Put Network Modeling in Your Arsenal of Analysis Tools

Decisions affect cost, lead time and customer service

A well-designed supply chain network configuration can reduce annual operating costs by up to 15 percent and often decrease lead times as well.

A proactive, continuous evaluation of your supply chain network is analogous to changing the oil in your automobile. It needs to be done proactively to ensure a long-lasting return on assets, and to minimize potential failure. More importantly, it provides peace of mind, so that as business conditions and variables change, your supply chain network continues to run on all cylinders.

Many companies have not performed a formal analysis to determine if they have the right number of DCs, and best locations and capacities to support current operations and forecast growth. Instead, facility location is often based on judgment alone, such as a general desire to be near plants, suppliers or customers. Other DC locations are inherited from corporate mergers and are arbitrarily broken down into separate buildings and locations by company division. Some locations are even chosen based convenience and proximity to the president's residence.

Supply chain network modeling is an objective, mathematics-based approach to determining alternative, lower-cost supply chain network configurations. It is the process of representing your network data in aggregate cost, size, volume and location terms, defining parameters (e.g., potential DC locations) and constraints (e.g., limit the total number of DCs to three or fewer), then feeding both sets of inputs into a modeling tool that runs via complex optimization algorithms.

The model outputs the least-cost locations, numbers, and sizes of DCs. It also assigns the least-cost sourcing locations and product volumes to each manufacturing plant, supplier, DC, and customer location. Finally, it provides a cost estimate for the entire network, as well as detailed cost estimates for each of the DCs and transportation lanes in the model.

Why Model Your Network?

The main reason to model your supply chain network is to identify opportunities for long-term, multi-year operating cost savings. Unlike ad-hoc logistics cost reduction efforts, such as annual bidding of transportation contracts, changing your network configuration impacts your overall logistics cost structure. A more efficient network structure automatically reduces all logistics costs based on that structure. In other words, if your new DCs are now closer on average to suppliers and customers, you will automatically save on transportation costs (independent of carrier contracts), simply because your merchandise is traveling a shorter distance.

Another reason to model your network is to identify cost-effective opportunities to reduce lead time to suppliers or customers.

Although it seems the goals of lower network costs and reduced lead times might be mutually exclusive, there are many times when a reduction in the number of DCs can actually reduce lead times. This occurs when new facility locations are closer to suppliers or customers.

Although the model cannot quantify the dollar benefits of reducing lead time, many network optimization programs help quantify lead time reduction through statistics such as average weighted distance between DCs, plants, suppliers, and customers.

A final reason to model your network is to quickly evaluate logistics-related proposals that may affect network costs and service levels. This is done through the optimization software's "what-if" or "sensitivity" analysis capabilities. For example, the network modeling tool could be used to analyze the transportation cost difference between sending parcel shipments to customers from one central DC (for inventory size economies) versus regional DCs (for zone skipping). Or, the model could be used to evaluate the cost impact of consolidating reverse logistics operations at a single DC. This might be proposed if a DC has extra space for returns or is located closer to a key product supplier.

When to Model Your Network

If you have never modeled your company's supply chain network before, now is the right time to do it. Only then will you acquire hard numbers demonstrating the cost and service differences to operate your current network versus alternative options. You should also model and optimize your network as soon as possible when there are one or more parts that are clearly are not performing efficiently.

Other key times to model your network are prior to a facility lease expiration, during corporate restructuring, or to pursue new sales opportunities. An expiring lease on a DC or a manufacturing plant is a good time to check if you are operating in the right location, because it is easier to move when you are not locked in with an early termination penalty. Corporate restructuring – which might involve your company in a merger, acquisition, or divestiture – generally requires a new network model to be optimized to include your network combined with, or separated from, that of another company. And if your company provides 3PL services, you may want to show a potential client how your network of facilities can provide the fastest customer service at a reasonably low price.

> A major DC that is operating at capacity for most or all of the year, or customer complaints about long and inconsistent lead times are two key indications that it's time to run a network model.

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An expiring lease on a DC or a manufacturing plant is a good time to verify if you are operating in the right location. It is certainly easier and less costly to move when not locked into a lease with an early termination penalty. Corporate restructuring – including a merger, acquisition, or divestiture - generally requires a new network model optimized to include or separate your network from that of another company. If you often change suppliers or customers, partnering with a 3PL with nation-wide DCs can be an effective approach to reduce network uncertainty. Then you could use network model results to form a policy of moving distribution locations within the 3PL's network every few years.

Using Network Modeling: An Example

Recently, a $1 billion footwear retailer with a single DC in the mid-South and over 1,000 stores across the U.S. was considering several strategic initiatives to increase speed to market and reduce transportation costs. The retailer suspected it should have a West Coast DC because the majority of its footwear was manufactured in the Far East (other footwear was manufactured in Europe and arrived through an East Coast port). This meant that shipments bound for West Coast stores were forced to move from the port of entry all the way to the DC and back. However, it was unclear whether the West Coast DC should be company-run and focused on order fulfillment, run by a 3PL and focused on cross docking direct-to-stores, or some combination of the two. Based on this retailer's logistics data, operational constraints, stated strategic goals, and the results of a separate cross docking cost reduction study, a network model was built and optimized to help answer the following questions:

- Is the extra cost to operate a West Coast DC justified by the transportation and inventory-holding cost savings alone?
- Where is the least expensive metropolitan area to operate the West Coast facility?
- Which set of stores should be served by the West Coast facility and which set of stores should be served by the existing DC?
- How many square feet would the West Coast facility require over the next five years?
- How much would operations reduce space and labor needs at the existing West Coast DC over the next five years?
- How much more would it cost to hold the additional inventory required in a two-DC network instead of a single DC network?
- Is it less expensive to perform order fulfillment or cross docking from the West Coast facility?
- Is it less expensive to cross dock from the West Coast facility direct-to-stores in the western U.S. only, or to all stores, bypassing the existing DC?

In the end, the retailer used model results and a subsequent ROI analysis to justify implementing a cross dock operation from a 3PL facility to West Coast stores. The cross dock may eventually operate from both coasts, involve all retail stores, and ship more than 50% of all inbound footwear.

Network Modeling Limitations

Network modeling is designed for long-term decisions on network structure. It is not appropriate for analyzing supply chain processes that operate over a relatively short time frame or that require a detailed examination of supply chain parts. Model inputs and results are typically aggregated over an average annual period or represent an overall average across all network DCs or transportation lanes. For example, DC size represents the average space needed throughout the year, while transportation modes (e.g., ocean, air, rail, TL, LTL, pool, parcel) are typically modeled as a single carrier with a single set of rates and discounts based on overall route averages. Thus, evaluation of where to place inventory on a month-to-month basis, how best to lay out and operate a particular DC, or which specific transportation carriers to use are better left to other analysis methods.

A network modeling project can also be complicated for the layman to manage. The process of interviewing key stakeholders, collecting and validating data, inputting model parameters and constraints, running the model and recording results, analyzing transition costs, calculating ROI, and getting buy-in from the rest of the organization can take 1.5 full-time analysts up to 14 to 16 weeks. If your network has multiple echelons of DCs (reserve warehouse and forwarding DC) or if you currently have two or more DCs, it is a good idea to hire an expert or use dedicated modeling staff to manage your network project. Only then will you have enough confidence in the results to proceed with actual implementation of a different, model-recommended network structure.

Final Thoughts

Supply chain network modeling is a powerful deterministic tool for evaluating the inter-dependencies that exist in your supply chain, with the goal of reducing costs and improving customer service. Model output includes not only the best locations, sizes and number of DCs, but also the best assignment of suppliers and customers to DCs, the optimal amount of product to store at each DC, changes in average distance between DCs and other network locations, and comprehensive operating cost projections for all network DCs, other network facilities, and transportation lanes. Modeling software also supports comprehensive sensitivity analysis to quickly analyze how different projections for future data inputs will affect optimal network configurations. For all these reasons, network modeling deserves an important place in your arsenal of supply chain analysis tools.

For more information, please contact 877-684-7700 or inforequest@envistacorp.com.

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