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OPTIMIZATION

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How To Optimize The Design Of Your Supply Chain Network

A Step-By-Step Guide



How To Optimize The Design Of Your Supply Chain Network



Your supply chain network forms the foundation that your business is built upon. Designing and deploying a robust supply chain network will position your company for growth, while failing to do so can put your business on shaky ground.

The process of designing a supply chain network involves critical strategic decisions that have a huge impact on:

- **Capital investments:** When designing your supply chain, you need to make major capital investment decisions on which manufacturing and distribution facilities to build and other assets to put in place.
- **Supply chain costs:** Experts estimate that network structure determines around 80% of total supply chain costs – and thus the decisions you make when configuring your company’s procurement, production, logistics, and transportation network will have a significant impact on your bottom-line over the long haul.
- **Tactical and operational decisions:** All of your company’s planning and decision making at the tactical and operational levels – in a whole host of areas including production planning, transportation mode selection, safety stock placement, delivery routing, raw material sourcing, workforce scheduling – is governed by the strategic decisions you make when designing your supply chain network.

These strategic supply chain network design decisions, however, are complex – as they entail complicated (and high-stakes) choices on matters such as where to locate production

and warehouse facilities, how much to invest in infrastructure, which suppliers to select, and how best to distribute goods and deliver services throughout your end-to-end supply chain.

For decades, mathematical optimization has been the go-to tool for supply chain network design. This AI technology is used by companies across the business spectrum – in a wide array of off-the-shelf and custom-built solutions – to automatically determine the optimal configuration of their supply chains.

With mathematical optimization, businesses can make the best possible decisions on how to design their supply chain networks – so that they can ensure long-term, end-to-end efficiency and profitability.

In this Guide, we will walk you through the key steps you need to take to optimize the design of your supply chain network:



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Step #1: Identify and analyze the problems you want to solve across your end-to-end supply chain network



The first step you need to take to optimize your supply chain network design is to examine and explore your end-to-end network – so that you can map the overall framework and flow of goods and identify the pivotal, strategic-level supply, demand, production, and distribution problems that you are facing.

After you pinpoint and define these strategic-level supply chain problems, you will need to analyze them to gain an in-depth understanding of their:

- **Decision variables:** The decisions that have to be made in order to solve these problems, such as:
 - Whether or not to build new production, warehouse, and distribution facilities and where they should be located.
 - Which plants to use to manufacture goods for various markets.
 - Which suppliers to rely on to provide parts and raw materials.
 - Which modes of transport to use to distribute raw materials and parts, and deliver end products to customers.
- **Business objectives:** The numerous (and sometimes conflicting) business goals that your company is aiming to achieve such as reducing costs (fixed costs, variable transportation costs, inventory costs, etc.), shortening lead times, maximizing efficiency, and improving service levels.
- **Constraints:** The various business rules that you have to follow and requirements

that you have to meet such as on-time delivery commitments to customers, and budget allocations for infrastructure investments.

As you identify and analyze your strategic-level supply chain problems as well as your overall framework and flow of goods, your end-to-end supply chain network design will start to really come into focus – and you will begin to see which areas of your supply chain network could and should be addressed with mathematical optimization.

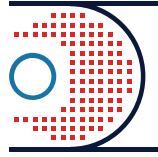
It's important to note that this first step – as well as the other steps in this supply chain network design process – should be undertaken with the cooperation and collaboration of all relevant supply chain subject matter experts (SMEs) from within your organization and across your network. In this way, you can ensure that you're able to effectively define your supply chain problems, efficiently develop solutions to these problems, and optimally design and deploy your supply chain network.



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Step #2: Collect the necessary supply chain data



Data is the lifeblood of AI technologies like mathematical optimization. Without access to accurate, up-to-date, and comprehensive data from across your end-to-end network, it is simply not possible to leverage mathematical optimization or any other AI tools in your supply chain planning.

Before embarking on a supply chain network design optimization project, it's essential to ensure that you have the capability to collect and process historical and real-time data (in the right quantity and of the highest quality) from all relevant sources (across your production

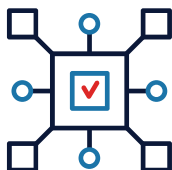
and distribution operations and from external suppliers and 3PL providers) and systems (including ERP, MES, and Excel as well as IoT devices). This often includes but is not limited to data on product demand, capacity of supply, fixed costs of building and setting up a facility, and variable costs of transportation.

This data will not only give you complete picture of past and current conditions across your supply chain, but it will also provide the fuel that makes your mathematical optimization application run – thereby driving optimal supply chain design and strategic decision making.



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Step #3: Build a mathematical optimization model of your supply chain network



After you've established that you have a firm grasp of the problems across your supply chain and have access to the required supply chain data, it's time to move on to the next step: Constructing a mathematical optimization model of your supply chain network.

This model is a mathematical representation (or, in other words, a digital twin) of your real-world supply chain network that ideally captures all the volatility of your supply and demand dynamics and the complexity of your sourcing, production, and distribution operations.

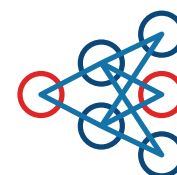
When you build a model, you define your end-to-end supply chain problems – their decision variables, business objectives, and constraints – in mathematical terms using modeling software tools. Many companies have in-house analytics specialists and data scientists who are capable of constructing such a model, while other companies opt to engage external consultants and academic researchers or leverage user-friendly, off-the-shelf modeling platforms to help them with the modeling process.

Throughout the process of building the mathematical optimization model of your supply chain network, you should:

- Involve all relevant stakeholders, decision makers and SMEs from within your business and across your supply chain.
- Test and validate the model to ensure that it accurately reflects your present-day business environment and encapsulates your procurement, production, and distribution problems and decision making processes.

- Balance the tradeoff between model complexity and the computational efforts needed to find quality solutions.
- Adjust and adapt the model – so that it encompasses the constantly changing supply and demand conditions across your supply chain network.

Step #4: Generate an optimal supply chain network design



Now that you have formulated your model, you are ready to begin using mathematical optimization to design an optimal supply chain network and drive optimal strategic decision making across your supply chain operations.

To achieve this, all you need to do is:

- Feed your model up-to-date data from across your supply chain network.
- Fuse your model with a mathematical optimization solver (an algorithmic problem solving engine, which will read the model and automatically generate an optimal supply chain configuration, taking into account your numerous decision variables, business objectives, and constraints).
- Use the output of the mathematical optimization application – your optimal supply chain network design – to gain visibility and control over your network, evaluate cost and service-level tradeoffs, and decide on the best courses of action to achieve your business goals.

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Step #5: Conduct scenario analysis to discover and assess supply chain risks and opportunities



Generating an optimal supply chain network design is not the end of the story – as, in order to realize the full benefits of using mathematical optimization to configure your end-to-end supply chain, you should leverage the AI technology’s robust scenario analysis capability.

Indeed, the optimal supply chain network configuration produced by your mathematical optimization application forms the base case scenario, but you can:

- Rapidly create countless other what-if scenarios (including supply, demand, production, distribution, inventory, investment, industry, and macroeconomic scenarios) to assess their potential impact on your business.

- Examine and evaluate these scenarios to uncover risks and opportunities throughout your supply chain network and assess new product and market opportunities, supplier relationships, inventory strategies, and potential infrastructure investments.
- Use the insights and intelligence from your scenario analysis to drive optimal strategic plans and decisions and optimal long-term business outcomes.

With mathematical optimization’s scenario analysis capability, you can proactively plan for the future and ensure your supply chain network is designed to succeed – today and in the years to come.

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Design, decide, and deliver with mathematical optimization

Your supply chain network design can make or break your business: A poorly designed network can be a source of increased supply chain costs and risk and decreased operational efficiency and customer satisfaction, while an optimally designed supply chain network can be a driver of long-term competitive advantage and revenue growth.

Using mathematical optimization, you can:

- Design an optimal supply chain network, gain end-to-end visibility and control, and evaluate numerous what-if scenarios.
- Decide on the best courses of action to achieve your strategic business objectives.
- Deliver product and service excellence for your customers and increased profit margins for your shareholders.



