Using Supply Chain Modeling to Mitigate Risk in the Automotive Industry

The more complex the supply chain, the greater the risk, and the automotive supply chain is as complex as it gets. Supply chain design technology enables automotive manufacturers to model, optimize and simulate supply chain network operations, transportation routes and inventory levels, leading to major improvements in cost, service, sustainability and risk mitigation.

Balancing Supply Chain Efficiency and Risk Reduction

In a typical car there are approximately 3,500 parts, and there are typically three to five levels in the automotive supply chain, which could be comprised of thousands of suppliers. In such an intricate inbound supply chain with thousands of vendors and parts, a critical problem in any node of the supply chain can cost millions of dollars in damage and delays. This could include a single-sourced supplier shutdown, quality issues with a critical part, a machine going down, a part stock-out in the production process or strikes at one of the component plants. These risks are even more severe considering that much of the automotive industry operates on a JIT (just-in-time) lean manufacturing policy, which requires having the right parts for every vehicle ready as it rolls down the production line.

Manufacturers know that they need to protect their supply chains from serious and costly disruptions, but obvious remedies such as adding capacity and suppliers, shifting to low-cost foreign manufacturing facilities and increasing inventory can significantly increase supply chain risk and costs. How can automotive manufacturers balance supply chain efficiency and risk reduction?

Automotive manufacturers that utilize modeling technology to create living models of their end-to-end supply chains have the ability to optimize networks for significant cost reduction, but also to redesign and re-optimize when forecasted changes or unplanned events occur.

LLamasoft provides software and expertise to help dynamic organizations design and significantly improve their end-to-end supply chain network operations. The LLamasoft supply chain design platform featuring Supply Chain Guru® enables automotive manufacturers to model, optimize and simulate supply chain network operations, transportation routes and inventory levels, leading to major improvements in cost, service, sustainability and risk mitigation.
Using Modeling Technology to Address Today’s Volatile Automotive Supply Chain Environments

These examples highlight how supply chain design technology can mitigate automotive risk at all stages of the automotive supply chain, including supplier, manufacturing/assembly and outbound.

SUPPLIER RISK: Preparing for Port Shut-Downs and Shipment Delays

Recent rumblings of massive strikes among dockworkers on the California coast have brought the reality of a major California port shutdown to the forefront. The Los Angeles and Long Beach ports handle nearly half of the nation’s cargo, and are the main gateway for imports from Asia, a key automotive supplier region. If a strike were to occur, it would mean a shortage of workers on the West Coast and shipping delays throughout the country.

OEMs can prepare for anticipated supply chain events by using supply chain design technology to build end-to-end models of the as-is supply chain and then test several potential shut-down ‘what-if’ scenarios incorporating alternate port entry points and routes. This scenario analysis can be used to prepare for other planned or potential supply chain disruptions in the automotive industry, such as supplier shipment delays (e.g. ocean freight with protracted lead times). In the event of unplanned supply chain events such as natural disasters, fire or political upheaval, manufacturers that have already built supply chain models can quickly respond by incorporating new scenarios to identify the best response plan for minimal disruption to production and service levels.

Case Example: Off-Shore vs. Near-Shore Decision Making

A U.S.-based company had used offshore contract manufacturing facilities in coastal China for the first 15 years of its existence. When the manufacturer insisted that a move to inland manufacturing facilities was required to keep costs down, the company decided to take a detailed look at alternate sourcing scenarios. A move inland would yield lower labor costs, but it would also increase lead time and add an additional transportation leg. Of course, there was no guarantee that if the company moved inland, labor costs wouldn’t rise there too. The company wondered: at what point would China no longer be a good sourcing decision?

By running scenario analyses that considered not only labor rates but also inventory, transportation and lead time variability, the company was able to accurately evaluate the Chinese location against other possible sourcing regions such as Latin America and Mexico.
MANUFACTURING/ASSEMBLY RISK: Evaluating Near-Shoring Strategies and Production Capacity

Many U.S.-based businesses are rethinking overseas manufacturing strategies as formerly significant cost advantages begin to evaporate. Rising labor costs and turnover and quality concerns are all contributing to increasing risk of manufacturing in China. “Near-shoring” to Mexico appears favorable in many regards, with its shorter lead time, favorable trade agreements with 44 countries and long-established, growing automotive manufacturing footprint.

In making fundamental facility location decisions, companies often fall into the trap of focusing only on the production costs or investment costs and forget to focus on the entire end-to-end supply chain, which includes the interdependencies of many cost factors including transportation, inventory and tax. Top-performing companies make decisions that are optimized across the entire supply chain, using modeling technology to help them identify the tradeoffs across all the different cost elements.

Supply chain models can also incorporate cloud-based industry recognized risk metrics and associated costs for different regions around the world; including political instability, logistics performance, corruption, climate risk and ease of doing business indices.

When considering manufacturing options, production capacity is another key consideration. Will you have the right capacity in place to support the record number of vehicle programs coming into the market? The automotive industry is trying to put so many vehicles through its current capacity that there’s no room for error. Demand for products shifts over time to new regions or different quantities, and suppliers and cost structures change as well. As these changes occur, the production footprint should also change to keep in-sync. This may mean investing in additional capacity in certain locations or perhaps completely moving production capacity to other facilities within the network. Modeling the production footprint and analyzing varying scenarios helps a company balance existing capacity with the investment required to add additional production. Simulation can be used to predict supply chain performance given changes in demand or supply chain structure.

Multi-Echelon Inventory Optimization

Inventory is your insurance against variability in the supply chain, but one of the biggest sources of variability is demand, and demand can be highly unpredictable, or very slow-moving, as with service parts fulfillment. LLamasoft inventory optimization recommends end-to-end stocking levels and appropriate ordering behavior after it thoroughly analyzes and automatically classifies the underlying demand patterns. This result is right-sized inventory levels at every level of the automotive supply chain.
OUTBOUND RISK: Identifying Optimal Consolidation Points and Transportation Routes

But with export numbers rising, carmakers are wondering whether Mexican infrastructure will be able to handle the surge. The problem is one of limited infrastructure, assets and service. Mexican ports are crowded and investment plans slow to be realized. Rail transport, the dominant mode for exporting vehicles to the US, will need fleet and track investment.

Supply chain modeling enables manufacturers to test out alternate transportation options given existing or potential network locations. If there is a disruption in one mode, companies can test the impact of shifting to other potential modes to identify alternatives with the least strain. Companies can model strategies such as consolidation, which may minimize risk at border crossings. Less than truckload (LTL) shipments in Mexico are often regionalized, more expensive, and have longer transit times due to Mexico customs regulations. Consolidation limits touch points, streamlines accountability, and addresses freight location issues for a smoother, more visible border-crossing experience.

Case Example: Service-Based Optimization for Service Parts Distribution

A major automotive manufacturer wanted to improve the structure of its Australian service parts distribution in order to align it with the brand’s global strategy for service parts and turn it into a competitive advantage. The company enlisted LLamasoft to identify the optimal regional DC size and locations to best fulfill orders.

Greenfield analysis was used to identify common Australian logistics locations and calculate costs of potential new DC locations, taking into account demand and customer service times. Regional facility costs per square meter for alternate new DC locations were considered, along with the company’s current fixed operating costs.

The model identified the optimal locations and facility sizes for multiple regionally managed DCs in Australia, resulting in an additional $23 million to the company’s bottom line (a 28 percent increase in current profits) while improving overall visibility to parts distribution and maintaining best-in-class service levels.

Service-area greenfield analysis samples show what percentage of customers can be reached with 1, 2 and 3-day service with alternate DC locations.
Three Elements of an Effective Automotive Supply Chain Risk Management Strategy

The LLamasoft supply chain design platform can help companies plan in advance to react rapidly to unplanned events in high-risk regions. By creating living models of the supply chain, automotive OEMs enable three key elements of supply chain risk mitigation:

1. **Visibility**: What is the current structure and flow of goods through my supply chain?

   Supply network visualization can help you understand:
   - Risk profile & locations
   - Sourcing for each part
   - Flow of products

   Drill-down reports and metrics take you a step further by providing:
   - Revenue impact of disruption
   - Percentage sourced from risk region
   - Percentage single-sourced

2. **Scenario analysis**: What if we try this? How would my costs or service be affected by this?

   Once you have digital models of your supply chain as it operates today, you can optimize for different scenarios, depending on which you decide present the biggest risks to your business at any given time. This scenario analysis is the key element of your risk management strategy. Sensitivity/scenario analysis enables you to make decisions in a digital environment in advance, instead of testing your theories in the real world when the event actually happens. Here are a few examples of you may use sensitivity testing to create action plans for the scenarios that present the most risk to your business at any given time:

   - **Optimize supplier configuration**
     - Single source vs. multi source
     - Low cost vs. local
     - High risk vs. low risk

   - **Evaluate alternative strategies**
     - Transportation mode selection
     - Production footprint
     - Inventory stocking locations and levels

   - **Simulate and perform what-if analyses**
     - Fluctuations in lead-times
     - Supply disruptions
     - Demand increases or decreases
     - Fuel-cost spikes
3. **Rapid response: How should I react to an unplanned event?**

Now that you have optimized for different scenarios, depending on which you decide present the biggest risks to your business at any given time, you are ready for an unforeseen event. When unplanned events occur, you can simply add them into the scenario and react rapidly and intelligently.

You can utilize simulation to test different courses of action to mitigate each unplanned event:

- **Use the supply chain models to evaluate contingency plans**
- **Balance production and sourcing against changes in demand**
- **Prioritize demand during supply short-falls**

**Related Resources**

- White Paper: Three Elements of a Truly Effective Supply Chain Risk Management Strategy
- White Paper: Enterprise Simulation Planning (ESP)
- White Paper: Production Modeling: Top 5 Initiatives to Drive Breakthrough Performance
- Special Report: Majority of Gartner Supply Chain Top 25 for 2014 Have Utilized LLamasoft