas Instruments)
- Resilinc (HP, Western Digital, Delphi, Amgen)
- Riskmethods (Bosch, Siemens, Nexteer, Swisscom)
- Elementum (Dyson, Tesla Motors, Microsoft, Flex)
- Sourcemap (Mars, IKEA, Stonyfield Farm)
Other options come from logistics specialists like DHL with its Resilience360 risk assessment and incident monitoring services. The best of these solutions incorporate algorithms to ensure that only alerts that are specific to a company’s supply chain and which relate to likely disruptions are sent to its managers for follow-up attention. This helps to limit the “noise” and information overload associated with big data.

**INTELLIGENCE THROUGH ANALYTICS**

Big data analytics – extracting practical insights from multiple data sources with which to make more informed business decisions – is certainly catching on in supply chain. In our FoSC survey it was rated as the most significant technological development for the second year running. More than three-quarters of respondents identified it as “disruptive and important” for their supply chain strategies – up from 64% in 2014. Again, hi-tech companies are in the vanguard here, with 90% seeing the potential to obtain valuable intelligence, along with CPG manufacturers (85%) and retailers (82%).

Slightly more than a third of supply chain professionals take the same view of machine learning – algorithms that get better at analysing patterns of data the more they consume – although its practical applications are less clearly understood (Figure 9). In the context of risk management, the volume and complexity of big data that exists across a global supply chain means that it’s unrealistic to expect human analysts to uncover all of the most important insights quickly enough. So computers are going to play an increasingly important role over the next few years in automating this work.

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**9 | Disruptive technologies**

Significance with respect to supply chain strategy

<table>
<thead>
<tr>
<th>Disruptive and important</th>
<th>Interesting, but unclear usefulness</th>
<th>Irrelevant</th>
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<tbody>
<tr>
<td>Big data analytics</td>
<td>77</td>
<td>21</td>
</tr>
<tr>
<td>Machine learning</td>
<td>36</td>
<td>48</td>
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Source: SCM World Future of Supply Chain survey 2015

*% of respondents n=1,018*

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**10 | Demand-side analytics at Nestlé**

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Source: Olivier Gléron, Nestlé
IBM, for example, is currently running a proof-of-concept “Risk Rover” project using its Watson supercomputer to analyse typhoons and cyclones that impact its hundreds of production suppliers in Asia. Watson is looking at the history of these storms in the region in terms of their proximity to suppliers’ sites, how often they actually make landfall, and how well prepared suppliers are to recover from the aftermath, in order to try to predict future disruptions. IBM’s supply chain organisation sees similar intelligence to be gained on other climatic events, such as seismic activity, as well as on incidents of social and political unrest.

“Predictive analytics around multi-tier supply chain exposures is the holy grail,” says Nick Wildgoose, who leads Zurich’s supply chain risk insurance business and chairs the SCRLC. Although most companies today are what he describes as “quickly reactive” in responding to crises and disruptions, opportunities to use advanced analytical methods to get ahead of competitors – for instance, by understanding a single point of failure or switching production to alternate locations – are becoming more compelling.

CUSTOMER FOCUSED

To date, use of predictive analytics in supply chain has generally been targeted more at the demand side than the supply side. Big retailers like Amazon have employed these tools for some time to more accurately forecast demand for particular products and to ensure that inventory is positioned in the right geographical locations. Six out of 10 practitioners say they expect to invest in predictive analytics to address the volatility around customer orders during the next 18 months, according to our FoSC study. CPG firms are particularly active here. Nestlé, for example, analyses point-of-sale data from its retail customers to better predict the demand for seasonal products like ice cream and to plan stock levels for in-store promotions more effectively (Figure 10)11.

Customer-facing applications are also more prevalent when it comes to social media listening tools, which just under a quarter of supply chain professionals believe are “critical and worth investing in” to manage demand volatility (Figure 11). Companies like Dell and Coca-Cola have created dedicated units to monitor social media channels for customer complaints, negative publicity and quality issues. And after a record year for vehicle recalls in the US in 2014, which cost General Motors more than $4 billion, the company set up a team responsible for scouring social media to find reports of potential defects in its cars while they are confined to a handful of drivers. “We’re finding issues much, much earlier,” said GM’s President, Dan Ammann12.

Innovative automotive firms like BMW and BorgWarner are among those that have adopted predictive analytics and social media monitoring techniques to assess supply-side risks, as IBM has done. In both cases, mathematical models and algorithms are used to either predict the likely impact of natural disasters, supplier consolidation or other events on business operations (in BMW’s case13) or to mine data about past supplier delivery performance and current financial health to anticipate future parts shortages (in BorgWarner’s14).

ADDING VALUE THROUGH PEOPLE

The trend towards big data analytics means that supply chain organisations need people with specialist mathematical and data interrogation skills. In a presentation on key tech trends – including big data and machine learning – at SCM World’s Leaders Forum in California this past summer, Jim Miller, Vice President of Worldwide Operations at Google, noted that “data scientists are the rock stars right now”. Demand for their services, which include being able to identify the most important problems to solve using multiple sources of data, has sent salaries spiralling in places like Silicon Valley.
Miller concluded his presentation by urging supply chain leaders to “embrace your millennials” – a view also expressed independently by several executives interviewed for this report. Our talent survey findings support the notion that closing this skills gap will depend in part on the profession’s ability to recruit and develop a cadre of younger, analytically orientated and technology savvy employees. Asked about the skills that millennials bring to supply chain functions, the most popular choice by a wide margin was “use of technology/data literacy skills to deliver fast, effective results”. More than 8 out of 10 respondents (including those in the baby boomer and Generation X age groups) agreed with this statement.

BASF, the leading chemical company, has been busy hiring such talent for its central supply chain function and the company now has a significant number of mathematicians working on analytical models to optimise different kind of challenges across its integrated operations, explains Dr Andreas Backhaus, Senior Vice President, Global Supply Chain Strategy & Performance. Predictive analytics are used to improve things like the quality of forecasts and pricing decisions, as well as to anticipate when plants will need to be shut down for maintenance work. Backhaus expects similar methods to be applied to supply chain risk issues in some areas of BASF’s business in the coming years.

Less than a fifth of supply chain organisations have data scientists on the payroll today, although 42% are either running experimental projects or plan to add such roles in the next three years, our latest data reveals. Once again it is hi-tech companies that are leading the charge – twice as many (39%) say they already employ data scientists to tease out valuable insights that can drive better decisions. Intel uses them to work on complex problems, mostly around inventory modelling and customer fulfilment, explains Cari Shim, Director of Business Operations for its global supply management group. In the future, she expects these specialists will help more useful predictive analytics to improve the way Intel manages supply chain risk too.

DEDICATED TEAMS

As both the stakes and the opportunities grow, so too does the case for dedicated risk management resources. Intel has a 12-person “risk and controls team” that works across sourcing contracts, business continuity and other types of sourcing and procurement risk for the entire company. It also has supply chain risk champions in each of its business units, who are responsible for ensuring that category-specific business continuity plans are documented, published and reviewed on a regular basis, as well as communicating local supply issue management to the central team.

A minority of supply chain organisations currently have a dedicated risk management team – whether physical or virtual – although as with data scientists there is an expectation that the numbers here will grow substantially in the next few years (see Figure 13). Our data suggests that industrial firms are among those most actively assembling these capabilities.

One large industrial company, for example, set up a central logistics group at its European headquarters in 2011 that monitors and responds to shipping issues, such as those that resulted from the 8.3 magnitude earthquake off the coast of Chile in September. This is complemented by a virtual supply chain risk team made up of supply chain managers, financial controllers and sustainability experts across its different regions and business units, says its vice president of supply chain management for the Americas and a member of the team.

<table>
<thead>
<tr>
<th>Dedicated supply chain risk management team</th>
<th>38</th>
<th>17</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data scientists in the supply chain organisation</td>
<td>19</td>
<td>20</td>
<td>22</td>
<td>39</td>
</tr>
</tbody>
</table>

Source: SCM World Future of Supply Chain survey 2015

% of respondents
n=895
TOWARDS THE GLOBAL COMMAND CENTRE

The fictional case of VysTech’s RiskHub described at the beginning of this report may be a little far-fetched, but the idea of bringing supply chain risk analytics, people, processes and technology together in a global command centre makes a lot of sense and is already reality for a handful of pioneering companies.

MIT’s Yossi Sheffi writes that: “Airport control towers – with their all-weather ability to choreograph the intertwining movements of aircraft on the ground and in the air – provide a natural model for managing supply chains… Although a supply chain control tower primarily serves day-to-day operations, it sits on the front line for detecting disruptions, handling incidents and coordinating responses. In that capacity, the control tower is similar to a full-time emergency operations center…”

In our Future of Supply Chain survey, we asked participants whether they had such a centre for risk management purposes or planned to set one up in the next three years. Overall, 42% say they have one in place, with more than one-third piloting or planning one, and just over a fifth saying “no plans to use”. Figure 14 shows a breakdown of responses by industry sector. However, talking to some of the executives who say they have a control tower today, it quickly becomes apparent that interpretations of what this means in practice vary widely and that few yet have the sort of comprehensive, permanent facility that Sheffi describes.

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>In place today</th>
<th>Currently piloting</th>
<th>Plan to use in next 3 years</th>
<th>No plans to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi tech</td>
<td>62</td>
<td>51</td>
<td>47</td>
<td>45</td>
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<tr>
<td>Utilities &amp; Energy</td>
<td>24</td>
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<td>14</td>
<td>12</td>
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<td>Logistics &amp; Distribution</td>
<td>21</td>
<td>14</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Healthcare &amp; Pharma</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Industrial</td>
<td>28</td>
<td>19</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td>Automotive</td>
<td>26</td>
<td>13</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Food &amp; Beverage</td>
<td>27</td>
<td>7</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>Retail</td>
<td>26</td>
<td>13</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>Chemicals</td>
<td>26</td>
<td>7</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>CPG</td>
<td>30</td>
<td>13</td>
<td>17</td>
<td>21</td>
</tr>
</tbody>
</table>

Source: SCM World Future of Supply Chain survey 2015

% of respondents

n=747
FINGER ON THE PULSE

One company that does is the contract manufacturer Flex (formerly known as Flextronics International), which now positions itself more broadly as an innovation design partner. In July, it opened the doors of its Pulse Center in San Jose, California, which Tom Linton, Flex’s Chief Procurement and Supply Chain Officer, likens to “a massive supply chain toy room”. Configured in a semi-circular layout, the room can seat 40 people and houses 23 large touchscreen panels that display real-time data from the company’s global network of 100 sites and 14,000 suppliers.

In 10 years’ time, explains Linton, the vision is to have half a dozen such centres around the world linked together, drawing on machine intelligence and cognitive analytics to enable collaborative decision making – or, to put it another way, “proactively dealing with issues before they are news”.

As a recent case in point, he cites the Tianjin warehouse explosions in China in August. He says he was alerted to this news by his Apple Watch 30 minutes before it was reported on CNN, thanks to information picked by Elementum (a software company spun off by Flex last year). Within hours, his team knew which of its customers would be affected by damage to a nearby diode factory run by supplier Vishay, for example, allowing it to consider mitigating actions. “Visibility gives you the ability to navigate,” Linton says.

THE APPLIANCE OF (DATA) SCIENCE

Appliance manufacturer Dyson has a similar, albeit smaller, control room at its operations centre in Singapore. It seats a team of eight production, logistics and sourcing managers who monitor real-time data on shipments in and out of its contract manufacturers, performance across its global transport network, and risk issues like natural disasters, fires, port strikes and political incidents that might impact its 350 direct material suppliers.

Having a team located together, looking at the same screens and the same data “creates a conversation among like-minded people”, says Jim Rowan, Dyson’s Chief Operating Officer. This drives greater awareness of issues across the end-to-end supply chain and allows problems to be solved faster. He adds that a physical control room also helps senior executives to understand the importance of proactive risk management, since they can see it in action, and supports an otherwise difficult to justify case for investment in expensive software.

Construction equipment maker Caterpillar is another risk command centre innovator. Its self-built Assurance of Supply Center, which tracks potential disruptions across all of its supplier facilities globally, was heralded by Cat’s Chairman and CEO, Doug Oberhelman, as “one of the most comprehensive visibility tools in the world” at its 2015 annual shareholder meeting. “It simplifies our supply network, a network that involves thousands of suppliers shipping more than a million parts and components every year,” he explained. “Now, we can see those orders from production to delivery – by facility, business unit and cost.”
CONCLUSIONS & RECOMMENDATIONS

Despite all the activity and capability building that has taken place in the last few years, it is still early days for supply chain risk management in most companies. As much as they are drawn by the promise of deep visibility into their supply networks and advanced analytics that throw up previously hidden gems of information, supply chain professionals generally speak in terms of future prizes rather than today’s winnings. As Raytheon’s David Wilkins puts it: “We’re still at the beginning stages of big data-driven supply chain decision making. I think all of the things we can do today will be even better, faster and smoother tomorrow.”

Barriers include significant software costs, the difficulty of quantifying hard business case benefits, data security concerns, a shortage of skilled personnel, and not understanding how to use the data generated by risk alerts and warning systems. For all the innovation around supplier mapping and data analytics, the options for actually mitigating risk remain largely the same. They include better inventory tracking, multi-sourcing, establishing alternate production or distribution sites, and creating and testing business continuity plans.

Knowing when and how to apply these processes remains, for now at least, the job of human beings. And most are sceptical of the ability of computers and mathematical models to recommend actions, even in defined circumstances (so-called “prescriptive analytics”). Judgment and considered interpretation of the data is vital in decision making, argues Sharon Hall, Director of Equipment Planning & Procurement at Intel. “We mustn’t get to a point where people stop thinking.”

Recommendations for companies seeking to become more proactive in how they tackle supply chain risk include the following:

**Look beyond the top tier.** While it’s tempting to restrict risk management attention to a relatively small number of strategic suppliers, a systematic approach means looking at all significant direct suppliers and ensuring that they have the fundamentals in place around compliance and business continuity, says Patrick Brennan, CEO of Supply Risk Solutions. Many don’t.

**Collaborate with suppliers.** By definition, risk across an extended network cannot be managed by one supply chain organisation on its own. “Suppliers are a great asset for risk mitigation,” says Oshkosh CPO Greg Fredericksen. “And the best form of mitigation is communication. So it’s very important that risk data is shared with suppliers.”

**Enlist top management support.** Supply chain risk efforts need to be aligned with wider enterprise risk management initiatives. This can help to secure the investment required. As Yossi Sheffi remarked in a recent SCM World webinar: “To think about what might happen is difficult; to invest money in what might happen is even more difficult. So this is a board of directors issue.”

**Learn from the demand side.** In many companies today, data analytics are more commonly applied in customer-facing and demand planning scenarios than they are on the supply side. So it’s worth looking at the tools and methods deployed here, the insights that supply chain and other colleagues have gleaned, and how the data has been used.

**Partner with academia.** If the high cost of commercial software is prohibitive, it may be fruitful to look for opportunities with the academic community. In exchange for assistance in the development and testing phases, universities are often willing to reduce or waive the costs of beta software. BMW partnered with the University of Manchester on its supplier risk assessment system. And Professor Brian Squire at Bath University, also in the UK, is currently looking for additional firms to support the supply chain risk alert software he’s developing.

**Broaden your hiring criteria.** Embracing millennials who have grown up with social media and have a digital mindset is vital. But those with advanced mathematical, data modelling and programming skills may differ markedly from the “usual” personalities found in supply chain organisations. The CSCO at one major global company puts it this way: “We are just hiring nerds.”
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ABOUT SCM WORLD

SCM World is the supply chain talent development partner for the world’s leading companies, empowering professionals with the capability, commitment and confidence to drive greater positive impact on business performance and help solve three of the world’s fundamental challenges: health, hunger and environmental sustainability.

The SCM World community accelerates collective learning and performance by harnessing the knowledge of the most forward-thinking supply chain practitioners, shared through industry-leading research, best-practice exchanges, peer networking and events. Over 150 companies participate in and contribute to the SCM World community, including P&G, Unilever, Nestlé, Samsung, Lenovo, Cisco, Merck, Caterpillar, Nike, Raytheon, Chevron, Shell and BASF.

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