eBook

# What is Supply Chain Engineering, and Why Companies Need It

**Supply Chain Engineering** has risen in prominence and necessity in recent years. This is due to the changing face of consumer expectations, rising globalization, and high market volatility, all of which are testing many businesses in unforeseen ways.

- **Lead time for production has increased to unprecedented levels.** General production materials have an average lead time of 88 days, the highest figure since 1987 when data began to be collected (Institute for Supply Management, Manufacturing Report, June 2021).

**La-Z-Boy® reported lead times increasing** from **four weeks** to up to **nine months** (Q4 2021-06-15 Earnings Report).

**Lead time for electronics** went from **16 weeks** to more than **52 weeks** (ISM Manufacturing Report, June 2021).

- **Consumers expect visibility, ease of use and support when making everyday purchasing decisions.** They want unique buying experiences that provide multiple product options, expedited delivery, and transparency at every step. If something goes wrong, customers want to feel supported. These same consumer habits and criteria are also brought to work, leading vendors and business partners to expect the same experience.

**Only 25% of consumers rank price** as their primary purchasing criteria (Accenture Global Consumer Pulse Research, 2021).

With these forces at play, the 21st century has seen a widespread focus towards organizations' supply chains around the globe—and how Supply Chain Engineering has risen as a top practice to mitigate these challenges.

# What is Supply Chain Engineering?

## Supply Chain Management

**At its roots, Supply Chain Management can be defined as** a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and stores so that merchandise is produced and distributed at the right quantities to the right locations, and at the right time to minimize system-wide costs while satisfying service level requirements.

## Supply Chain Engineering

**Supply Chain Engineering takes the discipline one step further** by emphasizing the *design* and *precision* of the supply chain network through the use of *applied sciences* and *mathematical models* to determine optimal strategies. Merging the best practices from consulting and engineering, it's more than just strategy and analytics—it is a calculated blueprint towards improvement.

## Supply Chain Engineering involves the following essential activities to effectively create a better network:

- Design of the supply chain network; namely optimal location of plants, DCs, warehouses, fleets, etc.
- Procurement process of raw materials or parts from multi-tier suppliers all the way to the manufacturing plants.
- Oversight of production and inventory of finished goods to properly meet customer demands.
- Governance of the transportation and logistics network to deliver the final products to warehouses and retailers on-time in full.
- Management of the integrity of the entire supply chain network by mitigating supply chain disruptions at all levels.

# Supply Chain Engineering—
# **Decisions and Drivers**

Supply Chain Engineering can be broadly grouped into three major decision categories—strategic, tactical and operational.

## Strategic

Strategic decisions involve the entire supply chain network and its portfolio of partners or vendors. These initiatives are made over a relatively longer period of time and have the greatest impact on a company's resources and future. Some examples of strategic decisions include:

- **Network design**
- **Production and sourcing: make or buy?**
- **IT strategy**

## Tactical

Tactical decisions are aimed primarily around planning activities for a moderate time horizon, generally set at weekly, monthly or quarterly intervals, up to one or two years out. These strategies will dictate the current performance of the network and guide operational decisions. Examples of tactical decisions include:

- **Purchasing**
- **Production planning**
- **Inventory management**
- **Transportation**
- **Distribution**

## Operational

Operational decisions focus on short-term improvements executed on a daily or weekly basis, usually once the tactical and strategic decisions have been made. Some included functions are:

- **Delivery schedules**
- **MABD for suppliers**
- **Production schedules**
- **Allocating materials**

**There are a few primary driving forces** behind the critical areas of decision-making that ultimately generate the results that impact the supply chain performance. These drivers typically act as design variables in the optimization models used in Supply Chain Engineering.

## Transportation

Transportation encompasses the movement of all items between various supply chain stages, such as suppliers, production plants, distribution centers, and customers. The key variables to manage are transportation modes (balancing speed and service vs. cost), and when to utilize 3PL services against managing your own fleet and performing "knapsack" analysis.

## Inventory

Companies maintain inventory of raw materials, work-in-progress (WIP), and finished goods to mitigate variability in both supply and demand. Inventory is considered an idle asset and is one of the biggest factors in total supply chain costs.

## Facilities

Plants and distribution centers have a key role in Supply Chain Engineering. They are considered strategic assets and directly affect the overall efficiency of the supply chain. Organizations need to ask themselves: *How many plants should I have and where should they be located?*

## Suppliers

In most manufacturing industries, raw materials account for 40-60% of production costs. External vendors can cause major impact on the core business, necessitating supplier selection to be viewed as a critical driver in overall performance.

# Supply Chain **Engineering Framework**

Industrial engineering, mechanical engineering and systems engineering all center around the designing, planning and managing of complex systems. By merging the best practices from both consulting and engineering disciplines, a detailed framework can be developed to approach any project or issue arising in the supply chain network.

A basic principle in traditional engineering design processes is that all the tasks in the current phase of the framework must be completed before the next phase begins. This process aims to avoid selecting a solution with any pre-conceived notions or underlying biases by working through each step with a science-based approach towards specific deliverables. Below are the stages of a Supply Chain Engineering Framework:

# Supply Chain
# Engineering Framework

### Formulate the problem

The formulation stage must create a clear understanding of the current function of the system, the goal of the new initiative, and the available budget and resources for design and implementation. Carefully defining the scope of the project, the targeted outcome, and the current operating environment will dictate the success and precision through the rest of the framework.

### Collect data and analyze the problem

During problem analysis, there are essentially three phases—the data on the current system must be collected, the constraints for the new system must be identified, and the evaluation criteria for the new system must be specified.

### Generate alternative solutions

Often denoted as "conceptual design," this phase aims to generate as many high-quality and creative solutions as possible. It is important to not be too risk-adverse by generating solutions that maintain the status-quo or only provide incremental changes, but to explore all options and resources available to generate the final optimal outcome.

### Evaluate and select design alternatives

At this stage, the various alternative solutions are evaluated with respect to their different criteria. The quality of each solution is compared against a structured weighted scale to identify their relative importance towards certain objectives. Each solution will also undergo cost-benefit analysis as well as feasibility assessment to understand if the proposed design solution satisfies the requirements and to determine its implement difficulty. Once completed, the optimal solution will be proposed to all major stakeholders and leadership.

### Specify and implement the design

Effective execution of the design is arguably the most critical step in the engineering process. The goal is to create the most thorough and actionable implementation guide or standard operating procedures.

### Assess the design in practice

After implementation, it is important to collect data under real-world conditions. Making minor adjustments (or evaluating through a **Digital Twin**) and repeating the process until the desired outcomes are achieved will finalize the project and establish a path for continuous improvement.

When Gartner Research compiled the **top 25 companies who best utilize Supply Chain Engineering**, they were found to:

Carry **15% less inventory** on average

Have **5% higher profit margins** on average

Be **60% faster-to-market**

Complete **17% more "perfect" orders**

Typically **outpace the S&P 500** in **share price growth**

# Get in touch with Velis today

so we can help your firm **Engineer A Better Way**.

▸ govelis.com ▸ CBeard@govelis.com ▸ 314.446.5400

**References**


1. La-Z-Boy® Lead Time: Q4 2021-06-15 Earnings Report with Melinda Whittington CEO https://www.supplychaindive.com/news/la-z-boy-lead-time-backlog-supply-chain-delay/602210/
2. Avg Industry Lead Time: https://www.supplychaindive.com/news/lead-time-record-highs-ism-supplier-labor-congestion/602923/
3. "Supply Chain Engineering; Models and Applications" A. Ravi Ravindran and Donald P Warsing Jr, CRC Press 2013
4. "Supply Chain Engineering" Marc Goetschalckx, Springer 2011
5. "Supply Chain Management: Strategy, Planning, and Operation" Sunil Chopra, Pearson 2019
6. Gartner Research, "Supply Chain Top 25", http://www.gartner.com/technology/supply-chain/top25.jsp