

What Is Supply Chain Network Design and Why Is It Important?

Supply Chain Network Design - Overview

It is important to recognize that a company's network determines its supply chain efficiency and customer satisfaction. Designing an optimal supply chain network means the network must be able to meet the longterm strategic objectives of the company. Most business units or functional areas within a company are impacted by a network design project. When designing a supply chain the following steps must be followed: 1) Define the business objectives, 2) The project scope must be defined, 3) The form of analyses to be done must be determined, 4) Determine what tools will be used, 5) Finally, Project completion, the best design. Once the path forward is determined and the design approach has been completed correctly, the business will reap many significant benefits.

What Creates Real Economic Value?

Business and operations strategy-the formulation of strategies that drive investment, operations, and competitive positioning-is where all value begins. There are five strategic questions that need to be answered:

1. What business is the company in and why?
2. How should value be added to the business?
3. What are the target markets?
4. What are the products and why will customers buy from this company?
5. What capabilities are needed to assure that the company adds value and differentiates?

Most companies develop strategies for target markets and products #3 and #4. Some at least consider #1 and #2. Few companies resolve #5 effectively. This is generally because operations strategies are not developed or implemented with the same scenario plan or rigor that is given to the more often seemingly interesting issues of markets and products.

The alignment of business and operations strategies is often weak or non-existent.

“The fact is that 90% of business strategies are not implemented through operations as intended.”

Mission and vision statements, plans, goals, objectives, and performance measures while important for driving execution, most often do not ensure that capabilities will be built for scenarios from the business strategies. Therefore, companies do not always have carefully developed alternatives for customer demand, new channels, competition, supply risks, and product development.

Achieving clear and sustained alignment between operations execution and the plans derived from business strategies is challenging. Leadership understands the complexities involved, but are concerned that 90% of business strategies are not implemented as intended. They are beginning to understand that supply chains are about more than logistics regarding the buying and selling of goods, they are about competitive differentiation and profitable business growth.

Leadership is concerned with alignment and how execution can best be used as an enabler of business strategies rather than an inhibitor. Common questions asked by leadership are:

- Our operations and supply chains are not dynamic or flexible enough to change with our new strategies. What should we do?
- We often set targets for margin improvements that our supply chains cannot meet, how can we meet these targets?
- Our business strategies are focused better than ever on our markets and our products. Our operations do not differentiate us from competitor. Are there ways to compete through operation functions?
- Our organizational structure hinders our strategies. How do we get all units to work together more efficiently?
- Why is it that our inventories are either too high or often in the wrong stocking locations, and we incur high costs just to meet demand? Can't we better align our sales and operations processes? How do we become more demanddriven?
- We need to be more competitive. How can our supply chain give us a competitive

advantage?

Strategy Before Structure: Smart companies are realizing that the first step to any network design is to develop the right operations strategy that supports the business strategy. There is no substitute or shortcut. The operations strategy specifies how operations will meet the service needs of target markets, which capabilities distinguish the business, and delivers the operational requirements of the defined value proposition. The operations strategy defines the network capabilities that are necessary to realize the business strategy. The capabilities are the operational elements of infrastructure, business processes, organization, technologies, and solutions that can deliver the specified services. The operations strategy is the starting place. With these newly established capabilities the network design will evolve. If there is not a clearly defined operations strategy then a valid network design process cannot be pursued.

Defining the Project Scope

Most business units within a company are impacted by a typical network design project. Leadership must understand and support which direction the project will take in order for it to be successful. This is where a clear definition of project scope based on the operations strategy becomes critical. What questions need to be answered? What factors need to be included?

All supply chain networks have these key components: customers, sources, facilities, transportation, inventory, customer service, and information technology systems to name a few. Where and how these are located and managed will be determined from a network design. Some of the numerous factors that influence network design decisions are:

- Network Structure, Policies, Practices, and Costs
 - Facilities – numbers, locations, roles, capacities, expansion capabilities, constraints, and costs
 - Distribution Centers (DC), Fulfillment Centers (FC), Store Operations – handling, storage, capabilities, productivity, constraints, and costs
 - Manufacturing Operations – capacities, lead times, and costs
 - Transportation – policies, practices, modes, service times, and costs

- Sources – impact of sourcing from various suppliers, lead times, product flow, inventory, and costs
- Execution Systems – such as OMS, WMS, TMS, and LMS
- Port redundancy and transportation contingency
- Real Estate – Availability of facilities and sites, closeness to transportation (seaports, rail, airports), availability of labor, and local utilities
- Inventory deployment policies – where is inventory stocked, the quantity, and the cost
- TESCO – taxes, tariffs, duties, duty drawbacks, exchange rates, and transfer pricing
- Incentives and grants
- Security – impact of security initiatives such as, CTPAT and CSI.
- Government regulations
- Customer Service rates and levels
- Political stability, clear legal system, and signing international treatments
- Competitive factors locating to capture the market customer response time and local presence
- Sustainability minimizing carbon footprint
- Financial Impacts
 - Capital required for network changes to the company's facilities
 - Costs and P&L impacts

- Cash flow and timing
- Business case ROI

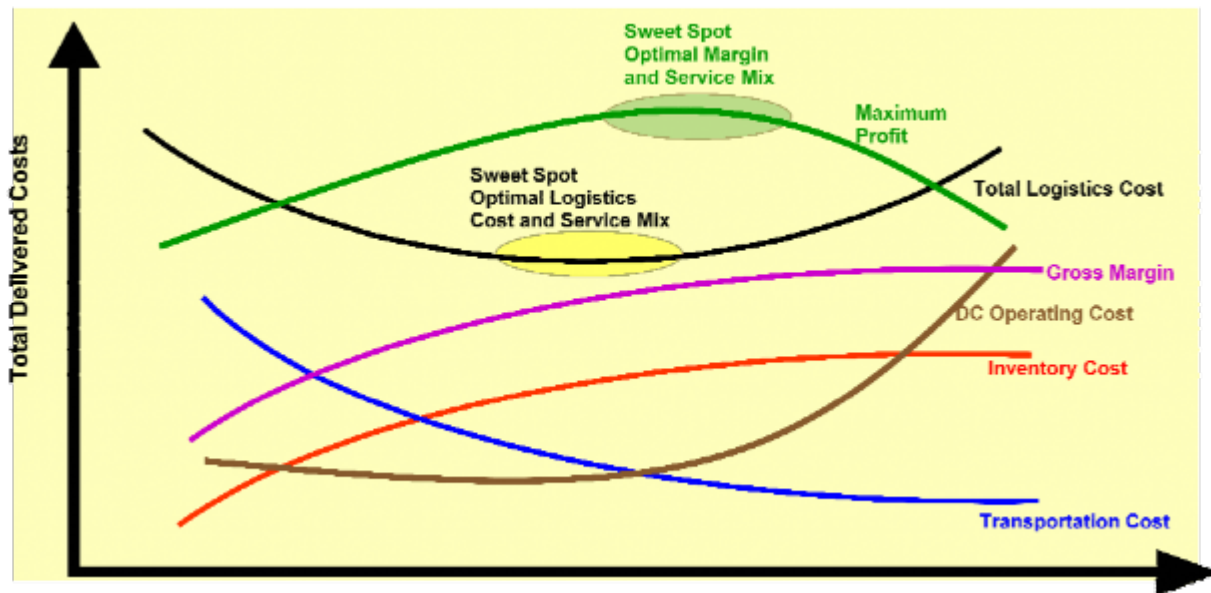


Figure 1

Figure 1 depicts the complexity that an endtoend supply chain analysis should incorporate. Network design that is founded on a factbased quantitative analysis should be coupled with a review of processes, technology, and people that:

1. *Ensure alignment* with the overall business environment and growth strategy to minimize costs and achieve desired service levels
2. *Utilizes the best analytical tool* for the individual project objectives
3. *Analyze alternative processes* to maximize return on investment while delivering improved operational metrics for customer service, inventory control, and transportation performance
4. *Model the design* with the intent to be refreshed with change in inventory policies transportation routes, costs, and service level changes, new product launches, or supply changes

Types of Network Design and Supply Chain Network Analyses

When a company decides to evaluate its network, leadership must first address the type of effort that should be performed. Network designs fall into three basic categories:

1. *Strategic Network Design*: How do I redesign my network of facilities, sources, transportation, inventory, product flow, policies, and practices in a way that best meets the operations strategies and the company's overall goals? Strategic network design often follows:
 - A major business expansion, such as an acquisition
 - A change in business strategy, such as targeting new market opportunities
 - The change of the business with the passage of time
 - Responding to competitive pressures
2. *Tactical Optimization of an Existing Network*: Given a fixed network of facilities how do I find better ways to support nearterm planning decisions (facility use, inventory deployment, transportation optimization, source selection, product flow, and policies) in order to leverage existing networks for more immediate gains? The primary purpose of tactical planning is to plan policies and programs and to set targets to accomplish the company's longterm strategic objectives. Tactical planning must anticipate the facility workloads to prevent overloading the primary resource-the workforce-during peak demand. In addition, the tactical plan defines how to develop the resources needed to achieve the goals in the strategic plan. For example, if a firm decides in its strategic plan that it requires a new warehouse location to enhance customer satisfaction, then the tactical plan should allocate resources for the needed facility.
3. *Contingency Planning*: How does my network handle unexpected emergencies such as a fire or disruption to supply? Contingency planning is one of the most overlooked tools for sound network design. This is a defensive tool used to guard against failure resulting from unpredictable changes in operations. Contingency planning should ask "what if" questions. For example: "What if a major supplier is on strike" or "what if we had a recall" or "what if my primary supplier location is destroyed due to a major weather event?" A prepared manager will look to contingency planning to counter the potentially devastating impacts of the many emergency situations that may directly

affect distribution. Contingency planning is the opposite of crisis management (“putting out fires”). The idea behind contingency planning is to significantly reduce the lead time required to implement a plan of action.

Events that can adversely affect a distribution system include:

- *energy shortages*
- *strikes*
- *natural disasters*
- *product recalls*
- *acts of violence*

Tools to consider

While there are a number of ways to approach the network planning processes. It is usually done with quantitative modeling and optimization tools. The advantage of these tools is that they can evaluate the complex relationships and tradeoffs of the overall system by tying together large numbers of variables in a conceptual framework that makes it much easier for the user to define relationships. This provides the capability to examine dozens or hundreds of options that are difficult to do so otherwise.

There are two main types of planning tools.

1. Optimization Tools including the following:

- **Network Design:** used to design the best network of facilities by balancing the tradeoffs between, demand, revenue, costs, and customer service
- **Inventory Optimization:** used to identify optimal inventory deployment policies and quantities by facility for a given network of facilities
- **Transportation Optimization:** used to determine the best use of transportation resources for a given network of facilities

2. Simulation Tools: used to evaluate how realtime variability can impact supply chain performance and risk

Alternative Modeling / Analysis Tools: In general, the tradeoffs between these different approaches / tools involve speed versus complexity and the need to achieve “good” versus optimal solutions.

Project Completion, The Best Design

Once leadership understands the components of the network then the scope of a project needs to be defined. The typical approach is:



1. **Project Launch:** The first step is to organize the project team and gain alignment on the business and operations strategies. The primary focus at this point is to develop a list of critical issues and identify how each of these may change over time. A good starting point for discussion starts with a review of the current market trends, competitive and financial pressures, and the operating environment. Next, develop a vision of the future market needs and the operating environment necessary to meet those needs. The network strategy must close the “gap” between current and future operating environments. Once the business and operating strategies are fully understood the detailed network planning process can begin.

The second part of the project launch is to develop the overall project management process including the project plan, expected outcomes, team roles and responsibilities, project review process, a schedule, and a communications plan. When kicking off a network design, team members often forget that one of the most important tasks is communication. Without communication a plunge into the retrieval of information and direction to perform a network design will surely experience gaps and an intensive reworking.

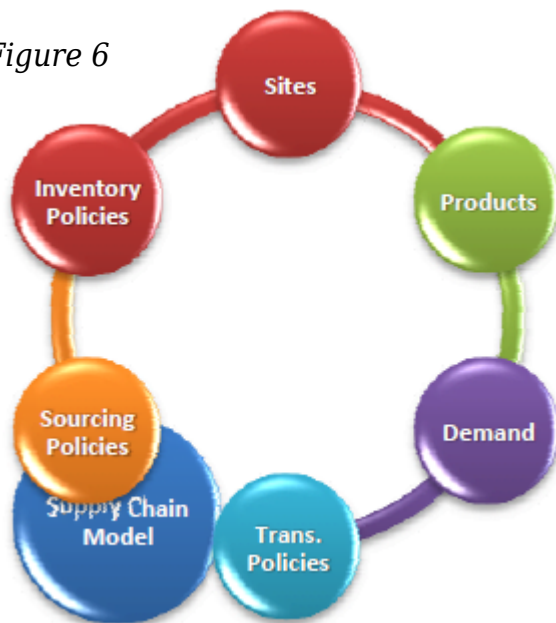
Current “AsIs” Assessment: Next the team needs to document the current network in order to gain the necessary understanding of the current network strategies, products, customers, suppliers, facilities, operations, planning processes, IT systems, and current key performance metrics. The assessment of the “asis” current state will produce a detailed description of “what, why, who, when, where, and how” the current state of the business. It is a good idea to interview all involved staff. Tour all relevant facilities and assess them in terms of equipment, systems, configuration, capacity, and

their capability to absorb volume. This is also a good time to map the current supply chain and to confirm the business situation and problem definition. Other information that is useful is to gain an understanding of customer requirements and expectations regarding service times, order placement, and delivery.

The Final part of assessing the current state is to conduct a best practices GAP analysis of all operations to identify GAP in performance.

2. **Data Collection:** Network design projects require a significant amount of data. Typical data required includes operational and historical data:

Figure 6



- Products and customer information
- Product flows and volumes including seasonality
 - Customer order files
 - Inbound and outbound shipments
 - Intranetwork facility shipments and routings
- Transportation routing, modes, rates, service levels, policies, and costs
- Facility information including assets, operations, capacities, and costs

- Inventory policies, levels, and requirements
- Customer service requirements
- Policies (sourcing, transportation, inventory, and customer service)
- P&L for supply chain operations

3. **Data Validation and Analysis:** As data is collected it needs to be validated to ensure that it is not “polluted.” It must accurately represent the current business and network performance. This is done to ensure entirety and validity of data required for the baseline model and to aggregate the product and customer demand data to the appropriate level.

Often times this becomes a very challenging step. The company must understand that network design projects require significant resources that recognize a sense of urgency but also a need to ensure that the information collected is accurate. There are costs and impacts to the accuracy of the network analysis if the beginning information is in poor condition.

4. **Baseline Model:** Create, configure, calibrate, and validate a baseline model that accurately replicates the existing “asis” network. Reach a mutual consensus for the analytical baseline that will be used to compare the predicted cost and service improvements with alternative network scenarios. Run baseline scenario analyses and validate model output for historical volumes and performance. If required return to the baseline model and recalibrate until consensus is achieved on baseline results. Establish evaluation criteria and KPIs for all network scenarios.

5. **Scenario Modeling and Analysis:** Identify alternative network designs that meet the business strategies. Test and analyze the alternative designs using the model and analysis outside the model in order to gain insight into the comparative potential benefits of the various network designs. Scenario modeling is where the company needs to identify the impact to customer service delivery. Including demand as part of the analysis of a scenario focuses on the revenue side of the equation and not just the cost side. The design objective becomes profitable growth and not just cost optimization.

Companies also need to pay attention to **ALL** of the costs associated with fulfillment including: capital, expense, and operating costs – for all fulfillment facilities – DC, FC, RFC, LFC, LFCP, and stores. For example, if stores are used for fulfillment of ecommerce orders then the cost of arranging the store, setting up the systems, hiring

any additional labor, and training needs to be included in the initial capital and expense. The impact the store fulfillment has on product flow and order fulfillment at the FC or DC needs to be considered.

Executing the model for each network scenario will identify the:

- Network configuration including the number of facilities, locations, roles, sizes, capacities, and costs
- Facility highlevel design concepts, capital, operating costs, and performance
- Transportation routing, modes, rates, service levels, and costs
- Reverse logistics and customer returns
- Inventory levels and deployment costs
- Network performance including:
 - Projected impact to demand
 - Total costs to serve (facilities, labor, transportation, and inventory)
 - Customer service levels by channel and/or location
 - Overall value proposition – costs to benefits
- For most promising network scenarios run sensitivity analysis around service levels and key drivers such as, transportation rates, fuel prices, labor costs, and order volumes
- Finalize economic analysis
 - Determine transition costs to implement each alternative

- Capital
 - Expense
 - Offsets for grants and incentives
- Develop financial model to provide the complete cash flow story by scenario to include total operating costs (facilities, labor, transportation, inventory holdings, and costs) capital expenditure requirements, inventory assets, and onetime expenses
 - Finalize financial analysis according to preferred methods

It is also a best practice to perform a qualitative analysis that looks at risk of factors such as, customer service, personnel, ease of implementation, cultural considerations, profitability, supply chain risks, and cash impact. These should be rated and presented as part of the overall recommendations.

6. **Network Strategy Formulation and Path Forward:** The last step is to finalize the network design and develop a path forward for implementation. The network strategy needs to be clear to leaders how to go from the existing network infrastructure and operations to the recommended network. These steps include: number of facilities, conceptual designs, their roles, sizes, and locations. Product flows include: operational processes, implementation plans detailing work blocks, sequenced timeline, resources, capital requirements, and operating costs. Market impact assessment and financial analysis includes: capital investment, operating costs, and cash flow. Last a ROI needs to be measured along with the business case for the new network design.

In Conclusion

How a company must prepare to evolve a supply chain network design: define the business objectives, defining the scope of the project, what type of network design analyses will be used, tools considered, and project completion, the best design. Once these are addressed a supply chain network will be optimal for helping a company to meet established goals.

A world class transformational supply chain begins with a network that utilizes an all encompassing view of the various business operations that manage the delivery of products to customers. The result is significant capital, operational, and tax savings helping to achieving optimal customer satisfaction.

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- [Supply Chain Planning and Network Design](#)
- [Facility Location Planning for the New Normal](#)
- [How to Design Your Distribution Network for the Next Normal](#)