

Tauber Institute Helps Two Companies Manage Supply-Chain Risk with New Tools

Hurricanes, earthquakes, floods, power outages, labor strikes, machine breakdowns, shipping interruptions, raw material shortages, terrorism, pirate attacks, and war – any and all of these can cause production delays halfway around the world in the automobile and aircraft manufacturing industries. No wonder supply-chain managers working at the leading manufacturers often lose a good night’s sleep. Although they may not be able to prevent the catastrophic events, these managers at least can keep the tossing and turning at bay by having clear visibility into the supply chain. Their hope is that the next time a severe storm pounds into the United States’ eastern seaboard, or any similar disaster or supply problem occurs, production of cars and airplanes will proceed as usual, on schedule, to meet customer demand. In other words, although airports, highways, and other major transportation networks may get shut down, the assembly line will keep moving.

I. Chrysler and Boeing Leading the Way

After a recent fortitude-testing collision with bankruptcy, Chrysler is accelerating into the fast lane of growth, profits, and global success. With 16 different vehicle models, they are undeniably offering consumers stylish, high-quality, innovative automobiles. And people are buying.

Similarly, Boeing is taking off to new heights despite the severe tailspin of the global economy over the last several years. The world’s leading manufacturer of airplanes is combining advanced aviation design and technology with lean and ultra-efficient manufacturing operations to maintain its vaulted position among its aggressive rivals. As before, Boeing airplanes are the gold standard for their industry, and production is at all-time highs.

Besides resilience, ingenuity, intelligence, and countless hard-working employees, these two companies share another strength: their proactive assault on supply-chain risk. And this is a battle they cannot afford to lose. Supply-chain interruptions can halt production for days, resulting in losses of millions of dollars. Just consider that the Boeing 787 Dreamliner is a 225-million-dollar airplane with 2.3 million parts. Paul Nuyen, Boeing’s Vice President for Everett Operations, emphasizes the high stakes that compel effective supply-chain control: “A robust supply chain is critical to ensure the right part is available when it is needed.” Mike Keegan, Senior Vice President of Supply Chain Management at Chrysler, readily articulates the challenge he confronts daily: “Chrysler’s global supplier footprint is vulnerable to a variety of risks.”

Through initial efforts to impose structure on this vast and amorphous challenge, Chrysler staff enumerated 15 separate risks that threaten its supply chain: forecast errors, capacity constraints, strikes and labor shortages, perceived poor quality, supplier financial performance, exchange and interest rates, liabilities and lawsuits, regulations, earthquakes,

tsunamis, floods, and fires. They also carefully sized the footprint: The company relies on over 3,000 suppliers in 22 countries.

II. Tauber Institute for Global Operations Dispatches Two Teams

To develop a supply-chain (SC), risk-management system, both companies turned to the Tauber Institute for Global Operations, located at the University of Michigan. The Tauber Institute is a collaboration between the university's Ross School of Business and its College of Engineering. It is a highly innovative teaching institute dedicated to preparing graduate-level students for employment with global organizations that demand outstanding technical and leadership skills of their new hires. Students from the Tauber Institute offer their employers a powerful combination of proven professional capabilities in most, if not all, of these areas: analytics, business management, communication, engineering, operations research, and strategic problem solving. Indeed, the Tauber Institute is leading the way in this important student-training endeavor, and in 2012 it was awarded the first-ever UPS George D. Smith Prize, which recognizes a single educational program providing an innovative training platform for graduate students in the areas of operations research, management science, or analytics. Boeing's Paul Nuyen acknowledges that Tauber graduates are "proven performers." Jeff Hanley, Boeing's Director of Parts and Assemblies and executive sponsor of the supply-chain project, says the students provide Boeing with a fresh look at challenges from an inter-disciplinary viewpoint.

The Tauber Institute sent a multidisciplinary team of graduate students (from both business and engineering disciplines) to each company, to execute a 15-week consulting project for the purpose of designing and implementing a customized SC risk-management program for each company. Both consulting projects produced exceptional results. The Tauber-Boeing team comprised Scott Foreman, Steven Kovalck, and Nisarg Patel. The Tauber-Chrysler team boasted Matt Carson and Abey George.

At Chrysler, Carson and George developed an Analytical Framework, specifically a sub-tier supplier data survey, for identifying supply-chain risk and complementary risk mitigation strategies, especially for suppliers identified by the survey as high risk. "Our goal," explains Mr. Carson, "was to identify the single points of failure, those 'pinch points,' that keep the supply-chain managers awake at night." These pinch points were ultimately identified, followed by development of numerous sets of supplier-specific mitigation strategies. Mr. Carson further elaborates: "We revealed the high-risk suppliers so Chrysler could focus its expenditures to prevent or mitigate failure where it would be most catastrophic." Mr. George adds, "We helped create a cost-effective 'insurance policy' against supply-chain risk."

The Tauber-Boeing team also developed a survey tool, dubbed the "Virtual Factory Manager," which monitors operational health of suppliers on a weekly, recurring schedule. "Boeing is extremely motivated to better manage supply-chain risk because they are ramping up production," explains Mr. Foreman. He continues, "With an increased assembly rate of merely one-half plane per month, Boeing must coordinate 1 million additional parts arriving through the factory door." Mr. Kovalck sums up the value of the team's new SC

risk-management tool like this: “Supply- chain management enables Boeing’s strategic positioning. By enabling increased production, the company fends off competition from emerging-market nationalized companies.” In terms of the actual tool, Mr. Patel explains that “Boeing must manage both itself and its suppliers; the Virtual Factory Manager puts Boeing’s procurement agents inside the suppliers’ facilities, directly on the factory floor. When Boeing employees help the suppliers and know as much as possible about them, Boeing helps itself.” Vice President Nuyen echoes Mr. Patel’s perspective: “With VFM, our agents can ask the right questions, make sharp observations, and flush out potential problems with suppliers. They can foresee issues so they don’t become spoilers.” Mr. Hanley underscores the value VFM plays at this particular time in Boeing’s history. “The suppliers to Boeing are really an extension of our production system. The Virtual Factory Manager provides us with an efficient way to gain insight into the supplier’s operation as we continue to seek new and better ways to support our increases in rate.”

III. Summary of Solutions

Chrysler’s Analytical Framework “speaks to the risk and consequences of such risk at each supplier,” according to Mr. Carson. Though just a straightforward spreadsheet, the tool fosters communication about risk between the “suppliers and Chrysler’s procurement supply-chain managers,” adds Mr. George. He continues, “We wanted to create a framework that could be implemented by all types of employees after we left. And we succeeded: the tool is very user friendly, and they ‘get it.’” Chrysler sees value in the ability to apply the tool to the entire supply chain, building upon the initial rollout for the Pentastar engine program with its 90 supplier facilities and 200 parts. In other words, the tool can easily expand to cover all 1,000 Chrysler suppliers. As mentioned above, the Tauber-Chrysler team also developed complementary risk mitigation strategies for the Pentastar program, especially for suppliers identified by the framework as high risk.

As with Chrysler, Boeing has an equally large and diverse supplier base. The Virtual Factory Manager (VFM), nonetheless, can “work for all of them, while it is an easy tool for each Boeing procurement agent to use as well,” offers Mr. Patel. The tool relies on common sense and doing a “walk around” the factory floor once each week. In a nutshell, it is just a “20-question checklist,” points out Mr. Kovalck, “which improves operations and intelligence across the supply chain.” Mr. Kovalck sums up VFM with a mix of humility and pride: “Boeing already had a large number of IT tools; they did not need another. We gave them something that works for all comfort levels without being redundant.”

IV. Supply-Chain Risk Poses Severe Problems

Once again, we can ask, “How important is SC risk to Boeing?” Quite simply, it is extremely important. Boeing intends that, between 2012 and 2014, it will initiate 12 production rate increases, yielding a total increase to its all-time highest production rate. With this ambitious assembly timeframe, the company needs to be absolutely certain that supplier delays or mistakes leading to unavailable components do not set back the production rate.

How important is this for Chrysler? In a word, “Terribly!” The company faces an increasingly competitive global marketplace, personified in a fickle and demanding consumer with many, many competing products to choose from. Losing a sale due to production setbacks is not something the company can absorb with just a shrug. They dodged a bullet in the aftermath of the 2011 Japanese tsunami when, by sheer good fortune, a large shipment of parts had just left Japan before the earthquake struck. This supply kept production moving and gave them time to find alternative means for future supply shipments. Similarly, a flood at a carpet supplier and a fire at a resin supplier have stressed the supply chain in recent years. On top of all these supplier-specific disruptions, the company’s suppliers en masse experienced near death in 2008, amidst the global economic meltdown and almost catastrophic collapse of the American automobile industry. As a result, suppliers are extremely cautious and hesitant to commit capital to expanding capacity. They are operating at maximum capacity, which puts enormous pressure on Chrysler. Unlike the seats of the Chrysler Luxury Series 300, the company’s supply chain has no cushion.

V. Innovative Solutions Implemented and Refined Quickly — Tools in Detail

Boeing:

The Tauber team took a three-phase approach to developing and implementing a vastly powerful analytical tool for identifying and managing supply-chain risk: implement, improve, and transition. Implementation involved developing the VFM data collection survey. Improvement comprised receiving and incorporating suggestions and corrections from the survey’s recipients, namely the Boeing procurement agents involved in the development and implementation of the tool. Finally, transition moved the VFM tool away from its Tauber creators to the Boeing personnel who would take over its continued functioning. Notably, the second phase, implementation, was spectacularly successful—achieving 100% adoption by the 83 intended users within 2 months. Jeff Hanley states, “We were able to rapidly deploy the tool across a broad base of suppliers and are now getting real-time data to help identify and manage supply-chain risk before it spills over into our factories.”

VFM essentially standardizes real-time risk monitoring. At its core is a survey tool that incorporates a four-step process into a worksheet that the supply-chain procurement agents utilize to identify risk areas within their supplier’s operations. As a quick example, consider Boeing’s supplier of interior cabin lighting. In step 1, the procurement agent for

this part visits the supplier's facility—either in person or virtually—at least once a week. With the VFM in hand, she walks the floor, talking to her counterpart and completes the worksheet. If risk exists, Step 2 facilitates a deeper understanding of that risk and the potential impact to production health and delivery performance. Step 3 prompts mitigation plans and a timeline for putting those plans in place, as a necessary contingency. Step 4 codes the particular risk with yellow, green, or red; and the particular color requires correlative progress tracking. Because the weekly VFM manages risk in real time, it yields real confidence up and down the supply chain. Again, Jeff Hanley praises the VFM in this way: “It is a good playbook for our procurement agents as they hit the field at supplier locations and factories. It multiplies the capabilities of our procurement agents, making them increasingly more competent and insightful at their jobs.”

Chrysler:

To manage risk for a supply chain with approximately 70 to 80% of vehicle components purchased from outside vendors, the Tauber team developed an analytical-based, action-promoting framework, with an emphasis on risk identification, prevention, and mitigation. As mentioned above, the framework was created and implemented at the pilot level in conjunction with the Pentastar engine program.

The analytic-action framework involves four phases: (1) risk identification at both Tier 1 and Sub-tier levels, (2) high-risk supplier identification, (3) full risk characterization for high-risk suppliers, and (4) mitigation strategies development. For the Pentastar program, initial risk identification was based upon stakeholder interviews to elicit risk factors followed by a full survey of all suppliers. The survey started at Tier 1: Chrysler's immediate parts suppliers. It continued to the next level: the suppliers of the Tier 1 suppliers. With the combined Tier 1 and Sub-tier data, the risk could be quantified by multiplying the margin at risk in dollar terms with the time to resource in day terms. This way, suppliers could be placed into three levels of risk, from highest to lowest. Risk was broadly defined to catch any and all potential causes of delays: manufacturing location, uniqueness of parts, transit time, volume, time to recover, concentricity, time to re-source, and complexity. The framework generated “transparency of risk throughout the multi-tiered supply chain,” according to Senior Vice President Keegan.

In response to results from phases 1 through 3, the Tauber team proposed both general and specific mitigation strategies for high-risk suppliers (phase 4). Applied to everything from valve stem seals, to engines, to fully assembled vehicles, risk-management strategies built upon a new and thorough Analytical Framework are improving Chrysler's control of the future. The company believes this new analytical tool is so significant to their improved global operations that they intend to advocate and promote it with pride as they contribute their best practices to an industry-wide, SC risk-management initiative. SVP Keegan is pleased with the partnership Chrysler has forged with the Tauber Institute: “The Tauber program provides a unique ‘best of both worlds’ approach, with highly skilled and energetic students on-site, bolstered by the expertise and thought leadership of the faculty.”

VI. The Eye on the Storm

Not even the greatest SC risk-management tool can hold back storms, tornadoes, and tsunamis. Bad things happen. But with recent help from the student consultants from the Tauber Institute for Global Operations, Boeing and Chrysler now can proceed with confidence that they have their eyes on the risk implicit in each and every aspect of their supply networks. They now not only see into “the eye of the storm,” they see their way out as well. With clear and continually updated perspectives, preventative measures in place, and mitigation strategies at the ready, these titans of the manufacturing industry are not about to be blown off course by catastrophes, breakdowns, and supply disruptions. Rest assured, they can once again sleep tight at night.

About Tauber Institute for Global Operations

The [Tauber Institute for Global Operations](http://www.tauber.umich.edu) is a joint venture between the University of Michigan’s Stephen M. Ross School of Business and the College of Engineering, and many industry partners to facilitate cross-disciplinary education in global operations management. In addition to broad array of core and elective courses, the innovative LeadershipAdvantageSM Program provides students with the tools to ascend to major operations leadership roles. Well-designed and managed team projects form the cornerstone of the Tauber Institute experience and allow students to apply their knowledge to real world settings. <http://www.tauber.umich.edu>

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Note to editors: photos available upon request
