Production Modeling: Top 5 Initiatives to Drive Breakthrough Performance

Introduction

> *Production modeling was once only used by plant-level operations engineers to help utilize capacity or schedule production. Today, many of the world's leading companies have found that modeling production footprint, operations and capacity as part of their end-to-end supply chain practice can be the key to outperforming the competition. And that extends far beyond the four walls.*

Recent advances in supply chain design technology have opened the door to a new era of extremely valuable enterprise-scale optimization. Companies can now manipulate large amounts of data to model, analyze and optimize their end-to-end supply chain operations, from large-scale network optimization all the way to SKU-level inventory optimization and transportation analysis. As part of this continuous supply chain design process, production modeling can be used to identify major improvements in cost, service and risk mitigation. From long-term and strategic initiatives to short-term and tactical planning, this white paper highlights five production modeling initiatives. Each section describes operational choices and challenges businesses face, along with real-life examples of how some of the world's leading companies have leveraged production modeling to help clarify these choices and drive true competitive advantage through better supply chain design.

Top 5 Production Modeling Initiatives to Drive Breakthrough Performance

1. **Manufacturing Strategy**
2. **Production Footprint Optimization**
3. **Capacity Planning**
4. **Sales, Inventory and Operations Planning (SIOP)**
5. **Risk Analysis**

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Supply Chain By Design

1. Manufacturing Strategy: What Should I Make, and Should I Outsource?

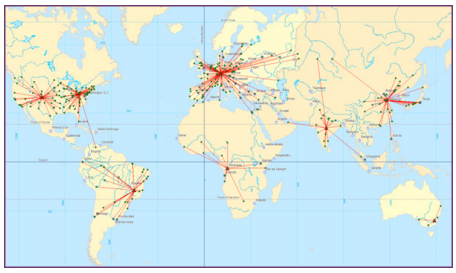
One of the most important decisions production or manufacturing companies face occurs prior to any decisions about how they will make and distribute their products: should they make those products at all? This question is often referred to as the "make vs. buy" decision. A second critical decision in this stage is where to make things. This challenge is often referred to as the "off-shore vs. near-shore" or "low-cost vs. local" question.

In making these fundamental 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.

Case Example: Make vs. Buy

A major global beverage retailer was planning to introduce a new product line. The big question was, should they produce the new product in their own facility or use a contract manufacturer? There was considerable risk involved in the launch. The new product was untested; it was uncertain whether it would be successful or not. In order to determine the optimal strategy, the company, taking into consideration the demand forecast, looked at the cost structure over three, five and 10 years of investing in the capital required to make the new product compared to outsourcing production. Outsourcing would be costlier on a per-unit basis, but given the risk and up-front investment cost required to produce the product themselves, this alternative may be better in the short term. Once the initial model was built, the company did sensitivity analysis around fluctuations in demand to determine the best production decision at varying demand levels.

Optimize for tax/duties in order to better understand and predict manufacturing costs in different regions



Optimized network without tax considerations

Tax efficient network

Case Example: Off-Shore vs. Near-Shore

A high-tech 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 this no longer be a good sourcing decision? By running sensitivity 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.

2. Production Footprint Optimization: Where and How Much Should I Make?

Another set of strategic decisions manufacturers need to consider involves the production footprint. Put simply, the "footprint" represents the physical facility and quantity in which each product is manufactured, along with the capacity required to make it happen. Just as with the initial manufacturing strategy questions, production footprint decisions are best made when considering the end-to-end supply chain, not just local or point-in-time requirements. Oftentimes 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.

Case Example: Capital Investment Planning

A major hard drive manufacturer was limited to a certain production quantity due to capacity constraints. Demand for the product was much higher than capacity. The company wanted to find out at what point would it be a good business decision to invest in additional capacity to meet demand levels, or whether it was a better choice to just continue at current capacity and take in profits. There were several risks involved in either decision, of course: staying the course would mean risking the introduction of another competitor. Investing in additional capacity would be expensive and where would the optimal location for a new facility be? Using a production footprint model with a three, five and 10-year horizon, the company was able to predict the best time and location for additional capacity.

Case Example: Facility and Asset Location

A large U.S.-based global petroleum company had decided to step back and reevaluate the best locations for its facilities and whether it made sense to consolidate any of these locations. In addition, because of the local overload of oil supply in the U.S. at the time, the company was also considering exporting more product out of the U.S. and selling it into Europe and other locations. The company was able to build a model that considered local demand, pricing, regulations and facility costs in order to make more informed decisions about facility location, where best to add capacity and how to utilize postponement strategies to move a percentage of product as raw material and a percentage as finished goods in order to attain the best frequency and mode combinations.

The assessment of actual production asset utilization on a rolling horizon basis allows users to foresee future requirements and plan accordingly

3. Capacity Planning: Utilize Existing Capacity for Lowest Total Cost

Even with a manufacturing strategy in place and the production footprint decided upon, there are still many tactical decisions that can drive significant cost savings and operational improvements. Detailed models of the entire production capacity as a function of the end-to-end supply chain can help a business determine the production location, timing and quantity of each product throughout the network to best utilize capacity at the lowest total cost. Modeling results can also determine lot sizing, labor shift allocation, working hours or best utilization of changeovers.

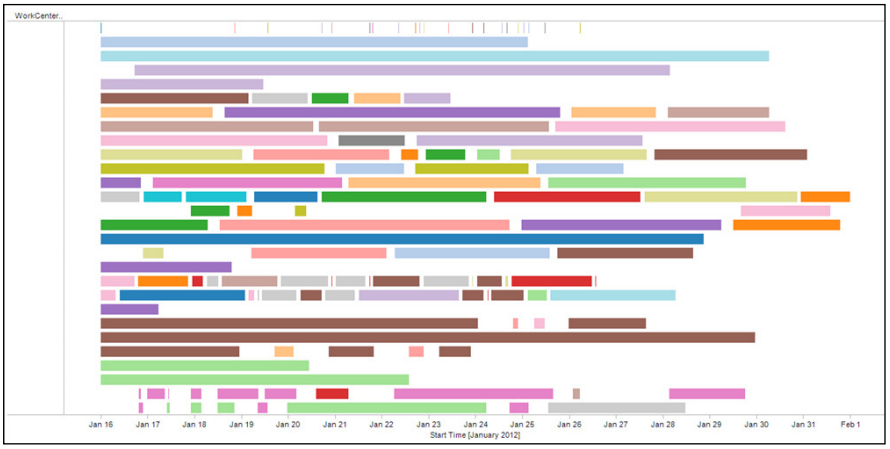
Case Example: Product Allocation

A large food manufacturer had already made investment decisions around facility locations and production footprint. The next question was how best to utilize that footprint. Over time, demand for its product fluctuates to different regions of the U.S. and the company wanted to evaluate the impact of shifting locations from which raw materials were source in order to provide a lower total cost. For example, if the company has 10 plants where a certain kind of soup is made, where and in what quantities should the soup be made, based on current raw material sourcing costs, transportation and facility costs? By utilizing capacity modeling to simply balance variables and capacity, the company uncovered $50 million in cost savings in just one year, without any changes to the physical production footprint.

Case Example: Asset Utilization

A global food producer was experiencing rapid growth in Latin America. In order to continue to serve these burgeoning markets in upcoming years they needed a model that incorporated bills of material (BOM), production details and times, transportation policies, supplier lead times and purchasing rules, changeover times, and all other pertinent details for 90 production lines and 5,000 SKUs for each of the countries in Latin America. The company was able to answer important questions such as which production lines will reach capacity and when, and at what point is it better to increase productivity of a line versus purchasing additional line capacity or building a new plant.

Detailed asset utilization simulation enables a food manufacturer and distributor to match production capacity to demand forecasts in order to quickly determine the optimal plan for weekly production. This example shows how optimization and simulation can be combined for work-center-level weekly production plans.



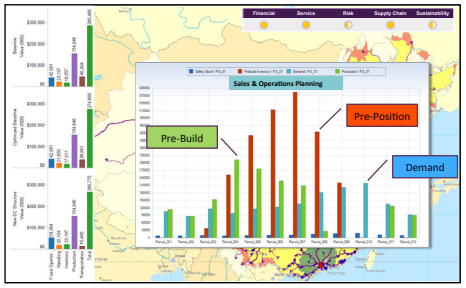
4. Sales, Inventory and Operations Planning (SIOP): Fine-Tune Production Plans in Response to Changing Conditions

In order to remain competitive, organizations need to adjust their production plans in reaction to changing market conditions and demand forecasts. Seasonality, promotions, and other situations that influence product demand can place stress on production schedules and overall capacity. Therefore, it is important for companies to regularly review demand forecasts as the information becomes available so that they can best balance limited production capacity with demand volumes that often exceed this capacity. This requires production strategies such as pre-building of goods or pre-positioning of inventory for certain products so that capacity remains available for the most critical items.

Detailed modeling is an essential means of determining the SIOP strategy. These models can be built to include such detail as changeover times; using simulation technology, businesses can get a detailed, accurate picture of exactly how much time will be required for changeover for each product type. BOM detail can easily be incorporated into models using ERP data.

Case Example: Product Allocation

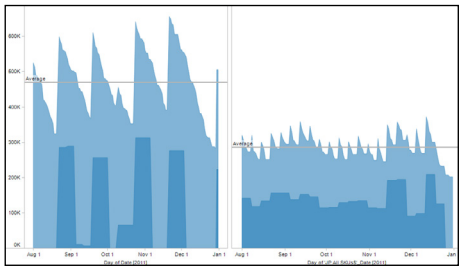
A global beverage producer wanted to analyze how its monthly tactical production planning could be adjusted based on demand changes. Seasonality, product promotions and new product introductions all had an impact on demand. A detailed model with a four-month rolling window of demand helped the company determine which products to schedule for production when, based on factors such as line capacity, cost and shelf life. As demand information becomes available, changes can be made on the fly in order to best utilize available capacity for lowest total cost.



Example sales and operations planning graph displays prebuild inventory, demand and production

Case Example: Product Allocation

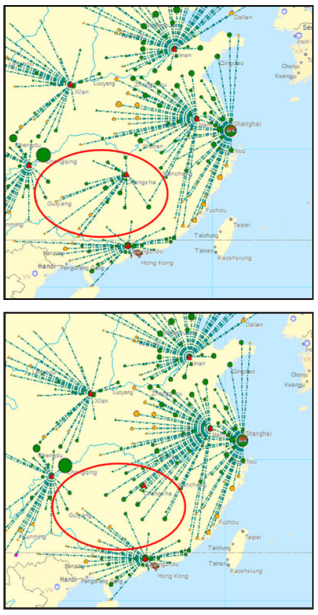
Utilizing modeling has made a significant impact on cost and inventory levels for a tobacco company. The company utilized product segmentation and simulation in order to create a more predictable production schedule and better meet demand. The models and simulation tests provide confirmation that the proposed production plans will work, and has aided in the change management process by visually demonstrating new, better production processes for senior management.



Smoother and more predictable supply plans and compressed cycle times (before and after shown), resulting in faster product flow at lower cost and lower inventories

5. Risk Analysis: Respond Quickly to Planned and Unplanned Events

Given the new global reality of sustained volatility, complexity and rapid change, risk management has now become a hugely important topic. Utilizing supply chain design modeling technology has become a critical method for companies to examine how their supply chain will perform under a wide range of market conditions and assumptions, and analyzing the trade-offs between cost, service and risk. Companies that maintain these living digital models of their end-to-end supply chain have the ability to redesign and re-optimize the supply chain under changing market conditions, and can test the sensitivity of their key assumptions. These companies are able to mitigate business risk through the engineering of their supply chain operations, therefore enabling significant and sustained advantage over competitors.



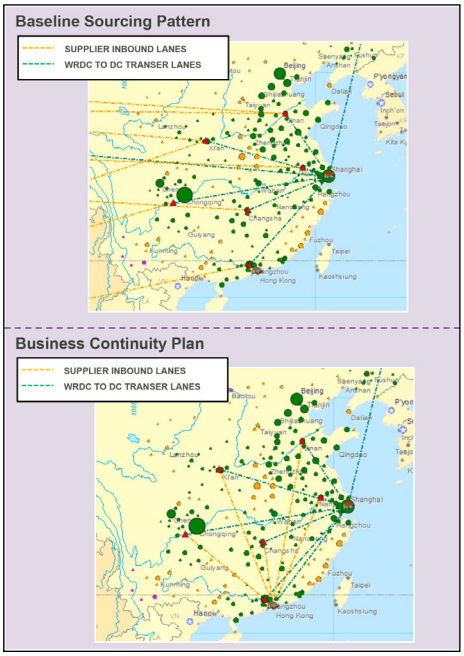
Example of a business continuity plan for facility outage simulation in China

Case Example: Effects of Variability

For a milk and dairy products producer, commodity price fluctuations are a way of life. The company produces different products based on variable market conditions and pricing. Recently, the company began expanding into new regions and utilizing ocean carriers. The challenge was now pricing fluctuations as well as distribution variability. The ocean carrier could arrive at its destination in 45 days but could take as many as 120 days. By building a model and testing different scenarios, the company was able to make more accurate inventory stocking decisions based on unpredictability of new stock arrivals, thus lowering its risk levels in the face of lead time variability.

Case Example: Responding to a Catastrophic Event

When a company has visualized its current supply chain and then optimized for the scenarios that present the biggest risks to the business, it can then react rapidly to unforeseen events. A hard drive manufacturer had these models in place and had evaluated the best ways to keep landed costs down. When a catastrophic flood occurred, a primary supplier was crippled, eliminating capacity for weeks. The company had buffer stock to service all of their customers. Utilizing current supply chain models, they quickly ran scenarios to determine, given lead time, when they would stock out and which alternative methods of servicing customers would be optimal. The company was able to rapidly provide these alternatives, with associated costs, to customers, thereby avoiding uncertainty and protracted delivery delays.



Modeling can be used to pre-plan supply chain responses in response to various risks in supply, demand, weather and geo-political events. This example shows alternate sourcing scenario in response to commodity pricing shocks

Conclusion

At one time supply chain design was considered to be an event that "happened" once every three to five years—if at all. Today supply chain design is a critical business function. Leading businesses are continuously redesigning and improving their supply chains. They are using modeling technology to examine how their supply chain will perform under a wide range of market conditions and assumptions, and analyzing the trade-offs between cost, service and risk. Companies that maintain these living digital models of their end-to-end supply chain have the ability to redesign and re-optimize the supply chain under changing market conditions, and can test the sensitivity of their key assumptions. As part of this continuous re-design process, production modeling can be used to identify major improvements in cost, service and risk mitigation. From long-term and strategic initiatives to short-term and tactical planning, companies across industries are leveraging production modeling to create faster, more efficient and lower cost production strategies, enabling significant and sustained advantage over competitors.

About LLamasoft, Inc.

LLamasoft supply chain design software helps organizations worldwide design and improve their supply chain operations. LLamasoft solutions enable companies across a wide range of industries to model, optimize and simulate their supply chain network, leading to major improvements in cost, service, sustainability and risk mitigation. Headquartered in Ann Arbor, Michigan, LLamasoft, Inc. is a leader in supply chain excellence and innovation, advancing technology focused on continuous improvement of enterprise supply chains for the world's largest organizations.

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