



## De-risking your supply chain

*Tap into frameworks, data analysis, and sales and operation planning to stop problems before they start*

By Reginaldo Montague

Over the past three decades, the discipline of supply chain management has moved from fragmented logistics and operating departments to highly coordinated functions that are core to successful business operations.

How supply chains fail to operate and how such outcomes should be averted are increasingly important to continued sustainability for virtually any type of organization. “Supply chain risk management (SCRM) also has taken on increased importance for firms, particularly as global sourcing has increased, companies have ‘leveraged out’ their supply chains, and product cycle times have become shorter,” Sime Curkovic, Thomas Scannell and Bret Wagner wrote in the *American Journal of Industrial and Business Management*.

According to APICS, a supply chain and operations management organization, supply chain risk is “the variety of possible events and their outcomes that could have a negative effect on the flow of goods, services, funds or information resulting in some level of quantitative or qualitative loss for the supply chain. It follows that supply chain risk management emphasizes minimizing the risk of adverse events and possible outcomes while capitalizing on the opportunities.

### Identify supply chain risks

Organizations can identify the risk to their supply chain through a variety of sources, including audit reports, consultants’ reports, sales and operations planning (S&OP) meetings, benchmarking exercises, customer complaints, supplier recommendations, competitor news and industry news.

In addition, the ISO 31000 standard offers a useful and instructive framework to manage supply chain risk. It is “a standard adopted by the International Standards Organizations that outlines principles and a set of guidelines to manage risk in any endeavor. The standard includes guidelines for understanding risk, developing a risk management policy, integrating risk management into organizational processes, and establishing internal and external risk communication processes,” according to APICS. Figure 1 outlines important aspects of the framework.

Internal and external audits are common in industry. They usually focus on finance and accounting controls and compliance, but these audits might reveal supply chain weaknesses. Although traditional teams often are composed of accounting specialists with limited supply chain skills, internal audit teams are well-positioned to uncover supply chain risks because they can be tasked to pursue particular problems.

An enhanced approach would be to augment the teams with supply chain skills. In fact, in “Using Audits to Improve Supply Chain” from *The Journal of Corporate Accounting & Finance*, supply chain specialists Reginald Tomas Lee and Marianne Novac wrote that “some of the most effective supply chain audits involve combining [internal audit] skills and processes with those who have deep knowledge of supply chain operations.”

In one case, a supply chain specialist teamed up with an internal audit team at a Fortune 500 manufacturing company to review the operations of a division that supplied the aerospace industry. One of the areas reviewed was the engineering change control. By pursuing a multidisciplinary approach, the results of the audit were superior to the results that would have been obtained without the supply chain skills on board.

The team produced a report that identified material weaknesses and included leading practices in engineering change control. In the turbine manufacturing industry, maintaining traceability of changes in the generation of products is particularly important. For example, one leading practice that was identified was applying a formal analysis of the impact. This formal analysis would address the cost and the benefit of the change, including the transition.

This particular organization faced a challenge in involving other stakeholders. A leading practice approach to managing engineering change control requires consulting a cross section of functions that the change affects. These functions usually have influence on the change. Without this, organizations risk an ineffective transition because there is a lack of consensus on the optimal timing, possible higher cost and possible excess inventory or obsolete inventory of the old parts.

Organizations that have adopted sales and operations planning can use the process to identify and manage the potential

FIGURE 1

### Risk management framework

A plan for monitoring and review can help organizations mitigate risk throughout their supply chains.

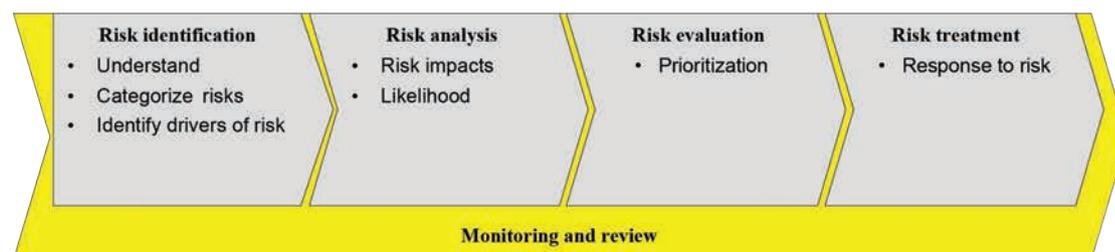
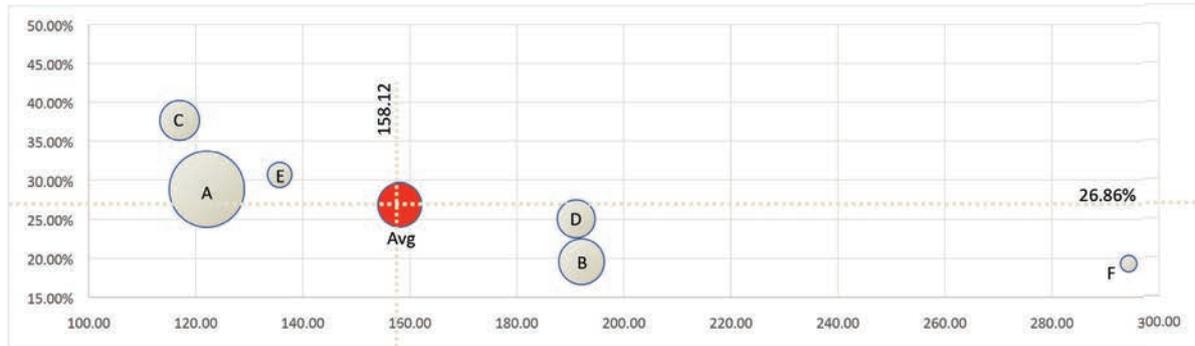


FIGURE 2

## Peering into the numbers

Examining cost of goods sold (COGS, the Y-axis) as a percent of revenue vs. days of inventory (the X-axis) can point to potential risks among suppliers. In this example, is company C spending too much on its supply chain operations? And is organization F holding too much inventory? Source: OneSource



liabilities. Sales and operations planning meetings are a forum to discuss what risks could impede the delivery of organizational objectives, offering an ideal space to discuss solutions. The sales and operations planning process also provides a way to keep senior executives informed, increasing the visibility of the risks.

Benchmarking offers companies the opportunity to compare aspects of their operations against other organizations. The results can provide insights into operations. Figure 2 employs public information about publicly traded companies in the cosmetics industry.

In the example, the vertical or Y-axis presents the cost of goods sold (COGS) as a percent of revenue. COGS indicates supply chain costs, and the figure generally includes direct costs (labor, materials) and indirect costs (overhead). It often includes supply chain management costs.

Using this financial metric, it is possible to compare the spending on supply chain and operations between companies. Because this information is part of published financial reports (annual reports, 10-Ks, 10-Qs and other reports), it is readily available.

Forms 10-K and 10-Q are annual and quarterly reports, respectively, required by the U.S. Securities and Exchange Commission (SEC). They give a comprehensive summary of a company's financial performance. Companies are required to disclose relevant information regarding their financial position, and they often include information about their suppliers, customers and other aspects of their supply chain.

Figure 2 shows that company C has the fewest days of inventory, while firm B has the lowest COGS as a percent of revenue. An organization conducting a comparison between itself and these companies could attempt to understand the reasons behind these variations and differences in business strategy.

In concert with other information, such as products and corporate strategy, it would be possible to determine if operating

outside the norm of the peer group should be considered a risk for these firms. Figure 2 illustrates two possible risks. Is company C spending too much on its supply chain operations? Is company F holding too much inventory?

Customer service departments can be valuable sources of data to inform risk. Customers might initiate contact to cancel an order because delivery was slow, or customers might lodge a quality complaint. Taken in aggregate, these reports can provide a rich set of data that, when analyzed, might point to risks in the organization.

Increased usage of social media also provides new datasets that can be examined for patterns that might indicate risks. Twitter or Facebook commentary might provide additional data, albeit the information is less structured than traditional data sets.

## Analyze supply chain risks

Supply chain risks can hit organizations from a number of outside arenas. For example, during a recent dispute between dockworkers and port operators on the West Coast of the U.S., shipments to retail establishments were severely delayed.

Home Depot, an American retailer of home improvement and construction products and services, experienced a 12- to 16-day delay on shipments. Macy's, another American retailer, experienced approximately a 12 percent delay of its first quarter merchandise. Macy's managed its risk by ensuring that it could return late merchandise to suppliers, according to *The New York Times*. Such delays have the potential to affect service levels and ultimately could lead to a loss of revenue.

During the 2013 holiday season, UPS experienced "unexpectedly high volume and huge delays" that "frustrated customers who wanted their packages delivered on time." The cause was attributed to an increase in shipping from retailers, an overall increase in online shopping, commitments by retailers that shipments would arrive by Christmas Day for orders

placed as late as Dec. 22, and bad weather. All of those factors contributed to “fourth-quarter earnings well below market expectations,” *The New York Times* reported.

Weather can be particularly challenging. A distribution business in Latin America recently experienced flooding as a result of the heavy rains that usually are associated with the rainy season. This organization’s main warehouse was not operational because it lost electricity, Internet and communications.

Likewise, a cosmetics manufacturer with a warehouse in the Northeast United States frequently encountered shipping delays during the winter months, which directly affected monthly financial results. When shipments intended for delivery by the end of the month are shipped in the earlier part of the following month, the consequences – besides angry and disappointed customers, of course – include an adverse impact on monthly financial results.

Adequately evaluating and preparing for risks can make the difference between profit and loss, survival and bankruptcy. When a maker of food service products received notice that a raw material no longer would be available, the company used its sales and operations planning process to identify and review the risk.

The company found a solution to the challenge. The solution was to identify alternate materials for future use, while allocating the limited supply of the raw material on hand for manufacturing products that had high sales. Supply chain managers also reviewed their purchased finished goods to ensure that the lack of raw material would not affect other products.

In March 2000, a Royal Philips Electronics manufacturing plant experienced a fire. The plant supplied mobile phone components for Nokia and Ericsson. Nokia switched orders to other manufacturers to mitigate this risk. In contrast, Ericsson’s application of a single source strategy meant that it had no other sources. Ericsson experienced \$400 million in lost sales, as explained by Sunil Chopra and Sodhi ManMohan in “Managing Risk to Avoid Supply Chain Breakdown” in MIT’s *Sloan Management Review*.

One study of 800 instances of supply chain disruptions found, not surprisingly, that such problems result in adverse financial results.

Corporations that suffer from supply chain disruptions experience a drop in stock returns that ranges from 33 percent to 40 percent. Share volatility, an indication of corporate risk, increased by 13.5 percent. Those companies also experienced a 107 percent drop in operating income, a reduction by 7 percent in sales growth and an 11 percent increase in cost, according to *Supply Chain Disruptions: Theory and Practice of Managing Risk*.

## Evaluate supply chain risk

Supply chain analysis and evaluation can be conducted using qualitative and quantitative methods.

## Targeting fraud, waste and abuse

As supply chains grow larger and more complex, the opportunities for fraud, waste and abuse increase.

According to *CGMA* magazine, warning signs include:

- Bidding/procurement processes that are not robust or independent
- Details in third-party invoices are unclear
- Poor or strained relationships with third parties
- Infrequent or nonexistent “right-to-audit” assessments of suppliers’ or licensees’ practices
- Little-to-no oversight into proper administration of agreements with third parties
- Use of third-party agreements that are sole-sourced without clear explanation or constructed as cost-plus agreements without clear definition of cost or other relevant terms

Companies can address these warning signs with four steps: Know your supplier to identify and prioritize risk; map the volume of products flowing around the world; identify, investigate and confirm anomalies; and track, manage and learn from the information.

These methods include checklist, hazop, what-if methods, variance analysis, risk matrix, risk mapping, Delphi technique, fault tree analysis, event tree analysis, the Jonsson analysis, simulation methods, decision tools, failure mode and effects analysis, sensitivity analysis and expected monetary value analyses (EMV).

EMV analysis calculates the average outcome when the future includes scenarios where there is uncertainty. In the following equation, V is the value and P is the probability of the event occurring.

$$\text{Expected monetary value (EMV)} = E(V) = \sum_{i=1}^N V_i P(V_i)$$

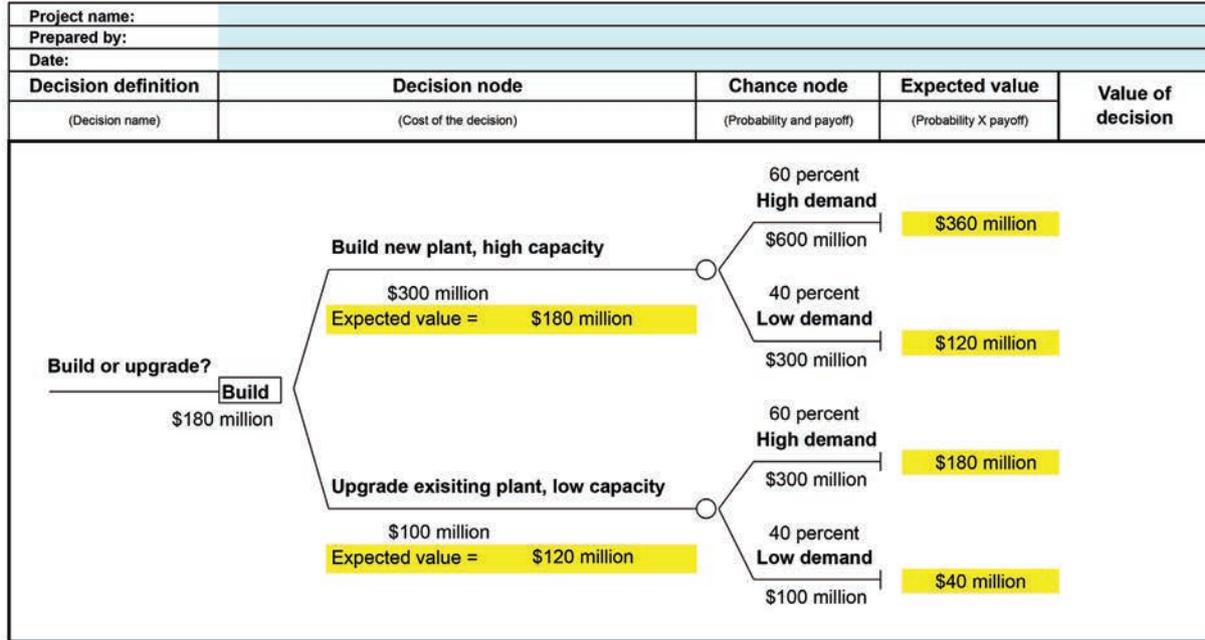
The following example from *A Guide to Project Management Body of Knowledge, Fifth Edition* illustrates how EMV can be employed to analyze risks. In this example, an organization anticipates increased demand of its products. However, it is uncertain about the extent of the demand and how much of that demand it can capture.

The organization can experience high demand or low demand, as illustrated in Figure 3. Should the company build a facility for \$300 million, it can capitalize on the high demand, but it also faces a risk if demand is too low.

FIGURE 3

## Decision tree analysis

This is an example of an analysis using expected monetary value (EMV).



The lowest cost option is to expand production at the existing facility through debottlenecking projects that would cost \$100 million. If the plant is built, there is a 60 percent probability that there will be \$600 million in sales for the product and a 40 percent probability that weak demand will result in \$300 million in sales. Figure 3 shows the EMV assessment for the risk associated with building the new plant.

For this calculation, the variables are as follows:

- $V_1 = -\$300$  million
- $P(V_1) = 100$  percent = 1
- $V_2 = \$600$  million
- $P(V_2) = 60$  percent = 0.6
- $V_3 = \$300$  million
- $P(V_3) = 40$  percent = 0.4

The  $V_1$  term is presented as a negative number with 100 percent certainty since in this scenario the construction of the facility is known with certainty. It is an acknowledgement of the required investment, and leads to the following calculation:

$$E(V) = \sum_{i=1}^N V_i P(V_i) = -\$300m * 1.0 + \$600m * 0.6 + \$300m * 0.4$$

In other words,  $-\$300$  million +  $\$360$  million +  $\$120$  million =  $\$180$  million. Organizations often do not have the probabilities to be able to conduct this type of quantitative analysis. As a result, supply chain managers might develop their best guess probabilities to conduct this type of analysis or might rely on the history. This model would allow the analyst to con-

duct sensitivity analysis by varying the expected demand, the probability and cost to determine if the decision would change under different conditions.

### Risk treatment

To address the risk, organizations can pursue a number of options. Examples of supply chain risk management disruptions and options to manage their risk are shown in Figure 4. The list is not intended to be exhaustive, and many strategies can be used in combination.

Some mechanisms that facilitate the identification of risk also offer the opportunity to monitor and review risks. Periodic audits and subsequent review of audit reports allow supply chain managers to review the risk mitigation measures that were put in place previously. Over time, repeated benchmarking can provide insights on the level of improvement. Another mechanism is to ensure that the performance measurement system incorporates the metrics that are important indicators.

The sales and operations planning cycle or cadence provides the opportunity to review the effectiveness of risk mitigation measures. One advantage is that these meetings provide the forum for the right people in the organization to be engaged and immersed in the risk. This helps make risks that might be hidden visible to stakeholders.

Specific measures can be put in place. Supplier scorecards allow managers to monitor suppliers. Supplier data should be reviewed, but frequent facility visits should be considered for key suppliers. Companies like Dun & Bradstreet Inc. can

FIGURE 4

## Responding to woe

Supply chain managers have a number of ways to mitigate risk.

	Examples of supply chain disruptions	Potential risk management responses
<b>Internal (firm, supplier, customers, supply chain partners)</b>	<ul style="list-style-type: none"> <li>• Labor dispute, plant breakdowns</li> <li>• Supplier viability or bankruptcy</li> <li>• Supplier quality concerns</li> <li>• High capacity utilization</li> <li>• Information technology (IT) woes</li> <li>• Inaccurate forecast</li> <li>• Long lead-times, seasonality</li> <li>• Bullwhip effect</li> <li>• Product obsolescence</li> <li>• Product quality concerns</li> <li>• Inventory holding costs</li> <li>• Demand and supply uncertainty</li> <li>• Environmental, health and safety failures (chemical and oil spills, plant explosions, accidents, fires, etc.)</li> <li>• Legal or industry standard compliance</li> <li>• Complexity of product portfolio</li> <li>• Lack of raw material availability</li> <li>• Product recall</li> <li>• Excessively complicated supply chain</li> <li>• Over-reliance on a single supplier (single sourcing)</li> <li>• Limited buffer or safety stock inventory</li> <li>• Precarious financial position</li> <li>• Sudden changes in demand quantity or product specifications</li> </ul>	<ul style="list-style-type: none"> <li>• Improving the accuracy of demand forecasts</li> <li>• Improve inventory management strategies (buffer/safety stock, EOQ)</li> <li>• Integrate and synchronize planning and execution</li> <li>• Reduce the mean and variance of lead-time</li> <li>• Invest in technology</li> <li>• Collaborative planning, forecasting and replenishment (CPFR)</li> <li>• Require suppliers to meet certain requirements</li> <li>• Qualify suppliers</li> <li>• Conduct supplier audits</li> <li>• Use approved list of suppliers</li> <li>• Multiple sourcing</li> <li>• Postponement</li> <li>• Expand capacity</li> <li>• Increase responsiveness and flexibility</li> <li>• Aggregate or pool demand</li> <li>• Increase customers</li> <li>• Segment supply chain</li> <li>• Training</li> <li>• Implement compliance (legal, safety, policy)</li> <li>• Contracts and service level agreements</li> </ul>
<b>External geopolitical, natural</b>	<ul style="list-style-type: none"> <li>• Weather, natural disaster</li> <li>• Armed conflict, terrorism</li> <li>• Threat of or actual pandemics (SARS, Ebola) or food contamination</li> <li>• Trade embargo</li> <li>• Exchange rate risks, currency devaluation, bank failure</li> <li>• Commodity price fluctuations</li> <li>• Loss of control of intellectual property</li> <li>• Changes in regulations or court decisions</li> <li>• Expropriation, fraud</li> <li>• Unreliable infrastructure</li> </ul>	

provide commercial information and insight on businesses, including reports that indicate credit risks.

Accounts payable departments frequently will have information on customer payment history. Annual reports and 10-K reports may provide insights into the fragility of organizations. Comparing contract terms to contract performance can provide insights into any gaps.

### Use the better approaches

Our personal and professional lives are fraught with risk, and supply chain management is no exception.

A framework like ISO 31000 offers a helpful and instructive formal approach to risk management that can be applied to supply chain management. The framework, complemented by other tools such as sales and operations planning, can help organizations better identify, analyze, evaluate and treat risk. Organizations can use qualitative approaches to risk management, and where data is available they can use analytical approaches to produce complementary quantitative results that can deliver better analysis and improved risk management.

Ultimately, managers and their staff will need to act to manage risks. Sales and operations planning is well-positioned to monitor, review and manage risk on an ongoing basis while providing the needed visibility to senior executives. ❖

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