Best-in-Class in Wholesale Distribution Series

Network Optimization:
Designing a Distribution Strategy

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Business is changing rapidly and wholesale distributors are in the middle, playing a critical role in helping their manufacturing and customer partners manage the supply chain and all the activities that go with it (inventory management, logistics, sourcing, payment, etc). In one recent study, 80% of CEOs said Supply Chain Management was **important or very important** for the success of their company, and within five years this number is projected to grow to 88%. In addition, external dynamics are impacting distributors in a profound way. Including:

- Customers who have more choices on where to get product and what they will pay for it. They are demanding more from distributors.

- Costs which are increasing at an ever faster rate and distributors have not or cannot pass on these increased costs. These costs are payroll, healthcare, and financing to name a few.

- Technology that is helping distributors to deliver things better, faster, cheaper, smarter - and more customized. This has been a great productivity tool for distributors in the past to help bring down costs.

- Channel partners that are forcing distributors to become more efficient and productive in search of profits. Distributors have responded primarily by rationalizing and leveraging their supply base and have achieved mixed results.

- Increased and new forms of competition and Globalization that have commoditized some products and industries, focusing attention on price and service as differentiators. Distributors try to remain current with this trend.

FedEx recently studied 197 publicly-held durable and non-durable distributors and found the following financial issues:

- Return on assets (ROA) remains low between 3%- 4% from 2000 to 2004. (see below)

- The median revenue of these companies was approximately $763 million, and the operating income margin was approximately 3.5% or $27 million. (See below) which although low is within a point of two of historical averages.

Thus, to increase profitability, distributors must focus on getting more out of existing assets. If network operating costs (inventory, facility and transportation) are about 8.0% of revenues, then the median public distributor spends about $61 million managing their network. A 10% improvement in managing this cost would result in $6 million increase to the bottom line or increasing operating income 22%. The data and this example provide a compelling case of why distributors are looking at new and creative ways to manage their business.

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1 Finlistics, FedEx, and Achieve Consulting study 2005.
2 Council of Logistics Management “State of Logistics” report
It was from the external dynamics and the fact that distributors are struggling to remain profitable that FedEx decided to launch a series of Best-in-class in distribution seminar series aimed at trying to help distributors address their key issues (internally or externally). By studying these problems, we hope to understand the issues distributors are facing and possible solutions.

FedEx has two goals in mind for this best in class series:

1) To help the distributor better understand their industry, their supply chain and the issues impacting them and;

2) To develop tools that distributors can use to improve their business.

We hope you enjoy this and future papers. If you have any questions, comments, or suggestions, please contact your FedEx sales rep or email us.

Sincerely,

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FedEx Distribution Industry Consultants
Best-in-class distributors understand the importance of a well-designed network and its implications relative to cost, investment, customer service, and profitability. These leaders make the review and analysis of their distribution network an ongoing priority and know that distribution networks can be designed and developed to deliver the service, cost and quality capability that are aligned with business objectives.

In this whitepaper we explore the common network model strategies employed by organizations and discuss methods for analyzing your network model.

**Key Findings:**

- Network model analysis is a powerful tool to improve overall supply chain performance. However, network model analysis is an often overlooked tool to unlock hidden supply chain opportunities.

- There are inherent tradeoffs between cost and service in any network. Consequently, there are many acceptable network designs but only one optimal one for a distributor.

- There are three basic distribution network models that can be employed by distributors: single site, multi-site and hybrid models. The hybrid model has 2 variations – the hub-and-spoke or mixing center models. All other distribution network designs are one of these models.

- The number of potential configurations can be mind boggling, but the method for arriving at the “best” answer is generally follows the same 4-step process.

  ![Perform Network Analysis](image)

  - While the process used to conduct a network analysis can be consistently applied, the methods used to do the actual modeling can vary dramatically in complexity and detail. Simple modeling problems can be solved using Microsoft Office tools such as Excel and Access. More complex models may require a powerful combination of linear and mixed integer programming models to “theoretically optimize” its network model based on available data.

- The output of a network modeling effort can provide a valuable roadmap for a company assessing its distribution network. At this point the organization has some heavy lifting to do to make the vision a reality. Once the solution of choice has been selected several key tasks remain including:

  1. Determining how to execute the network model and
  2. Selecting specific sites for facility location.
The Distributor's Network: A new view is needed

Every distributor transporting goods faces a similar business challenge – utilizing their distribution network to deliver products fast and cost effectively to an ever more demanding customer while reducing inventory investments and lowering costs. The distribution network includes all of the facilities, inventories and services associated with procuring, storing, picking and shipping products and can be designed and developed to deliver the service, cost and quality capability that are aligned with business objectives.

The cost of managing the network is costly, at about 8% of revenue, but also has strategic implications as it dictates how distributors will provide the service and quality aligned to its business objectives. In other words, it is a major driver of distribution value, growth and profitability. Best in class distributors understand the importance of a well-designed network and its implications relative to cost, investment, customer service, and profitability. These leaders make the review, analysis and investment of their distribution network an ongoing priority.

Many distributors' networks are ineffective. Distributors look only to try to manage the variable cost portion, transportation and inventory carrying costs, and often fail to notice the semi-fixed facility cost. More importantly, they overlook the affect a well-designed distribution network can have on a company's top-line revenue growth, customer service and profitability.

Companies avoid conducting the fact-based analysis required for a strategic network design owing to the multitude of interrelated data that must be considered, including transportation costs and capacity, ship to locations, labor costs and availability, inventory investments and holding costs, and other operational costs and investments.

However, there are several key drivers that indicate a review of the network model may be in order. These key drivers include the following:

- Acquisition, divestiture or merger activities
- Expansion into new geographies or new product categories
- Shifts in customer or supplier base locations
- Expected growth in customer demand
- Reliance on expedited shipping methods to meet customer delivery demands
- Distribution points that serve distant customers using LTL or overnight parcel shipments
- Facilities that are out of space and without expansion capability
- Outsourcing storage and/or fulfillment activities to higher cost third-parties
- Inventory levels growing faster than sales
- Operating costs growing faster than sales
- Poor operating conditions at existing facilities.

While all of the above can drive the desire to conduct a network model analysis, the pace of change for most businesses makes periodic reviews a worthwhile practice. Deploying and configuring the right assets in the right locations is a major factor in the overall performance of any distribution network. Companies that focus on their network model are often rewarded with a cost efficient and customer responsive distribution network. A well-designed network model can deliver increased value for your company in the form of:
- Reduced operating costs
- Reduced transportation costs
- Reduced inventory levels
- Improved customer service
- Higher return on investment

Moreover, well-designed networks are able to handle current demand while remaining flexible enough to react to ever changing customer and market demands.

Benefits of a Good Network Model

A fast growing automotive parts distributor in the U.S. and struggled to cost effectively support over 1,500 dealerships through a network of 2 large DCs and 9 smaller facilities. This network had evolved over time and had not been analyzed in 20 years.

The company embarked on an analysis of the network model used to support 100 related dealerships. The analysis indicated that the current DCs were poorly located. Upon relocating several of the DCs the company was able to reduce overall operating costs by over $2.0 million while increasing the speed of parts delivery by over 100%. In addition, the company scrapped an expansion plan scheduled for one of the current DCs.

Tradeoffs Definitely Required

A major healthcare company undertook a network analysis of their European distribution operations. The company had 12 facilities spread across 7 countries and recognized the opportunity to consolidate facilities. The ideal scenario from a cost and investment perspective was to consolidate the 12 facilities into 2. This scenario resulted in system-wide savings of over $7 million. However the company had to account for certain customer service requirements that the 2-location model could not meet. The end result was a 5-location model, $5 million in system-wide savings, and the ability to satisfy customer service demands.

In general, some basic relationships hold true with respect to network models. First, as it relates to customer service more facilities are typically better than fewer facilities. The assumption here is locations closer to the customer are more responsive. So, all things being equal a distributor wanting to increase customer service would continue to add facilities into its network in order to better serve its customers.

However, such a strategy comes with significant costs and investments. There are 3 main cost components that generally

Network Models and Tradeoffs

Before exploring the various network models employed in distribution it is important to understand the fundamental objectives of a well-designed network to ensure they are aligned with the overall company goals.

At its core, a network model strives to do 3 things:

1. Meet the needs of the customers it serves;
2. Meet those needs at an acceptable level of operating cost;
3. Accomplish both 1 and 2 while providing for an acceptable return on assets (for this purpose assets are represented by capitalized facility assets and investments in inventory).

It is important to understand that even the most “optimized” network model will require tradeoffs and sacrifices in order to satisfy all of the objectives identified by the company.
move higher as more facilities are added to the network. This relationship can be depicted graphically (Figure 1). As the number of facilities increases the investment requirements (e.g. inventory, equipment, facilities) and the total operating costs (e.g. labor, management, supervision) associated with the model also increase. This is typically offset in part by decreasing transportation costs to customers. Thus, the model tries to balance cost and service.

This balance can be expressed as the "cost-service" equilibrium point where the total cost and customer response curves intersect (Figure 2).

**Network Models – Basic Models**

Given the relationship between customer service, number of facilities, and total cost and investments, it is easy to see that networks can be configured in infinite combinations. At the extremes there are 2 basic models of distribution – the “one-to-many” model and the “many-to-many” model. In between are vast arrays of design possibilities to address the objectives of a robust network design. Let’s start our discussion by examining the basic models on either end of the network model spectrum.

**Single Site Model: “One-To-Many”**

The most basic model is the single site model. This is a model and used by a majority of distributors today. All the goods and activities of the distributing organization are located at a single point. Goods flow into the facility from suppliers and all goods are stored centrally. As customer orders are received they are filled from this single location. The benefits of this model are obvious – facility operating costs are lower owing to the single facility to operate. Typically, this model results in lower total inventory levels and high levels of inventory control. The downside of this model is equally obvious – customer service and the ability to get product to the customer quickly can suffer as proximity to the customer is reduced, especially for a company with a nation-wide customer base. Also, offsetting the lower facility operating costs are higher transportation expenses on both the inbound and outbound sides of the equation. It is referred to as a one to many because it has one facility and distributes to many customers.

**Multi-Site Model: “Many-To-Many”**

At the opposite end of the network spectrum is a multi-site model or “many-to-many” model that features multiple, full service distribution centers located in key markets or regions. In this model, each facility receives all products from the supply base and then ships product to specific customers.

Relative to the single site model, having multiple sites in the network typically results
in higher facility operating costs. These costs are partially offset by lower outbound transportation costs, offset by generally higher inbound transportation costs from long distance suppliers. Inventory balances also increase as the number of facilities with full SKU stocking are added to the network. The benefit of this model is improved customer service owing to the increased proximity to customer locations. While the picture presents a simplified “many-to-many” network it is easy to imagine the numerous options and models that could be employed – and the attendant increased complexity and coordination challenges.

**Hybrids: Numerous and prevalent**

Smaller, geographically focused companies can utilize a single site model effectively and often times employ this strategy. When companies serve a geographic niche most customer locations will be within an 8-hour drive by truck making this a viable option.

At the extreme, only companies that must utilize a multi-site model featuring dozens of full service facilities will do so. Companies in highly time sensitive industries such as perishables view this model as feasible. The vast majority of companies use some hybrid of the above extreme models. The possible models are too numerous to articulate and even to the casual observer it becomes clear that designing and deploying a successful network model can have a significant impact on costs, investments, and customer service.

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**Common Distribution Models**

Considering the design of a cost effective and customer responsive distribution network can be a mind-boggling exercise. The number of models to consider can be staggering and the tradeoffs are required between cost and service.

**Single site**, one-to-many, models often apply for smaller companies that focus on sales and product management – operations command lower priority. However, larger companies that are “parcel” intensive shippers may be able to satisfy demand cost effectively from one large facility. Additionally, companies that distribute high value product or critical parts are more likely to use a single site to minimize the inventory costs and risks.

More common are the **multi-site**, many-to-many distributors, where new facilities are added to service new territories, new products, or improve service performance to key customers. Typically, inventory is replicated across all facilities and performance levels are common to multiple regions. These companies often try to behave as a set of one-to-many companies with emphasis on minimizing intra-facility shipments. Also, companies that ship to customers with high service expectations (e.g., 95% on time, 98% + fill rate) or companies with large shipments (high % of truckload) are more likely to have multi-site networks.

Since so many factors are at play concurrently, most companies utilize a model that includes elements of a “one-to-many” and a “many-to-many” model – call them the “**hybrids**”. The hybrids take many forms but typically fall into one of two broad categories.
Network Model Design Process: Analysis and Scenario

For a distributor with hundreds of suppliers and thousands of customers located across the country or the around the globe the complexity of a network model analysis can be staggering. Conversely, for a local or regional distributor the decision-making process can be fairly straightforward. However, a network model analysis generally follows the basic methodology outlined below.

In Step 1 of the process it is important to define and confirm the company’s overall distribution strategy and objectives. A solid network model strategy supports the overall company mission. The objective might be to operate a high service network or to operate a low cost network. Most objective statements combine elements of service and cost, for example, to design a network with the lowest possible total cost while being within less than a 1 day drive from 90% of the customer base.

The next activity is to gather, clean and validate the data required to conduct the analysis. Any organization entering into a network analysis project should expect 60% to 80% of their effort to be spent on these activities.

As evidenced by Table 1, vast amounts of data can be utilized in a network analysis. Even for the most rudimentary analysis, data for one or more years of the types indicated in the table are valuable to a thorough analysis. Owing to the amount of data and the validation required this activity must be allotted adequate time for completion. The old adage “garbage in garbage out” is very true as it relates to a network model analysis.
Step 1 also includes identifying the critical factors and future requirements that impact the business and its operations. These are typically borne out of the data, but can include prospective changes to the business related to mergers, acquisitions, new products and markets, and other “structural” events. The key deliverable of Step 1 activities is a valid baseline model of network performance – service levels and costs. This is a crucial activity for two main reasons:

- Modeling the current network can further validate the data used in the analysis as the objective is to replicate the results (costs and service levels) of the historical model.
- A baseline level of performance and cost is established against which we can compare alternate scenarios that will be identified in Step 2.

**Step 2** in a network analysis focuses on identifying the potential scenarios to model and conducting first level scenario analysis. A common question early in a network model analysis project is “What scenarios should we model”? At one end of the spectrum companies consider the ‘clean sheet’ optimization scenario where all existing facilities are temporarily disregarded and service time and costs are the only critical factors considered. This produces a theoretical optimal solution for the number and locations of facilities that can then be compared to the actual network. While the results of a “Greenfield analysis” may be interesting, execution of such a strategy is often not practical.

This leads companies to consider the other extreme alternative of optimizing the existing network. This approach accepts that certain constraints may exist and that existing facility locations, service levels and costs are simply too relevant to the final solution. This scenario allows for consolidation and closure of certain locations, but does not allow for a complete redesign of the existing model.

Both of these scenarios should be included in any credible network modeling effort and often help to frame the discussion of scenarios with varying magnitudes of change.

Equally critical to identifying viable scenarios is to clearly articulate the key constraints and key factors to be modeled in each scenario. For example, if in Step 1 the company identified high customer responsiveness as a more critical consideration than low inventory investment, this tradeoff would be considered in the scenarios to model. These conscious tradeoffs need to be quantified (i.e. % of orders received by customer in < x days; no more than $x of inventory in the system on average) so that scenarios can be evaluated as they are developed and tested.

Table 2 illustrates a simple model analysis where the shipper identified Product Demand, Wages, Facility Costs, Transportation Costs and Supplier Proximity as the critical factors. Additionally, each factor was weighted for its relative importance.

<table>
<thead>
<tr>
<th>Key Constraints &amp; Factors (Weighted)</th>
<th>Demand</th>
<th>Wage</th>
<th>Facility</th>
<th>Trans</th>
<th>Inbound</th>
<th>Supply</th>
<th>Proximity</th>
<th>Total</th>
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<tbody>
<tr>
<td>Weighting</td>
<td>40%</td>
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Transportation Costs and Supplier Proximity as the critical factors. Additionally, each factor was weighted for its relative importance.
Locating close to the market (Demand Proximity) and labor (Wages) accounted for 80% of the decision. Viable scenarios were identified as shown in the left column.

Each scenario will be evaluated relative to these constraints in future steps.

**Step 3** of the process is highly iterative in nature. At this point, the data has been validated and the model has been tested.

<table>
<thead>
<tr>
<th>Step 3 - Major Activities</th>
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<tbody>
<tr>
<td>Select the modeling technique</td>
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<tr>
<td>Model the viable scenarios</td>
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<tr>
<td>Conduct sensitivity analysis and “what ifs”</td>
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<tr>
<td>Evaluate and narrow the scenarios</td>
</tr>
</tbody>
</table>

Also, static scenarios have been evaluated and the results quantified. What remains is to assess the robustness of each scenario given dynamic changes in the assumptions. A wide variety of modeling techniques are available and the company should explore the technique that is best suited for their network.

Larger and more complex organizations will want to explore the benefits of a true optimizer tool. These software tools require large amounts of data and information. Their optimization engines will then run millions of calculations and return a “theoretical ideal” given the data and constraints identified by the organization.

Excellent products are available from a variety of vendors including LogicTools, I2, Manugistics, MicroAnalytics, Insight, and Logility. Many ERP vendors including Oracle, SAP, and SSA Global now include some level of network modeling capability with their advanced planning modules.

Software costs can range from $10,000 per user for a small company to $250,000 for a larger company requiring multiple user licenses. Buying the software outright is a good option for companies that are constantly evaluating their network model. Companies that will review their networks less frequently may want to “rent” the software and have the vendor or qualified consultant run the network modeling tool. Many vendors, consultants, and 3PLs now provide such services. The cost range here can be $25,000 to $500,000 depending on the complexity of the network, number of scenarios to run, and the software tool to be utilized.

While it is impractical to test all the potential “what ifs” that might occur, identification and...
testing of a handful of viable alternative assumptions is both practical and prudent. This iterative testing leads to a few good choices to optimize more thoroughly.

**Step 4** in a network analysis is the final validation, selection, and justification of the selected network. The validation activity consists of a thorough review of the scenario as a practical solution for the business. Not only should the “numbers” support it, but it should also make sense for the business. It is interesting to note that the scenario chosen may not be the lowest cost, lowest investment, or highest customer service scenario identified during the scenario evaluation activities. Often times the selected scenario is the one that best balances the tradeoffs among these 3 competing objectives. Comparing the results with the baseline is instructive for building the business case for change. Lastly, a detailed action plan of how to change from the existing network to the desired future state must be developed to properly determine the one-time costs.

### Network Modeling Methods – From the Simple to the Mysterious

While the process used to conduct a network analysis can be consistently applied, the methods used to do the actual modeling can vary dramatically in complexity and detail. We have outlined a few methods below to illustrate different levels of complexity.

One simple method is “criteria weighting”. Under this method, network scenarios are developed and evaluation criteria created. Then each criterion is given a weight based on importance to the overall business. Finally, the scenarios are scored against how well each meets the specific criteria. This method results in a solution that is most favorable relative to the other scenarios considered.

The pros to this method are its simplicity and analytical approach; the cons are that the weights and criteria are subjective and altering them, even slightly, change the best fit scenario. Nonetheless, this method provides a guide.

Another simple method involves basic mapping exercises using rudimentary geometry to triangulate around critical demand or supply points. The most basic of these methods, the p-center method, triangulates demand to minimize the total distance from the “best” location to all demand points. This is commonly referred to as the Diamond Cover technique. (See box on next page on procedures for utilizing and illustrating this technique.)
The advantages to this technique are it is fairly quick and easy to implement and provides a guide to an optimal location. The shortcoming is that it treats all demand points as equal.

A slightly more advanced method, p-Median or “Weber” problem, adds a weighting factor to each demand point so that the facility is located closer to the high volume demand points. This is commonly referred to as the Circle Cover technique and is outlined in box titled P-Median technique. If you assume that order size and costs are relatively constant this method results in a location that minimizes the transportation distance-cost factor of the network.

**Diamond Cover Technique:**

The following steps can be used to for establishing single sites using the Diamond Cover technique:

1. Establish the coordinates of each Demand Point and plot on a map (or graph).
2. Draw lines at 45 degree angles from outside demand points away from neighbor points.
3. Draw a diamond that connects the lines from the outer most points and equalize the sides of diamond to the longest side forming a square.
4. Join the diagonal points at 90 degrees. This will create a small center square inside the diamond.
5. The small center square provides the best location for a site equidistance to all the demand points.

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**Diagram:**

1. **Plot Coords**
2. **45’s**
3. **Square Off**
4. **Connect Points**
5. **Best Area**
This Circle Cover technique does typically result in a better solution than Diamond or criteria weighting, but more complex methods exist. In fact, advancements in computer technology have made these more complex solutions more accessible and easy to use for logistics analysts and managers.

Reiterative computer modeling using widely available spreadsheet and data base models can be used to consider more factors than the simple methods above. These are usually static models that require a fair amount of data collection and manipulation to compare scenarios. Analysts typically create a baseline of the

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**Circle Coverage and P-Median technique:**

1. Establish the coordinates of each Demand Point and plot on a map.

2. Establish weight ($W$) of each Demand Point relative to other demand points. Weight could be based on sales, profits, or number of customers.

3. Draw a circle with radius ($R$) around each Demand Point where $R = p / W$, where $p$ is an arbitrary value (start with a guess).
   
   a) If all circles do not overlap select a higher $p$ value and continue to increase $p$ until all circles intersect each other.

   b) If the intersection of the circles is too large select a smaller $p$ value. Continue selecting a smaller $p$ value until a small intersection area is found.

4. The intersection of circles provides the best location for a site minimizing the total load-distance costs to all the demand points.

Figure 4 below illustrates the Circle Cover technique.

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**“p-Median (Weber) problem”**

- $p = 48$
- Draw circles
- Best Area

<table>
<thead>
<tr>
<th>Customer</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<td>(130, 60)</td>
<td>(70, 100)</td>
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</table>

Figure 4
existing network and then compare viable logical scenarios to the baseline. This method is best suited for models involving up to 3-4 locations. More than 3-4 sites can create too many scenarios to effectively manage through the analysis process.

Even more advanced “heuristic linear programming” models can be used to develop an optimal, theoretical solution that includes all relevant data and can handle more complex networks. Sophisticated computer applications have been developed and commercialized based on these advanced linear programming methods. In fact, many enterprise resource planning (ERP) systems now include some type of strategic modeling module within the advanced planning functionality. These tools still require extensive up-front data collection and validation, but once the model is built, the “what-ifs” and sensitivity analysis can be evaluated quite readily.

**Distributors Network Optimization Case Study**

Let’s examine two real distributors to understand the challenges and analytical method utilized.

- Distributor A is a small stamped metal distributor currently serving the United States out of a single facility located in Chicago.

- Distributor B is a large food and beverage container distributor serving its customer base out of 22 facilities scattered across the United States.

Both distributors are wrestling with network issues. But each has slightly different needs and different methods are used to analyze their situation and determine the optimal solution.

For Company A, changing industry dynamics led to significant profit pressure and the company was interested in answering two basic questions about their network:

1. Did they need more than 1 facility to efficiently and effectively serve their customers?
2. Where should they locate their facility or facilities for the future?

To answer these questions, Company A utilized a simple network model decision path based on off criteria weighting method (Table 3). The primary analytical focus was on the company’s supplier and customer base.

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Demand Proximity</th>
<th>Wage Rates</th>
<th>Facility Costs</th>
<th>Trans Costs</th>
<th>Inbound Supply Proximity</th>
<th>Total</th>
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<td>0.15</td>
<td>4.1</td>
</tr>
<tr>
<td>NC GA</td>
<td>2.00</td>
<td>1.60</td>
<td>0.50</td>
<td>0.20</td>
<td>0.35</td>
<td>4.7</td>
</tr>
<tr>
<td>IL - TN</td>
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<td>2.80</td>
<td>0.60</td>
<td>0.30</td>
<td>0.05</td>
<td>6.2</td>
</tr>
</tbody>
</table>

On the supply side, the company imported the majority of products from the Far East by container into West Coast ports. The data indicated that the vast majority (over 60%) of sales were in the Southeastern and Midwestern United States. Customer service requirements were reasonably flexible so the company determined that a single location would be adequate.

After developing possible scenarios, management turned their focus to determine the best single site would meet their needs. They first identified the criteria important for the location selection. The criteria included the costs associated with a location, the distance or proximity to the market and supply base, transportation availability and rates, and other intangible factors.

Using simple models each scenario was scored using the criteria, weights, and data to arrive at a total score and the scenarios were compared to one another to select the
best-fit scenario. The analysis indicated that the company’s optimal location point was Tennessee. This conclusion was tested for robustness and sensitivities and was ultimately selected for implementation.

The projected savings of almost $700,000 per year on revenue of $25 million provided a significant impact. The entire analysis was completed using basic Microsoft tools such as Excel and Access.

Distributor B had a much more complex analysis to perform but needed to determine the right number of facilities and where they should be located. With a national presence, 22 existing facilities, and a widely dispersed supply base it would be difficult for them to arrive at a good conclusion using the simple “weighting” method like distributor A.

The amount of data required to make such decisions was much larger, more complex and required the effective use of high powered computational technology.

Company B utilized a powerful combination of linear and mixed integer programming models to “theoretically optimize” its network model based on available data. These models used all the available data and assumptions to “solve” the problem indicated by the programmer – in this case the problem to solve was “find me the lowest cost network model that allows me to meet various customer service requirements”.

The primary objective for Company B was to reduce distribution costs which had reached 8% of sales and increase inventory turnover which was less than 6 per year. Most customers expected delivery of product in less than 2 days, but some were more demanding.

After analyzing dozens of potential scenarios, the end result was a network of 15 locations based on customer and supplier proximity. The reduction of 7 facilities led to a 20% reduction in distribution costs and an increase in ROA of over 50%. Customer service levels were maintained and inventory levels were actually increased.

The process to analyze the network for this complex distributor was similar to its less complex counterpart, but the method of analysis and tools utilized were dramatically different.

From Vision to Reality

The output of a network modeling effort can provide a valuable roadmap for a company assessing its distribution network. At this point the organization has some heavy lifting to do to make the vision a reality. Once the solution of choice has been selected several key tasks remain including: 1) Determining how to execute the network model and 2) Selecting specific sites for facility location.

Regarding the execution of the model several alternatives exist. These include company owned and operated facilities, 3PL owned and operated facilities, and company owned and 3PL operated facilities. All of these options have pros and cons. Most likely, some of the cost profiles have been modeled in the network analysis so the company has a feel for the cost sensitivity of each. For companies that view logistics and distribution as a critical competitive differentiator and core competency the company owned and operated model would make sense. For a company that requires more flexibility and where distribution activities provide little competitive differentiation it might make sense to outsource the entire activity to a competent 3PL partner.

Selecting a specific site is usually the last step in the network design project. The network model analysis may have used Chicago as a location to analyze. But Chicago is made up of several counties and can be thought of as an even larger corridor of potential sites. With the help of a good real estate consultant an organization would
engage in a site selection process that evaluated variables such as grants, tax breaks, incentives, specific road access, labor availability and overall location benefits. For example, many foreign automotive manufacturers identified the Southeastern United States as an ideal location for a plant. In the site selection phase however they made decisions between Tennessee and South Carolina, and then made decisions about specific counties within each of those states.

**Conclusion**

Network model analysis is a powerful tool to improve overall supply chain performance. It can help companies:

- Design a distribution network that best meets their needs including the number and location of facilities
- Quantify the cost and operational impacts of different scenarios and alternatives

Although we recommend one four-step approach, there are a variety of different methods to analyze the network and create the optimal one for your wholesale distribution network. In this paper, we have laid out key variables and criteria to consider in network design, a framework and examples of a few methods. We have also designed a tool that can quickly help guide distributors toward the right number of facilities for their network. To access this tool, please go to our website:


In today’s competitive market place can your company afford not to explore the potential of an improved network design?