Using Information Technology for Supply Chain Modeling

Developing a model of your supply chain components can quickly give you a view of multiple perspectives and the opportunity to compare what you see to what you expected. To realize full value of this effort, it is crucial that you first develop an overall modeling strategy.

A model can imitate real-world objects, processes or systems, generally on a smaller and more simplistic scale. For purposes of this document, a supply chain model consists of the components within the supply chain such as raw material suppliers, customers, vendors, shipments, manufacturing processes or distribution functions, distribution facilities, and transportation modes, along with the cost of all these components.

A supply chain model will help you understand the impact of changing systems, processes, facility locations and capacities, operations and strategies before implementation. Given fixed or variable inputs, including product demand, the model can process events and/or calculations to produce the same or similar output as that which is being experienced. This process creates a baseline model to which alternative scenarios can be compared.

Investing in information technology projects for supply chain modeling can save your organization time and money, but may require significant capital. An alternative to investing in supply chain modeling software and developing internal resources is to engage consultants who understand supply chain planning.

Consultants have geographic and benchmark data, which can be very helpful in conducting what if scenarios and alternative assessments, and have resources who understand the complexities of various modeling techniques, which can pay huge benefits in developing accurate, timely results.

Combining your knowledge of the businesses with a team of experts in supply chain modeling will enable you to jump-start the process as well as enhance the model integrity. This type of organizational planning and execution allows you to focus on your customers and your core competency, while ensuring that your supply chain will be capable of fulfilling forecasted changes cost effectively.

Strategic and tactical planning

Detailing your business forecast and understanding current capacity is the initial step in this process. Predictive analysis is then used to determine future infrastructure requirements, and *what if* analysis is used to show the tradeoffs of various demand levels with different network configurations. This knowledge will enable the supply chain team to develop alternative supply chain networks focused on minimizing costs, and maintaining service levels. Once the supply chain strategy is defined, then tactical plans need to be developed and implemented to achieve the optimal network configuration within the prescribed timeframe.

Supply chain modeling tools are generally categorized by their functionality in answering (A) supply chain network questions focused on total network capacity and cost or (B) facility equipment and process assessment to determine flow and usage rates used to balance workloads and plan capacity invest-

ments. Following are typical questions representing supply chain modeling project goals.

Strategic Questions

What is the optimal supply chain network configuration to support customer requirements at the most efficient cost?

How many facilities should we have?

Where should facilities be located?

What should be the processing capabilities of these facilities?

How big should facilities be?

What products should they handle?

From whom should products be sourced?

What is the cost of a given service level?

Should operations be further consolidated?

Does outsourcing provide benefit?

What is the impact of adding new customers with varied service expectations?

Are expected operations synergies realistic?

Tactical/Operational Questions

What enhancements to current operations are required to improve throughput, productivity, inventory turns, customer service and cost performance?

How can operations be more flexible to support current requirements and future opportunities?

Where should incremental capacity be added?

Should I upgrade a line, add a new line or new facility?

What is the impact of adding new products?

What is the impact of different transportation modes?

Should I pre-build inventory or increase capacity?

Should I postpone final processing from manufacturing to distribution?

How do fluctuations in inventory levels affect customer service?

Which type of model?

Using supply chain modeling, you will understand the factors impacting distribution operations. These can be as detailed as an internal process, such as single item order level shipment vs. batch order preparation, or as complex as relocating facilities. Potential distribution operation and material handling system issues, capacities and opportunities for improvement can also be identified. Supply chain models come in two general types.

Static model

A static model is a time independent model that generates a unique set of results based on input. A static model is used when the output yields one acceptable result or results that can be aggregated or averaged over the time periods being analyzed. Insight's SAILS (Strategic Analysis of Integrated Logistics Systems) is an example of software designed for static network modeling.

SAILS can also help to determine inventory deployment and stocking strategies and aid in understanding transportation issues impacted by next-day customer service levels or off-shore vendors.

Dynamic model

A dynamic model, formally called a simulation model, is a time dependent model that utilizes probabilities and statistics to generate results that vary according to events that occur within the timeframe of the simulation. A dynamic model is used when multiple simultaneous processes and events may occur randomly within the time period being analyzed that are too complex to aggregate manually or where averaging the results would be insufficient. Rockwell Software's Arena is an example of software designed for dynamic modeling, typically used within a facility.

The right information technology?

The appropriate information technology depends on the type of model you desire. SAILS utilizes sophisticated mixed integer linear programming to consider factors such as transportation and facility operating costs to minimize total supply chain cost and optimize the entire supply chain network. Arena uses probabilities, statistics and historical data to simulate processes and events that occur dynamically and are tracked over time.

Before you begin

The first step toward developing a successful model is to create a project charter defining the scope and expectations of the model. Naturally, this is possible only when you have an in-depth understanding of current supply chain practices. The second step is determining what results you expect the model to produce or what questions you want answered.

The third step is recognizing what data is required. Typical inputs are:

- Finished products and raw or component materials
- Geographic stratification of product demand
- Facility data
- Detailed fixed and variable costs
- Sales forecast by product category and geographic region
- Customers and sales channels
- Inventory policies and status
- Performance cycles
- Performance measures (current results and desired goals)
- Operations, methods and practices for all entities to be analyzed
- Statements of constraints
- Functional relationship of all model variables

A well-crafted supply chain model provides the following analyses:

Sensitivity - Relative impact of changes in input data on solution results.

Comparative - Total cost or service calculations of two or more courses of action.

Break-Even and Return on Investment - The changing nature of total cost as a function of volume between two or more alternative system designs. The factors that cause the designs to yield similar results may be evaluated to determine ROI justification and payback periods.

Network Optimization - Considering the distribution channel as a network of nodes and arcs, where costs are incurred to move goods between nodes. The network model objective is to minimize throughput costs subject to supply, demand and capacity constraints.

Supply chain modeling

Whether you choose to model your supply chain internally, or hire consultants to assist you, the effort can result in significant savings. You will learn a lot about your internal network, and be able to identify ways to work more effectively with trading partners by recognizing the cause and affect of things like cross-docking, vendor-managed inventory and changing transportation modes. You will also see how to better serve your customers more cost effectively. You will realize a return on this investment over multiple years of the planning horizon. And the payback will be immediate.

216.206.4700
www.jasedlak.com
info@jasedlak.com