



Unlock the Hidden Potential of Your
Supply Chain Network Design with
Digital Twin Technology

The Role of Network Design in a Supply Chain

With the advent of globalization and online shopping, patterns of production and consumption have changed drastically. Products are manufactured in one location, assembled at a different place, and finally distributed across the globe.

Besides, consumer expectations are highly dynamic and ever-fluctuating. If a product takes too long to reach or fails to meet buyer preferences, customers will simply move to another brand. The demand for omnichannel selling and fulfillment has only added to further intricacies.

Let's look at a typical online shopping scenario. The customer browses products on a website or mobile application, places an order, and requests for a lightning-fast delivery within 24 hours. The next day, the product is delivered to the doorstep, as requested by the customer.

But, what the customer sees is just the tip of an iceberg. The inside of a supply chain is quite complex and certainly not as simple as it looks to the end customer.

In order to fulfill this next-day delivery promise, the brand needs to be prepared in advance. The ordered item needs to be available in the nearest distribution center, must be packaged and shipped at the earliest, and assigned to the right executive to ensure timely delivery and a happy customer experience.

Successful last-mile delivery is made possible by a well-planned network of warehouses and distribution centers connecting manufacturing units to end customer locations.

Now think of hundreds of customers placing similar orders every day, requesting for speedy, convenient deliveries. Without supply chain preparedness, fulfilling customer expectations is extremely difficult and challenging for a brand.



Key Insights

Network planning and optimization is a strategic and long-term business decision. The most successful brands recognize this and place significant emphasis on network optimization by leveraging data science, Machine Learning, and Artificial Intelligence in their supply chains.

Efficient network design planning is the fundamental building block for a successful supply chain, enabling seamless and smooth flow of goods from the point of manufacture to the end customer. Simply put, supply chain network planning is the process of building and modeling a supply chain network with the most ideal locations and optimal size of warehouses and distribution centers, to be included in the supply chain network for easy and cost-effective distribution and flow of goods.

Network optimization primarily focuses on streamlining the four major elements of a supply chain network:



Key Insights

Supply chain network planning is the process of building and modeling a supply chain network with the most ideal locations.



Physical Flow of Goods

Transportation, lane, route planning, and logistics optimization



Location Intelligence

Accurate placement of supply chain nodes, warehouses, and distribution hubs



Inventory Optimization

Effective inventory planning and optimization across the supply chain



Strategic Sourcing

Optimizing sourcing costs and procurement processes using data intelligence

What-If Scenario Simulation, Sensitivity Studies, and Constraint Studies are commonly used approaches to achieve network optimization in the supply chain. In recent years, 'supply chain digital twin' has emerged as a groundbreaking network optimization model and is gaining popularity among several industries, including FMCG, retail, food-delivery, e-commerce, healthcare, and 3PL for supply chain network efficiency. In this white paper, let us look at how digital twins are transforming supply chain networks and understand the role of AI-enabled logistics tech in optimizing distribution operations.

Factors that Influence a Supply Chain Network Design

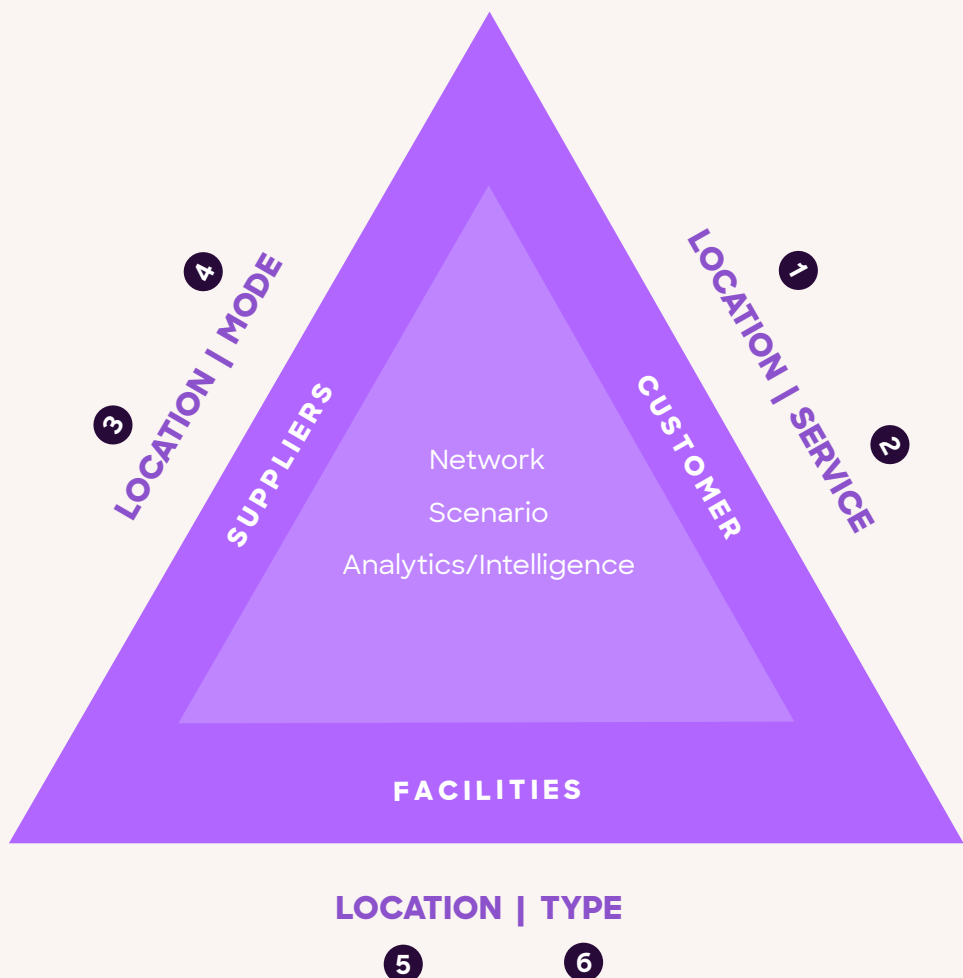
If you look at it, a supply chain is simply a network of facilities for producing, storing, and distributing goods. Network design planning is the process of determining the most optimal chain of logistics infrastructure to provide the most effective strategic solution in terms of cost and service throughout the supply chain journey. It is a critical business decision that ties the entire supply chain together and can make or break your distribution operations.

To come up with an ideal supply chain network, decision makers must determine the number of warehouses and distribution centers, the size and location of these facilities across the supply chain, ideal inventory levels, customer fulfillment response times, and also the cost of operation involved. The nature and shape of a supply chain network design is influenced by a number of different factors.



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Suppliers/Manufacturers

Where your suppliers or manufacturers are located, and the mode of transport used to ship the products determine the overall cost of inbound logistics in your supply chain.



Customers

The location of your end target customers, the products you're selling and the serviceability timeline you're providing is crucial in determining where your supply chain nodes must be located and the inventory levels in them.



Storage and Distribution Facilities

Finally, the location of every stock holding facility and distribution hub within your supply chain will determine the distance, time, and transportation costs involved in the movement of goods from one location to another.

However, manual planning and brainstorming is not the best way to figure out the most optimal distribution network design. There is a dire need for a systematic and data-driven approach to strategizing a distribution network.

Supply chain enterprises are therefore leveraging data analytics to understand market dynamics and demand and supply fluctuations. They are using location intelligence tools for optimal routing and infrastructure placement to ensure a steady, smooth, and accurate flow of goods throughout the supply chain.



Digital Twins – Transforming Supply Chain Networks

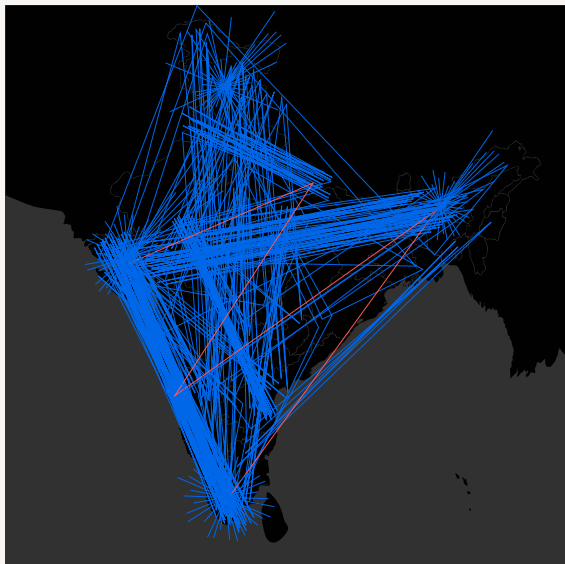
The concept of digital twins was first introduced in 1991 by David Gelernter in his book 'Mirror Worlds'. Michael Grieves of the Florida Institute of Technology then went ahead and applied this concept to manufacturing. In 2002, Grieves formally introduced the digital twin concept at a Society of Manufacturing Engineers conference in Troy, Michigan.

However, it was NASA who first embraced the digital twin concept and, in a 2010 Roadmap Report, John Vickers of NASA gave the concept its name. The idea was used to create digital simulations of space capsules and craft for testing. Thereafter, the concept of digital twin continued to become popular, when Gartner named it as one of the top 10 strategic technology trends in 2017. Since then, the concept has been used in an ever-growing array of industrial applications and processes, and the supply chain is no exception.

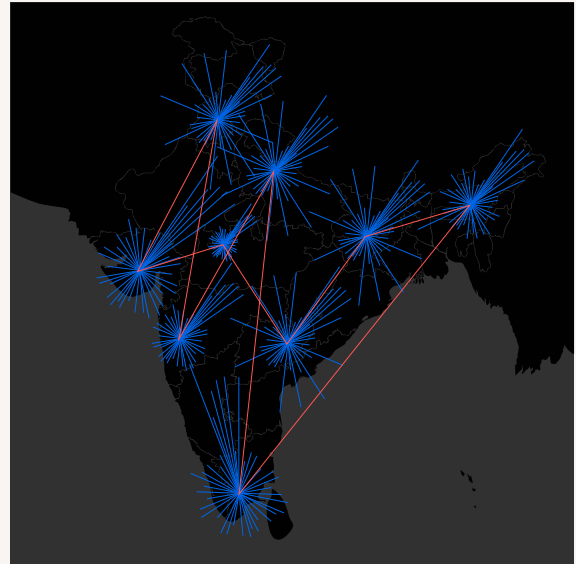
Digital twin technology is emerging as a smart and agile solution for logistics optimization, helping businesses design optimal distribution networks, save operational costs, and reduce wastage and inefficiencies in the supply chain. But what exactly is a supply chain digital twin?

The below image shows an existing supply chain network vs an optimized digital twin network.

AS-IS



OPTIMIZED



In supply chain, a digital twin is a virtual replica of a real-world supply chain model that mirrors supply chain assets, processes, transactions, third-party relationships, and other operational details on a virtual screen, enabling businesses to view, plan and monitor supply chain networks efficiently.

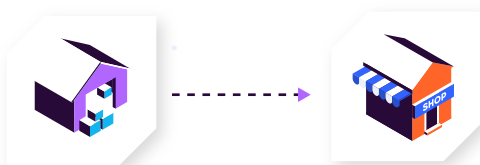
Digital twin visualization of the supply chain allows decision-makers to tinker and design an effective supply chain strategy.

Digital twin enables network optimization at three levels:



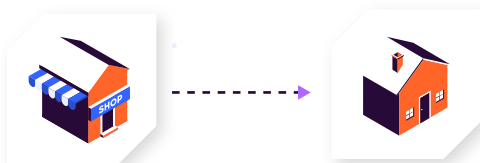
Manufacturing locations to warehouses

Designs optimal inbound logistics routes from various supplier locations and manufacturing units to storage units and warehouses, and also determines the exact number of warehouses required for equitable distribution.



Warehouse to distribution hubs

Determines the shortest distance and most optimal routes from each warehouse to its nearby distribution hubs to enable sufficient serviceability of goods in every region based on market demands and trends.



Distribution hubs to customer locations

Finally, plans efficient last-mile delivery routes from distribution centers to end customer locations or retail outlets, ensuring minimal distance covered and maximum cost and fuel savings.

Key Components that Enable Successful Supply Chain Digital Twin Modulation

Based on a 2019 survey of engineers across a range of disciplines, analysis by Reboot Online reveals some interesting inferences.

71%

of engineers think that the presence of a 'physical asset' is the most necessary for a digital twin. In the case of a supply chain, physical assets can range from manufacturing units to warehouses and distribution centers, to even the size of fleet and human resources available at each stage of the distribution process.

39%

of engineers placed 'trend analysis of historical data' as a vital attribute for a digital twin. Analyzing historical information about supply chain demand trends, seasonal fluctuations, on-ground bottlenecks, etc. gives valuable insights for improved network planning and decision making.

52%

of the experts view a 'live data set' as an essential feature for the functionality of digital twins. For supply chains, data and information sets would include the locations, number and size of existing facilities in the network, ongoing market demand for diverse categories of goods in trade, real-time changes in consumer preferences, and so on. This data is crucial to simulate a digital twin comparing an existing supply chain to identify gaps and optimization measures.

32%

felt 'prediction of future events' as a critical aspect to digital twin modulation. Predicting future events with the help of what-if scenarios allows supply chains to be prepared for future uncertainties and improves distribution performance.

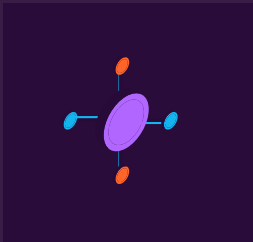


Key Insights

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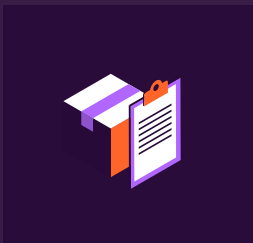
Why Consider Digital Twin Simulation of Your Supply Chain?

Whether you're a consumer goods manufacturer selling merchandise directly to customers, a 3PL or 4PL provider facilitating distribution activities for another business, an e-commerce enterprise sourcing varied categories of goods from multiple suppliers and shipping them to customers across widespread geographies, or a hyperlocal delivery business with high density order volumes in an urban set-up, digital twin technology can streamline your supply chain network from end-to-end, bringing in consistency, transparency and efficiency in your distribution operations.



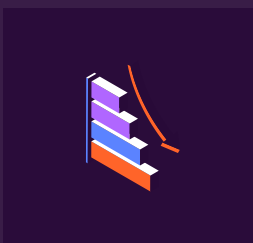
Establishes a standard distribution framework

The digital twin of a supply chain allows a visual comparison of existing operations versus ideal operations, establishing an optimal distribution network, placing warehouses and distribution hubs in cost-effective locations and establishing a standard distribution framework throughout the supply chain. It significantly eliminates chaos in different aspects of a supply chain including sourcing, storage, secondary and final-mile distribution.



Enables fast and agile decision making

Digital twin technology leverages real-time business data, market trends, and consumer dynamics to offer a visual representation of an ideal supply chain network. This helps managers to be flexible and take quick decisions about sourcing, inventory levels in warehouses, and dispatch volumes depending on demand fluctuations caused by unseen trends, seasonal or regional factors.



Reduces inefficiencies and resource wastage

A supply chain network is all about connecting the dots between multiple facilities to finally reach the end customer. A digital twin representation of supply chain activities provides the shortest, most cost effective routes to connect these dots, thereby minimizing fuel usage considerably, improving time-to-market, and enhancing distribution efficiency throughout the journey of a product.



Minimizes inventory and warehousing costs

One of the biggest problems faced by supply chain businesses is maintaining the right levels of inventory in distribution hubs and ensuring that every warehouse or supply chain node is actively in use and utilized efficiently. Digital twin technology considers real-world scenarios and suggests the most optimal levels of inventory to be stocked up in each facility based on the demand changes in nearby distribution regions. More importantly, it accurately predicts the exact number and size of warehouses required across the supply chain for efficient capacity utilization. This allows businesses to invest only in an optimal number of facilities, and close down the ones that are under-utilised or inactive, leading to greater cost savings.



Speeds up last-mile deliveries

By determining the shortest routes between each facility across the supply chain and distribution centers to customer locations, digital twin reduces the overall number of miles driven and time taken in order fulfillment, thereby speeding up last-mile operations and improving customer experience with the brand.

Locus' advanced machine learning and Artificial Intelligence-based network optimization provides end-to-end digital simulation of your supply chain and helps you redesign your distribution networks effectively using the power of data science, algorithms and analytics.

Locus' AI-Enabled Digital Twin Simulation for Your Supply Chain

Supply chains are evolving rapidly today to meet the ever-dynamic customer expectations, and keep up with innovations in technology. Whether you're scaling up and expanding your supply chain, or seeking a more streamlined network design through your distribution processes, implementing a supply chain digital twin is a great way to boost your network performance and strengthen distribution operations.



Digital twin representation of your supply chain

Gives you a virtual replica of your supply chain on an interactive dashboard view, compares your existing operations with ideal-case distribution operations, and improves end-to-end visibility in your supply chain.



Network design and optimization

Locus' NodeIQ enables network design decision making with its deep tech features, such as 'what if' simulations that give a complete visibility into long-term supply chain operations on an intuitive and user-friendly dashboard.



Flow optimization

Enables smooth and steady flow of merchandise throughout your supply chain with the help of flow-based digital mapping and real-time what-if simulations.



Location optimization

Suggests optimal locations for warehouses and regional distribution centers to ensure efficient space utilization, and accurate placement of supply chain nodes for fast and efficient order fulfillment.



Inventory optimization

Follows a mathematical approach to offer multi-echelon inventory optimization at each layer of your supply chain and identifies optimal safety+cycle stock levels to maintain the right levels of inventory across facilities and lower inventory holding costs.

*Are you ready to transform your distribution network design
with digital twin visualization of your supply chain?
Get in touch with our experts for a quick tour of our
network optimization offerings.*



Locus is a leading-edge technology company
dedicated to solving the most challenging all mile
problems in global logistics.

1020m+

Total deliveries
optimized

12m+ kgs

Reduction
in GHG emissions

\$288m+

Savings
in logistics costs

**GROWTH,
DELIVERED.**

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