# **Governing Tangible Risk:**
# The SCOR Model

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The following excerpt is from Chapter 6 of *X-SCM: The New Science of X-treme Supply Chain Management*.

# X-SCM

## The New Science of X-treme Supply Chain Management

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# Governing Tangible Risk

## The SCOR Model

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Today's extended global supply chains are highly complex systems, and identifying and managing potential risks throughout these systems is daunting without a structured approach. Managing supply chain risk therefore demands a tool that focuses resources where they are most effective.

For many companies, the Supply Chain Operations Reference (SCOR) model[1] meets that need. The SCOR model has been used by supply chain managers since 1996 to structure and guide supply chain analysis. Its proven utility as an analytical framework for evaluating, improving, and managing supply chain performance has been demonstrated across almost every industry. The SCOR model integrates process definitions with performance and diagnostic metrics and leading practices for improving operational efficiency and customer service.

Recently, the Supply Chain Council (SCC), which owns the SCOR model, formed a project team to investigate the intersection between the SCOR model and supply chain risk management.[2] The team's work resulted in the addition of risk management elements to the model as well as the development of a structured approach for using the SCOR model as a risk management tool. In this section of the chapter, we will briefly explain the SCOR model, and then describe a method for using the model to assess and manage risk.

### SCOR Model Overview

The SCOR model is a process framework for defining, analyzing, and improving supply chain performance. Its modular structure allows users to assess the extended supply chain to identify and correct performance shortfalls, leading to cost and customer service improvements.

The model includes three primary elements. The first element is a process structure that facilitates the definition of supply chain processes throughout a network. The second is a metrics hierarchy for measuring supply chain performance and setting targets. The third is a series of best practices for improving supply chain performance. All three of these elements are integrated into a single framework. The metrics, for example, are linked to the processes to allow root-cause analysis of performance gaps. Similarly, the best practices are linked to the metrics and the processes; this allows users to identify implementation requirements and target performance improvements. Together, they form a framework that supports a relatively quick, consistent method for defining supply chain processes and can then be used to manage and improve performance.

The SCOR model defines supply chain operations through five primary processes: Plan, Source, Make, Deliver, and Return. These five processes are the building blocks for defining supply chain operations. Most locations in a supply chain include Plan processes to manage resources and

requirements, although in some cases this is done at a central location. Every material handling location has, at a minimum, Source and Deliver processes to order and receive material and to process and ship customer orders. Production locations (or any location that uses the material received to create a new product) will include a Make process as well. Locations that return product to suppliers or handle returns from customers will also have a Return process. Repeating these process elements across the supply chain allows you to quickly describe operations using standard definitions.

For each of the SCOR model processes, there are three levels of detail. Level 1 is the strategic-level view of the five processes (Plan, Source, Make, Deliver, and Return). Level 2, the configuration level, defines how material moves in the supply chain: in response to a forecast, in response to a specific customer order, or in response to design specifications. Level 3, the activity level, identifies the activities involved in completing the process at hand. Together, these three levels provide a view of supply chain processes that allows companies to conduct strategic analysis, along with rapid root-cause diagnosis and correction of problems.

The SCOR model performance metrics are designed to highlight supply chain performance in a business context. Metrics are allocated to five performance attributes: Reliability, Responsiveness, Agility, Cost, and Asset Management. These five attributes align supply chain performance to business objectives of customer service and cost management. The metrics have a diagnostic hierarchy to facilitate root-cause analysis, and each metric is tied to a process or activity to help identify not only the cause of a problem but also where in the supply chain it is occurring. Throughout the hierarchy, the SCOR model metrics maintain the five performance attributes to ensure the entire supply chain is aligned to strategic business objectives.

The best practices in the SCOR model serve as methods for improving supply chain performance. The practices are based on the SCC's research and are proven techniques for enhancing supply chain execution. The SCC continuously updates the best practices in the model to capture current, leading management methods.

## Using SCOR for Risk Management

The SCOR model lends itself very well to supply chain risk management for several reasons. First, it allows you to leverage the SCOR framework to quickly define and map your supply chain. This means that you spend less time creating maps and process diagrams and more time on the task at hand—identifying and mitigating risks.

The SCOR model approach is also repeatable, meaning that you can use the same framework, tools, and methods for every supply chain in your portfolio. The model's structure also simplifies the evaluation of elements that are common to multiple supply chains, such as warehouses or suppliers, without having to redefine those elements. Not only is this a time saver, but it also highlights risk events that can impact multiple nodes in your supply chain or multiple supply chains.

Finally, the SCOR framework integrates risk management metrics and best practices with the five supply chain processes. The risk metrics have standard definitions, which facilitate benchmarking of supply chain risk across internal supply chains or with external peers. Because the metrics have standard definitions, they are ideal for sharing information about risk performance and objectives among supply chain partners. Moreover, the linkage of the metrics to processes allows you to quickly identify risk sources and develop appropriate mitigation actions.

As we move through the SCOR model approach for managing risk, you will see how the model provides the structure that is essential for an effective and continuous risk management program.

## The SCOR Risk Management Approach

Before you can use the SCOR model to address risk, there must be a risk management program already in place. The initiative must have an executive sponsor who can define objectives for the program as well as provide funding and organizational support for managing supply chain risks. One

of the executive sponsor's most important roles is to ensure that the supply chain risk management program is aligned with corporate risk management goals. As with any other supply chain effort, a misalignment between supply chain and corporate priorities is a sure recipe for failure.

The SCOR model, then, is applied within this corporate supply chain risk management program, in five phases:

1. Define the supply chain
2. Analyze the supply chain
3. Assess the supply chain risks
4. Mitigate the supply chain risks
5. Implement the mitigation measures.

This five-phase approach, which is discussed in detail below, is based on the results of research on best practices in supply chain risk management that was conducted by the SCC team. Its basic elements are not necessarily unique; the advantage of the SCOR framework is that it provides the necessary structure for a comprehensive and repeatable program.

## Phase 1: Define the Supply Chain

Supply chain risk management starts with a clear definition of the supply chain you will be evaluating. This step is essential for establishing a reasonable project scope. It is also necessary for understanding the risk management requirements of the supply chain. Since supply chains for different product categories—for instance, star performers, steady "cash cows," questionable sellers, and poor performers—will have differing performance objectives in terms of cost and service, it is reasonable to expect that they should also have differing risk objectives.

Once you define the supply chain you will focus on, the next step is to create a map of that supply chain. This exercise starts with locating the relevant supply chain nodes on the appropriate geographic map (or set of maps). Once the nodes have been located, you can depict the direction of material flow between them. Lastly, for each node, you should identify the associated SCOR model processes (Source, Make, Deliver, and Return).[3] An example of this type of geographic map is shown in Figure 6.1.

With the SCOR model structure, you can quickly transform the geographic map into a process or thread diagram showing the SCOR processes identified at each node and the associated material flows. This depiction of your supply chain is very useful for risk management because it lets you visualize the supply chain as a process, complete with the geographic context of operations and the organizational roles involved (that is, the owners and operators of each node). Figure 6.2 shows an example of a thread diagram that is based on the geographic map in Figure 6.1.

The last step in this phase is to define your tolerance for risk in the supply chain you are analyzing. In many cases, the tolerance for risk will be closely linked to corporate priorities for the supply chain. For example, supply chains handling steady-performer, "cash cow" products are likely to be risk-averse in order to protect a major source of income. Star product supply chains, however, probably will accept more risk in an effort to continue capturing market share.

In most cases, the information required for this phase will be readily available; the intent is not for you to start from scratch. At the end of this phase, you should have the information you need to define the scope and intent of the risk management program, and then to start analyzing your supply chain.

## Phase 2: Analyze the Supply Chain

The second phase builds on the risk tolerance identified earlier to more specifically define the risk-related requirements for the supply chain. To accomplish this, you need to first define the metrics you will use for quantifying supply chain risks.

The SCOR model uses "value at risk" (VAR) to quantify supply chain risks. VAR's roots are in

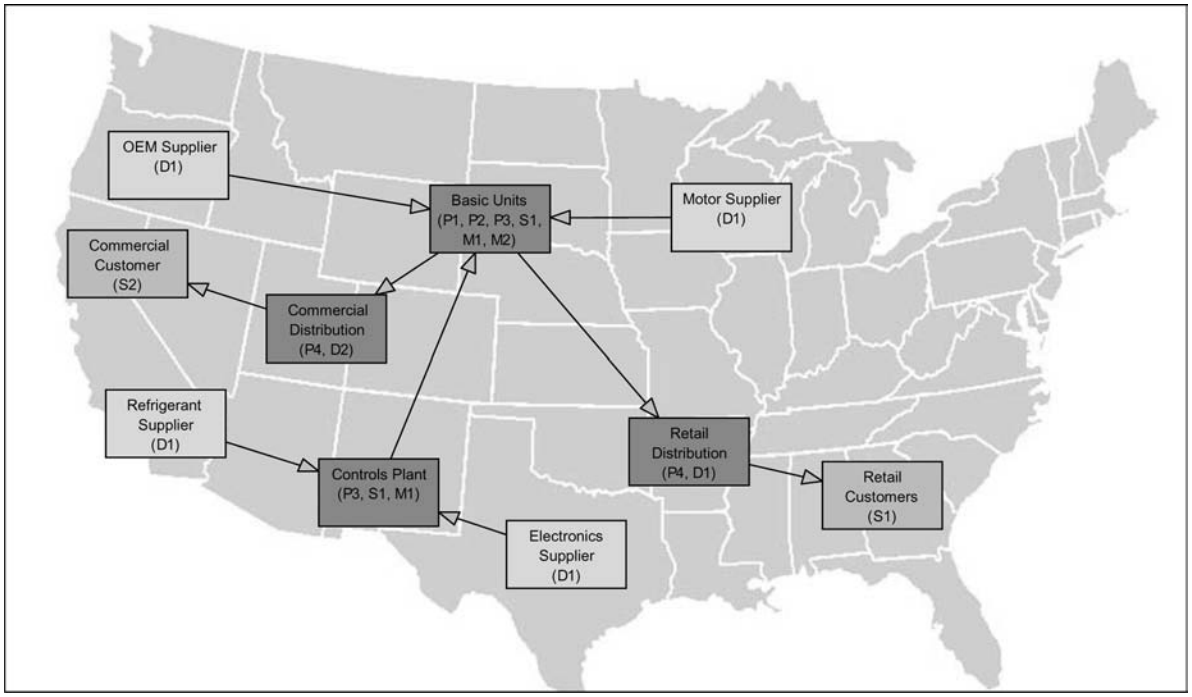


**FIGURE 6.1** A geographic diagram of a supply chain using the SCOR model. The diagram depicts the physical locations of supply chain nodes, the SCOR model processes accomplished at each node, the organizations involved in executing those processes, and the material flows between the nodes. This diagram can be used to identify portions of the supply chain at risk due to geographic or political considerations.

Source: Supply Chain Council, 2009.

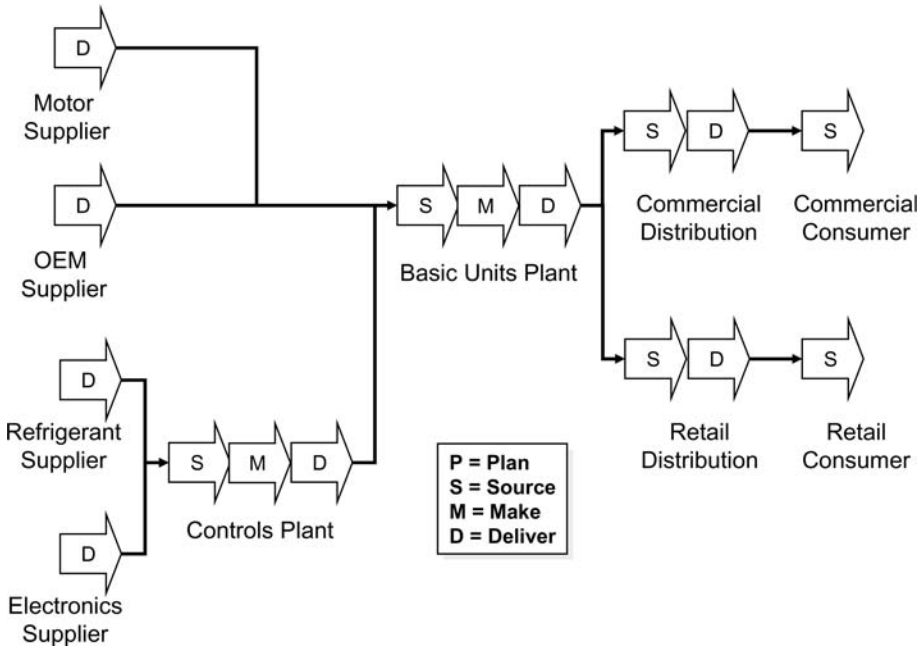


**FIGURE 6.2** A SCOR model thread diagram of the supply chain. The diagram illustrates the supply chain as a high-level process flow based on the SCOR model. This process view highlights the roles of organizations in the supply chain and the interactions between them. This diagram can be used to identify which branches of the supply chain are critical for risk management prioritization.

Source: Supply Chain Council, 2009.

measuring and managing financial portfolio risks. It enables equivalent comparisons of different types of risk by putting them all in a financial context.

The VAR for a specific risk is simply the probability of the risk event occurring multiplied by the financial impact that would result if the event should occur. The VAR for an entire supply chain, then, is the sum of the VAR for each risk in the supply chain. The result is an assessment of the likely financial impacts of all risks in the supply chain. This information can be used to develop return on investment (ROI) calculations to guide mitigation efforts.

Before that can happen, however, you need to define the acceptable VAR for the supply chain. There are several ways to arrive at this figure, but the most common are to benchmark peer supply chains or use company-defined risk goals to set a target VAR value. Once the target has been set, it needs to be validated by the project sponsor as well as by key functional managers in the supply chain. Having an agreed-upon supply chain risk target will allow you to better prioritize mitigation efforts.

It is worth noting that although VAR is the preferred metric in the SCOR model, it is not the only way to measure risk. For example, Cisco Systems, among others, uses "time to recover" (TTR) to quantify the risks in its supply chains. TTR is a measure of the expected elapsed time between a risk event occurring and the supply chain recovering to normal operations. By articulating the time to resume normal operations, you can understand the business impacts of that lost capacity in your supply chain.

Whichever risk metric is used, though, it should be meaningful and expressed in a business context that can be understood by all involved, not just supply chain experts. After all, the risks need to be understood across the organization in order to be effectively managed.

## Phase 3: Assess the Supply Chain Risks

With the supply chain mapped and risk priorities set, you are ready to assess your supply chain's risks. This phase involves three steps: brainstorming, validation, and documentation.

Brainstorming, or free discussion, starts the risk-identification process. The SCOR model provides a structure for the brainstorming exercise to ensure comprehensive assessments and useful results. Using the geographic and process maps developed earlier, you can start the discussion by asking a series of questions about each supply chain node. Note that the following questions are intended to be general guides; you should add other risk-related questions that would be meaningful for your particular supply chain.

- Are the location and its related material flows subject to natural disasters?
- Is the location in a politically stable region?
- Does the location or the associated material flows indicate a bottleneck or critical failure point in the supply chain?
- Does the location have adequate security? Are the associated material flows adequately secured?
- Are the material flows subject to traffic congestion, border crossings, or other transportation problems? Are transit times consistent?
- Is the location likely to experience significant labor disputes?
- Is the location in an industry or region that is subject to market risks or volatility?
- Is the location financially secure?
- Does the location maintain consistent quality in its operations?
- Is there a risk of product damage along any of the related transportation routes?

As you discuss each node, note any questions that you cannot adequately answer as well as any potential risks that are mentioned.

The more complex your supply chain is, the more brainstorming sessions you will need to identify all of the risks. To keep this manageable, it may be useful to categorize the material

flowing through the supply chain by its potential impact if it should be disrupted. For example, if one of your supplier's inputs is a common material that is widely available, you probably can leave that aspect of the supply chain out of your assessment without fear of overlooking a significant risk.

Once the brainstorming sessions have been completed, the next step is to validate the results to be certain that they accurately represent the potential risks to the supply chain. Start by grouping similar risks among the nodes into common risks that have a common cause, or trigger. Then compare nodes to ensure that locations with similar characteristics (geographic location, operations, ownership, etc.) reflect the expected similar risks. This is also the time to research the answers to any questions that could not be fully addressed during the brainstorming sessions. Next, review the overall inventory of risks to identify and remove from consideration any that clearly are highly unlikely to occur or represent a minimal impact. Then do the opposite: identify any significant risks that were overlooked and add them to the inventory.

For each of the risks, assess both the likelihood of the triggering risk event occurring and its potential impact on the supply chain. The information you will need to assess the likelihood of occurrence can come from any number of sources, including insurance actuary data, historical event data, and statistical analysis, to name just a few possibilities. If all else fails, though, you can use an educated guess *with sufficient justification.*

When calculating the potential impact of an event, consider both direct and indirect costs. Direct costs would include the actual damage to property, loss of inventory, idle time expenses, and other costs associated with bringing the supply chain back to full operation. Indirect costs could include lost sales, lost market share, and even lost brand equity due to the disruption. While indirect costs can be difficult to calculate accurately, it is important to include them in your assessment. Without that information, you will not be able to evaluate the full impact of the event.

Lastly, document the risk inventory in a format that can be used in detailed analyses in the future. In most cases, this documentation is best captured in a database system or spreadsheet. Each risk should be identified by location, type of risk, triggering event, likelihood of occurrence, potential impact, and similar considerations.

## Phase 4: Mitigate the Supply Chain Risks

At this point, you now have a comprehensive inventory of risks in your supply chain. The next phase, then, is to look for ways to mitigate those risks. Mitigation involves taking action to reduce either the likelihood that a risk will occur or the impact of the event when it does occur. An easy example to understand is theft. Installing locks on your doors will reduce the likelihood that a theft will occur, but it will not change the impact of a theft that does occur. Likewise, buying insurance will reduce the financial impact of a theft, but it will do nothing to prevent it from occurring. Most risk mitigations address some combination of prevention and loss reduction.

How much risk you mitigate will depend on both the risk tolerance of the supply chain (which you have already calculated and expressed in terms of VAR) and the resources available to implement mitigation actions. Using the data collected, you can calculate the VARs of each identified risk and add them together to determine the total potential impact of all of the risks in the supply chain. You can then compare this to the target risk tolerance to determine how much risk must be removed from the supply chain.

It is unlikely that you will be able to actively mitigate every risk you identify; therefore, you need a method for selecting which risks deserve the most attention and effort. A simple and effective way to do that is to plot them in a matrix of likelihood of occurrence and potential impact, as shown in Figure 6.3.

The first priority, of course, should be to address risks with a high potential impact that are most likely to occur. Start with the risks that fall into the upper-right quadrant of Figure 6.3, identifying potential mitigation actions for each. Mitigation actions take many forms and need to be designed

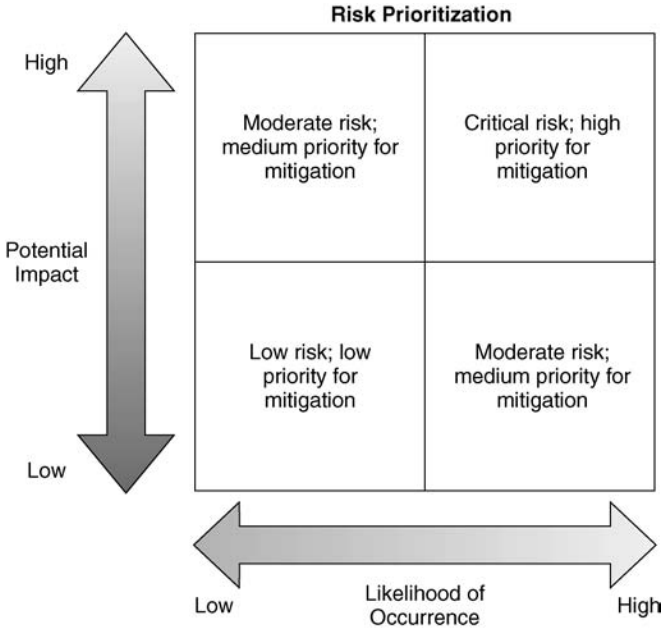


**FIGURE 6.3** Risk-prioritization matrix. The prioritization matrix is used to organize identified risks based on the likelihood that the risk event will occur and the impact to the supply chain. This serves as a foundation for allocating risk management resources and mitigation actions.

Source: LMI, 2008.

based on the risk and the operational environment. Just a few of the many possible examples of mitigation actions include redundant supply chain nodes or suppliers, facility relocation, physical security procedures, and active management of potential trigger events.

As you design mitigation actions, be sure to consider how they will reduce the VAR associated with each risk. This serves two purposes. First, it allows you to track how much risk you are taking out of your supply chain. Second, it allows you to start building a business case for the mitigation action by comparing the cost of the action to the value of the risk being removed from the supply chain.

A final word on mitigation: No risk should be left completely unaddressed. At a minimum, you should create a response plan for the less likely and lower-impact risks. While a general response plan will not reduce the likelihood that an event will occur, it will greatly reduce the time to respond to the event and resume normal operations. Remember that the response plan needs to capture a supply chain response, not just your actions. Therefore, the plan needs to include elements that define how you will communicate with suppliers and customers during the risk event and how you will coordinate response actions.

## Phase 5: Implement the Mitigation Measures

Now that you have defined your mitigation actions, it is time to implement them. This process begins with the development of an implementation plan and continues through project management and risk monitoring.

The planning stage involves grouping the mitigation actions into common projects for implementation. These projects are then prioritized and put into a project timeline based on such considerations as the availability of resources, project impact, dependencies on other projects, and other implementation factors. Once the project plan has been completed, you can secure the necessary funding and begin implementation. (This topic can only be discussed very briefly here; for more detail and direction, consult standard project management texts.)

A critically important aspect of implementing risk-mitigation measures is having a risk monitoring program. The purpose of such a program is to recognize a risk event or the increased potential for a risk event as early as possible so you can react more quickly and reduce the impact. An effective monitoring program will allow managers to proactively respond to events as they happen, or even take preventive action before they occur. Which monitoring activities you carry out will depend on the risks you have identified in your supply chain; examples include tracking weather patterns, news developments, market trends, and partner companies' financial information, to name just a few.

Monitoring becomes more important when supply chains are extended and event response involves multiple organizations. The sooner you can detect the event, the sooner you can marshal your partners to respond.

## Continuous Risk Management

When you have completed all of the steps in the SCOR approach to risk management, you will have identified, prioritized, and mitigated the risks in your supply chain. But this is not the end of your risk management program. In today's economic environment, there is no such thing as a static supply chain—and that means there is no such thing as a static risk profile. As suppliers, customers, and partners are added and removed from your supply chain, you will need to assess the impact of those changes.

That is why it is recommended that you regularly revisit the five-phase process. Just how far back in the process you go, and how often you do so, will depend on your needs and resources. The modular structure of the SCOR model, however, allows you to consider these changes, or even test proposed changes, without reevaluating your entire supply chain. Here is an example of a typical schedule:

- *Monthly*—revisit mitigation plans to ensure that they are being properly implemented and accurately reflect operational needs.
- *Quarterly*—revisit risk assessments, especially those that are subject to market or political conditions, to verify that the VAR for each risk is accurate.
- *Annually*—revisit the supply chain to ensure the supply chain definition and risk priorities accurately reflect the current supply chain configuration.
- *Biannually*—revisit the supply chain definition to ensure that the risk management program reflects both the organizations that are currently involved in the supply chain and the role the supply chain plays in your company's corporate strategy.

A schedule like the one above is important, but in some situations it may be better not to wait for the scheduled review. Specific events may call for a reevaluation of risk in a supply chain. Market shifts, corporate strategy changes, and new technologies are just some examples of developments that should trigger a reevaluation.

## A Consistent, Repeatable Approach

Every supply chain faces potential disruptions from multiple sources. The challenge is to understand where your supply chain is exposed to risk and determine how to mitigate the most significant of those risks. The SCOR model provides a framework and structured approach for identifying and managing such risks. The repeatable nature of the SCOR model means that you can use the same approach to manage risks across all of your supply chains and quickly adapt your risk management program to structural changes. The result is a more robust risk management program that is aligned with corporate risk management and business goals as well as with customers' needs.

## Notes

1 The SCOR® mark and the contents of the SCOR® model are the exclusive property of, and are used herein with the permission of, the Supply Chain Council Inc. More information about the SCOR model is available from the Supply Chain Council at www.supply-chain.org.
2 Many of the ideas in this section originated with the Supply Chain Council Risk Management Team. I am deeply indebted to my teammates for their contributions to this body of knowledge.
3 For this example, we are using the Level 1 processes to define the supply chain. In many cases, you will want to identify if material is made to stock, made to order, or engineered to order using the SCOR Level 2 processes.

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He is coauthor of *GreenSCOR: A Green Supply Chain Adaptation of SCOR*; author of "Can One Green Deliver Another," which was published in MIT's *Supply Chain Strategy* newsletter; a contributing author to *X-SCM: The New Science of X-treme Supply Chain Management*; and a contributing author to the *Air Quality Control Handbook* published by McGraw-Hill. He has also published articles in *Awareness Into Action* and *Defense Standardization Program Journal*.

Mr. Wilkerson is a member of the Supply Chain Council Aerospace and Defense Special Industry Group Steering Committee and has contributed to various council project teams, including GreenSCOR, Risk Management, Returns, Best Practices, and others. He has SCOR-P certification and is a certified SCOR trainer with the Supply Chain Council. He also represents the SCC on the Supply Chain Risk Leadership Council. Mr. Wilkerson led the Boundary and Allocation technical working group for development of the Greenhouse Gas Protocol Scope 3 and Product Standards.

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