

# USING INFORMATION TECHNOLOGY TO MITIGATE SUPPLY NETWORK RISK

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M. Douglas Voss and Omar Keith Helferich

This case is based upon interviews with representatives of jadian enterprises (jadian), and Supply Chain Sustainability, as well as publicly and non-publicly available information provided by the firms. The authors would like to extend their appreciation to the employees of jadian and Supply Chain Sustainability for their cooperation in producing this work. Although both authors are partners in Supply Chain Sustainability, the purpose of this chapter is to provide insights to a process for identifying, assessing, and measuring supplier risk.

## INTRODUCTION

The importance of supply chain management came to light partially due to the successful implementation of its principles by firms such as Wal-mart, Dell, and Toyota. Wal-mart maintains its position as a low-cost leader in the retail segment through globalization of its supply base to acquire less expensive goods while effectively and efficiently managing logistics processes such as transportation and inventory management. Dell has recently fallen on hard times, but its use of the response-based business model and postponement allowed them to reduce finished goods inventory and allowed consumers to purchase products that better fit their needs. Toyota's success is due in part to its use of lean principles to reduce costs while simultaneously improving

quality. Other supply chain strategies, such as supply base rationalization, are ubiquitously applied by a variety of firms.

Each of these strategies has its benefits. However, as with many other supply chain principles, they also involve trade-offs. For example, the response-based business model seeks to allow demand to *pull* product through the supply chain, thereby overcoming the excess finished goods inventory and other problems posed by the forecast driven anticipatory business model. The response-based business model allows the firm to only produce what is demanded by its customers. This reduces dwell time (the amount of time supply chain assets sit idle, not contributing to value creation) and requires increased visibility of supply chain assets and closer supplier relationships.

The response-based business model also has its pitfalls. Similar to the application of lean principles, the response-based business model reduces supply chain inventory buffers, exacerbating the effects of supply disruptions. This increases the importance of monitoring suppliers and sharing information both internally and externally to ensure supply continuity and prevent disruptions before they occur.

Globalization increases the number of parties involved in a given supply chain. Each node in a supply chain has a given probability of failure (e.g., financial, quality, or security failure) at any given time. As the number of nodes in a given supply chain increase, these failure probabilities are compounded, and the probability of failure at some point in the supply chain rises. Further, as firms rationalize their supply base, they become more dependent on each remaining supplier.

Dependence may be the key theme in the preceding discussion. As firms implement supply chain strategies they become more dependent upon their suppliers and their risk of supply disruption increases. Firms must find a way to incrementally improve supply chain strategies without adding counter-productive inventory and mitigate disruption risk through the exchange of information both internally and externally.

One method of accomplishing this goal is through the implementation of supply chain assessment and monitoring technology. Appropriate technology should allow the purchasing firm to calculate the consequences posed by the failure of any given supplier then allocate monitoring resources to those suppliers with the greatest *a priori* probability of failure and the greatest potential to negatively affect performance. The confluence of consequence severity and probability of failure defines the risk posed by any given supplier.

Methods of monitoring suppliers may include self-assessment benchmarking of financial metrics or third-party audits of production and supply network facilities to ensure sustainable business practices and quality compliance, among others. Information gathered should feed back into risk algorithms to adjust suppliers' failure probability. Information should also be shared vertically within the purchasing firm and horizontally with suppliers to proactively prevent and mitigate failure and subsequent supply chain disruption. The use of such technology simultaneously increases coordination efficiency and effectiveness both internally and externally.

This chapter profiles two Michigan (USA) based firms—jadian and Supply Chain Sustainability—and illustrates how a web-based software tool called CommonView® can be used to mitigate supply network risk by monitoring suppliers and exchanging information both internally and externally. Information used in this case is based on interviews with jadian and Supply Chain Sustainability executives as well as publicly and non-publicly available information provided by the firms. Following an overview of jadian and Supply Chain Sustainability, CommonView is described and coupled with a detailed discussion of how supplier risk is incorporated into the tool with a real-world application of a supplier risk calculation. Next, a template for technology implementation is provided. The chapter concludes with benefits of implementation. Caveats are discussed throughout the chapter.

## **JADIAN AND SUPPLY CHAIN SUSTAINABILITY CORPORATE OVERVIEWS**

The jadian organization is a Lansing, MI, global software and services company that provides complete solutions for managing compliance, audits, inspections, work orders, licenses/certificates/permits, and enforcement activities. Its solutions are being used 24 hours a day, seven days a week and process over a million audits per year with certifications issued in over 49 countries in multiple languages. Jadian's customers include a wide variety of private industry companies and government agencies, including public health agencies, audit and inspection companies, road transportation authorities, national accreditation bodies, and federal agencies. Their software is used for inspection and audits of such high profile facilities as The Indianapolis 500 Speedway and the Burj Khalifa, which is the tallest building in the world at 2684 feet.

The concept for jadian was developed in the mid-1980s by Jerry Norris, an auditor and business process consultant who envisioned a way to streamline field audit and report writing tasks related to ISO certification. This vision has grown to incorporate all aspects of compliance management. Today, jadian is a privately-held corporation offering multiple software solutions to its rapidly growing customer base. It provides all of the services critical for a successful implementation, including consulting, software configuration and customization, data migration, systems integration, hosting services, and ongoing support.

Jadian partners with select firms that provide specific domain knowledge and assist in the sales and software implementation processes. For many supply chain and supply chain risk related projects, jadian partners with Supply Chain Sustainability. Supply Chain Sustainability is an Okemos, MI, limited liability corporation comprised of a core group of professionals with experience in supply chain management, benchmarking, security, disaster management, and environmental issues. Its focus is to utilize knowledge of the above domains to improve client performance through the implementation of risk-based management processes and information technology tools.

The remainder of this case draws upon information gleaned from these two firms to detail how technology can be used to monitor global supply chains. It is important to note that this chapter does not focus on the mitigation of any one risk. Tools such as CommonView are adaptable for the assessment and monitoring of multiple domains separately or simultaneously. This case is intended to illustrate how information technology can be used to mitigate a firm's supply related *risk of choice* through assessment, monitoring, and information exchange.

## **RISK MITIGATION: THE ROLE OF COMMONVIEW**

As previously mentioned, many supply chain relationships and strategies are based upon acknowledged dependence. Acknowledged dependence implies that the performance of one supply chain partner is heavily contingent upon the performance of another. For example, a purchasing firm is dependent upon its suppliers to reliably deliver quality inventory. A supplier's efforts to accomplish these goals may be hampered by intentional or unintentional product defects, financial hardships, or security issues. The effects of intentional/unintentional product defects has been widely publicized in the consumer goods industry with recent recalls of toys with excessive lead content, pet food containing unauthorized and harmful ingredients, and peanut butter tainted with salmonella.

Rightly or wrongly, the purchasing firm is often held liable for problems caused by supplier mistakes. Purchasing firms must take proactive steps to mitigate this risk through auditing and assessing suppliers, then sharing results both internally and externally. A number of issues complicate the matter. First, a large purchasing firm may have thousands of suppliers that sell diverse products, which leads to a diverse set of risk profiles. Given limitations on audit and assessment resources, it is impractical and foolish to devote the same resources to all suppliers. Therefore, it is necessary to determine the risk of failure for each supplier and allocate more resources to those suppliers at greater risk of failure. Second, given the voluminous amount of data generated from audits and assessments, there exists a need to standardize and prioritize the results, (e.g., nonconformances, product test failures) and make them available to relevant internal and external parties quickly and in an actionable format so that issues can be proactively addressed.

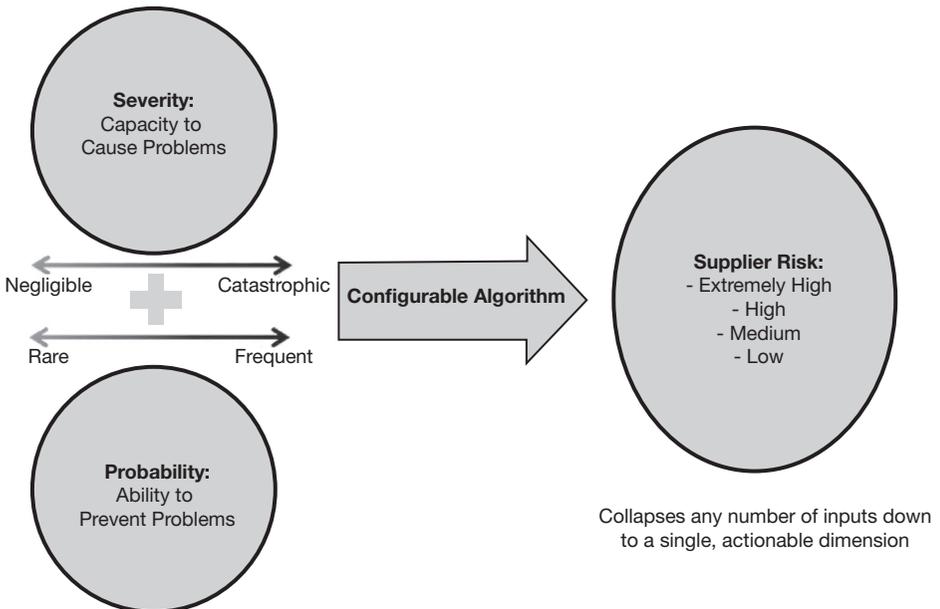
This is where information technology tools such as CommonView are useful. CommonView is a web-based software solution produced by jadian that consolidates compliance data from multiple systems into a manageable online format. It provides a centralized location for executives and managers to view multisite and supply chain performance in the areas of inspections, nonconformances and corrective actions, product samples and test results, second and third party certifications, security, and other domains of interest. The system automatically calculates supplier risk scores based on business rules. These risk scores are then used to drive risk mitigation activities and focus resources on higher risk sites and critical suppliers. Risk scores

can be used to determine inspection frequencies, sampling and test plans, and other requirements.

Defining risk is often one of the more challenging aspects of implementing tools such as CommonView, which this chapter will refer to as supply chain risk monitoring software (SCRMS). The first step to defining the risk of a certain outcome, such as a supplier security failure, is to determine the probability and the outcome severity of that event. For example, a security failure may take the form of a case of product stolen from a supplier's 53' trailer. This is a high probability event that likely occurs relatively frequently. However, the severity of the outcome related to this event is likely negligible. Conversely, a security failure may take the form of a disgruntled supplier employee contaminating food product with a substance that is dangerous or fatal to those who consume it. This is likely to be a relatively low probability event, but one that has a severe outcome, should it occur. Each supplier's probability of failure and failure outcome severity would be fed into an SCRMS solution to calculate the supplier's risk profile, as illustrated in Figure 15.1.

The *outcome severity* of a security problem related to a given supplier may be relatively static. While some suppliers supply multiple products, others only supply a single input and the outcome severity of that input does not change. However, the *probability* of a security problem related to a given supplier is likely to be more dynamic.

For example, take the case of a fast food establishment that purchases chicken breasts from a poultry processor based in the Southeast United States. A security issue related to the poultry processor's product could have severe effects (i.e., customer morbidity or



**Figure 15.1** SCRMS solution example.

mortality). However, the fact that this poultry processor has had few security issues in the past, led the fast food establishment to consider them a relatively low risk supplier.

Over the course of a month, the fast food establishment began receiving complaints from customers that their chicken breasts contained small, black pieces of plant-like material. The fast food establishment's employees can feed these customer complaints into a SCRMS solution. These systems automatically calculate supplier risk based on the fast food establishment's business rules. In this case, the supplier's risk profile was changed from a medium risk supplier to a high risk supplier due to the customer complaints. Figure 15.2 illustrates this change in relation to the risk profiles of the rest of the fast food establishment's suppliers. The size of the black circles in Figure 15.2 represent the number of suppliers that occupy a given risk category. As the number of suppliers in a given risk category increases, so does the size of the circle in that category.

This change in the supplier's risk category triggered emails, short message service (SMS) messages, and other alerts to relevant parties that a problem with the supplier may exist. The fast food establishment then quickly contacted the supplier and informed them of the nonconformance and that an audit of their production procedures would occur. This audit uncovered several potential security problems and determined that the root cause of the chicken breast contamination was an employee dumping smokeless tobacco into product as it travelled through the production process. While the presence of smokeless tobacco did not pose a severe health risk to consumers, it did indicate a security issue on the part of the supplier.

A strong SCRMS solution would also make risk mitigation activities transparent. The system tracks root cause and corrective action plans submitted by nonconforming

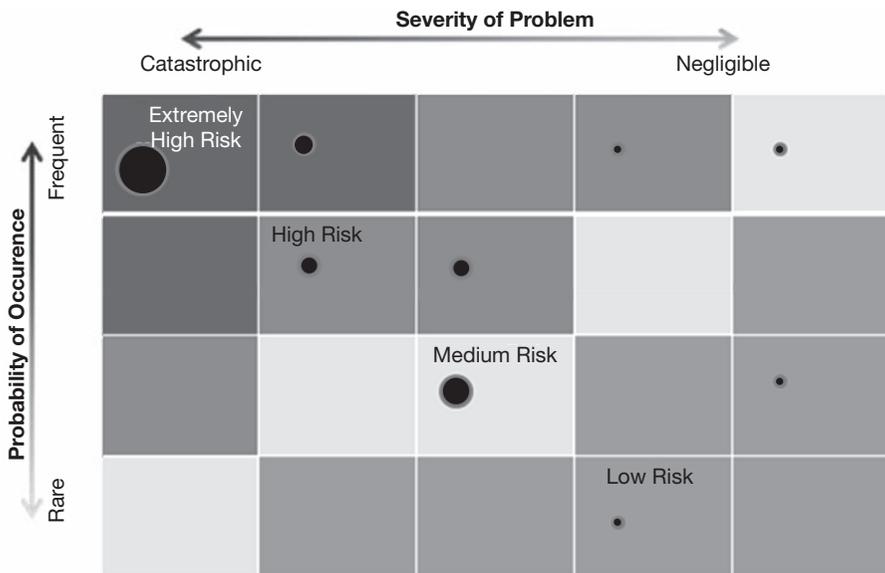


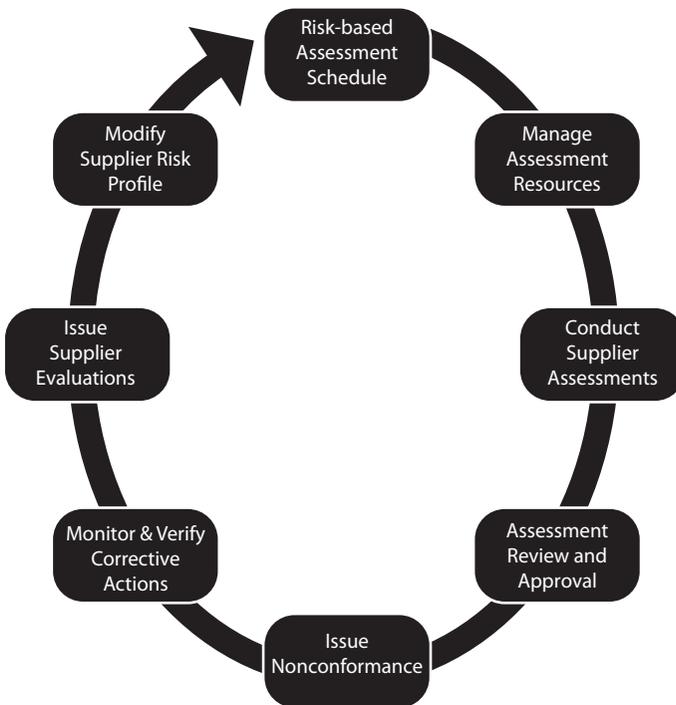
Figure 15.2 Risk profile change example.

sites or suppliers. The poultry supplier mentioned previously would be required to submit a plan to correct the security issue, possibly beginning with firing the offending employee then proceeding to ban personal items and tobacco from the production line. Executives can then easily assess what the poultry supplier is doing to become compliant, whether the supplier should be put on probation or disqualified, and how quickly vulnerabilities are recognized and addressed.

All SCRMS information is available online, in the form of an easy-to-read performance scorecard. Aggregating information from all suppliers allows executives and managers the ability to easily identify their best and worst-performing suppliers, the most common nonconformances, plans to achieve conformance, and other issues.

## THE RISK-BASED SUPPLY CHAIN MONITORING PROCESS

While the above fast food restaurant case illustrated one possible use of an SCRMS solution, it would be helpful to detail the separate activities that compose the implementation and use of such technology. The process advocated by Jadian and Supply Chain Sustainability is illustrated in Figure 15.3.



**Figure 15.3** Supply chain monitoring process.

## Step 1: Define Risk Based Supply Chain Standards

The first step firms should take to monitor supply chain risk is to define the standards on which they will measure their suppliers. This could take the form of any of the ISO standards, the Business and Institutional Furniture Manufacturer's Association (BIFMA) standard for environmental sustainability in the furniture industry, Customs-Trade Partnership Against Terrorism (C-TPAT) standards, and Food Safety and Inspection Service (FSIS) guidelines for the food industry, as examples. This step is obviously driven by the domain of concern, such as quality, environmental sustainability, and security. Firms often find that a number of standards exist for any given domain, which causes confusion as to which standard is the best for their particular application. It is also possible that firms lack sufficient and specific domain knowledge to even begin the process. To remedy this confusion, many firms consult industry groups for advice or may employ third parties to construct a standard that specifically applies to their operations.

Supply Chain Sustainability executives recounted an instance involving a major consumer products manufacturer with multiple production facilities across North America. This firm had recently merged with another large firm. The two merging parties had vastly different or non-existent standards. In this instance, the construction of a shared, mutually agreeable standard that suited their needs was a difficult task that would require a great deal of work. If an industry standard is not applicable, and firms do not wish to bring in a third party, jadian and Supply Chain Sustainability advise that firms begin by informally determining a small number of *best* and *worst* suppliers. Once these are determined, firm representatives should attempt to ascertain the best and worst practices of this group, and then construct a standard around these practices that can be applied to the broader supply base.

## Step 2: Identify and Select Participating Suppliers

After constructing a standard that will be used to assess suppliers, it is important to implement the project in a manageable way. This likely entails selecting participating suppliers based on some factor of import. For example, firms often decide to begin by assessing their *Top 100* suppliers based on purchase spend. Firms may also segment their suppliers based on perceived risk. This may take the form of past supplier incidents, perceived outcome severity, or both. Going headlong into an assessment and audit software implementation with the goal of assessing all suppliers immediately is not likely to be practical or achievable.

Firms must also be pragmatic in determining who is going to pay for the chosen software package. While an ownership model is available from many software service providers, purchasing firms often wish to purchase SCRMS tools on the Software as a Service (SaaS) model. This has the advantage of decreasing the cost borne by the purchasing firm at the expense of passing this cost off to supply chain partners. Utilizing the SaaS model, supply chain partners are typically charged a recurring monthly fee for the use of the tool and the ability to share, receive, and send information related

to assessments, nonconformances, and efforts to rectify any nonconformances. If the purchasing firm has the channel power to impose this fee on its suppliers, or if suppliers are able to see the benefits of software implementation, this may not be an issue. However, the purchasing firm must be prepared for the unwillingness of some suppliers to participate. The purchasing firm may wish to engage unwilling suppliers in meetings to discuss the advantages and disadvantages of implementation. If these meetings are not successful, the purchasing firm may discontinue doing business with a noncompliant supplier or impose some other penalty.

### Step 3: Supplier Assessment Tools

Supplier assessment tools can take many forms and this stage could be interpreted as, “Who inputs the information into the software, and how?” According to Jadian and Supply Chain Sustainability, the options range from the relatively simple and easy to the complex and difficult. In the case of the fast food establishment with contaminated chicken, CommonView could be used as a method to collect customer complaints. In this case, employees at the retail level would log-on to CommonView and fill out a relatively simple customer complaint form. More applicable to the supplier audit theme is the case of a team of internal or external auditors traveling to a supplier’s facility to determine compliance to a standard of interest. In this case, the auditors may employ handheld electronic devices allowing them to complete standardized questions. Results of this would be automatically uploaded to tools such as CommonView. Another option would be the use of *paper and pencil* during the actual audit with auditors logging-on to the software tool later to input results.

A more complex option is to integrate tools such as CommonView with existing software. In this instance the tool would *sit on top of* existing software, collect information, and use that information to determine supplier risk. This allows the firm to leverage existing legacy systems. For example, a purchasing firm may employ a quality system that tracks out-of-spec product delivered from its suppliers. The same firm may employ a transportation management system (TMS) that tracks over, short, and damaged (OS&D) deliveries from suppliers. If the purchasing firm believes that product quality problems and OS&D are indicators of a lack of security control on the part of its supply base, tools such as CommonView may be integrated with the quality system and TMS, and these two systems would feed the number and type of quality and logistics nonconformances into the risk model. In this sense, CommonView would serve as a quasienterprise resource planning system that aggregates risk related information from multiple legacy systems to calculate a supplier’s risk score.

### Step 4: Defined Certification and Audit Cycle

The certification and audit cycle is the process of formally scheduling assessments, managing assessment resources, conducting assessments, issuing nonconformances, correcting nonconformances, evaluating suppliers, modifying suppliers’ risk profiles, and restarting the process. Scheduling assessments, managing assessment

resources, and conducting assessments are, at face value, most applicable to the formal acts of scheduling times to audit a supplier's facility, determining the manpower and manpower qualifications available to conduct the audit, and formally conducting the audit. SCRMS solutions often possess the ability to schedule the formal audit and also track the resources available to conduct audits. Jadian and Supply Chain Sustainability report that purchasing firms with a large number of suppliers often find it difficult to:

1. Schedule audits at times amenable to both the supplier and the audit team
2. Remember to schedule assessments at regular intervals so suppliers are not audited too frequently
3. Schedule unannounced audits with an audit team but without the knowledge of the supplier

Further, auditing supplier performance on a particular domain of interest (e.g., security) often requires specific domain knowledge. For firms wishing to audit a large number of suppliers on a large number of domains of interest, the capability to collaboratively schedule audits and determine whether auditors possessing requisite knowledge are available is particularly valuable.

By following the audit and input of information into the software, tools such as CommonView issue nonconformance reports to suppliers and alert relevant parties inside the purchasing firm of these nonconformances. CommonView specifically offers customized dashboards for suppliers, purchasing managers, and executives that detail information most relevant to their tasks. For instance, the supplier would be most concerned with any nonconformances found during the course of the audit. The purchasing manager would not only be concerned with the nonconformances, but also the supplier's plans to correct the nonconformances as well as the performance of the other suppliers under his or her purview. An executive in the purchasing firm may wish to detail the performance or risk profile of all the firm's suppliers and the purchasing managers' progress in ensuring suppliers correct nonconformances. After noncompliances are corrected, and the risk profiles of each and all suppliers are modified, the process begins again with scheduling further audits and assessments.

## **SUMMARY OF BENEFITS AND CONCLUSION**

Supply chain risk has simultaneously become more difficult and important to mitigate as firms employ the supply chain strategies mentioned at the beginning of this case. Despite supply base rationalization efforts, many firms utilize thousands of suppliers. Purchasing firms are faced with the need to ensure product safety, security, and quality, while simultaneously determining if suppliers provide appropriate working conditions for their employees. Further, Wal-mart has recently set a goal of determining the carbon footprint of each product they sell and will begin requiring suppliers to assess the environmental sustainability of their supply chains. Assessing suppliers

on any or all of these domains is a daunting task requiring appropriate information technology and processes. Tools such as CommonView may hold the key. The benefits of implementing such software include:

- Ability to monitor supplier performance on any risk related domain of interest
- Online, anytime, anywhere access to supplier risk related performance information
- Ability to integrate information from disparate legacy systems to collect, synthesize, and analyze supplier risk related performance
- Customized, dynamic risk model that automatically calculates the risk of any given supplier and alerts relevant personnel if a supplier moves from a lower to a higher risk category
- Reduced response time to risk related incidents through alerts in the form of customized SMS messages, emails, and other methods ensuring potential and actual risk related issues are not buried in paperwork and corrective actions are taken expediently
- Ability to analyze risk related metrics by type, supplier, location, time, or any other variable collected by the software in the form of graphs, charts, or other chosen output methods affording the ability to track root causes
- Access to customized dashboards for suppliers, purchasing agents, appropriate domain staff, and executives
- Reduction in risk related incidents
- Reduced costs related to risk related incidents and, in some instances, increased customer service resulting in enhanced revenues and other, less tangible improvements, such as improving public relations

The first step firms must take in implementing supply base assessment and monitoring tools is likely to be overcoming the myopic *What we don't know can't hurt us* mindset. While supply chain assessment and monitoring will likely uncover difficult issues, it benefits all parties involved to rectify these problems before they affect the end consumer. If recent history has taught us anything, it is that a purchasing firm is held responsible for the actions of its suppliers. Perhaps now is the time to reach back one, two, or even three tiers and determine whether suppliers are living up to your firm's standards.



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