Supply Chains: Definitions & Basic Concepts

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So, what’s a Supply Chain?

A *supply chain* is the collection of processes and resources required to make and deliver a product to the final customer.
Typical Links of a Supply Chain

1. End Consumers
2. Retailers
3. Wholesalers
4. Manufacturing & Assembly Plants
5. Component Manufacturers
6. Subcomponent Manufacturers
7. Logistics Service Providers

Adapted from careersinsupplychain.org
Many variations exist:

- There may be multiple players at each stage
- Materials may skip stages
- Some stages may not exist
End Consumers (millions?)

Distribution Channel
Wholesalers (100s?)
Retailers (1,000s?)

Manufacturing & Assembly Plants (a few?)
Component Manufacturers (dozens?)
Subcomponent Manufacturers (100s?)

Adapted from careersinsupplychain.org

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Perhaps, Supply NETWORK or Supply WEB would be a more appropriate term than Supply CHAIN!
Each link in the chain/network might include...

1. Facilities
2. Inventory
3. Storage Resources
4. Transport Resources
5. Human Capital

All of these must be considered when making decisions on the supply chain

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The overall performance of a supply chain is driven by its design and its operation

- **Facilities**
  - No. of plants and their locations and capacities
  - No. of warehouses/distribution centers (DCs), their locations and capacities
  - No. of retail outlets and their locations

- **Inventory**
  - Inventory control strategies
  - Storage facilities
  - How costs are balanced against service

- **Transportation and storage resources**
  - Warehousing, distribution and logistics strategies
  - Modes of transport used

- **Suppliers**
  - How are they sourced?
  - In-house vs. outsourcing balance

- **Human Resources**
A supply chain can be viewed as having three integrated segments:

- **Upstream**, where sourcing or procurement from external suppliers occurs.
- **Midstream (or Internal)**, where manufacturing or assembly takes place.
- **Downstream**, where distribution (often by external distributors) and sales to the customer take place.
Supply Chain Segments

UPSTREAM
- Subcomponent Manufacturers
- Component Manufacturers

INTERNAL
- Manufacturing & Assembly Plants
- Logistics Service Providers

DOWNSTREAM
- Wholesalers
- Retailers

End Consumers

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Typical supply chain activities include…

- Forecasting IN ALL SEGMENTS
- Production Planning and Execution INTERNAL
- Inventory Management INTERNAL/DOWNSTREAM
- Sourcing and Procurement UPSTREAM
- Warehousing and Logistics
- Distribution and Transportation DOWNSTREAM
- Marketing and Sales
- Payments and financial flows UPSTREAM/DOWNSTREAM

These activities are *coordinated* as much as possible
An Example of a Supply Chain (Automotive Industry)
There are three major flows in a supply chain

<table>
<thead>
<tr>
<th>Materials</th>
<th>Information</th>
<th>Money</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical products, materials, and</td>
<td>Data associated with demand,</td>
<td>Payments, credit card information,</td>
</tr>
<tr>
<td>supplies that flow along the chain</td>
<td>shipments, orders, returns and</td>
<td>payment schedules, e-payments, etc.</td>
</tr>
<tr>
<td></td>
<td>schedules</td>
<td></td>
</tr>
</tbody>
</table>

Typically:

- **Materials** move downstream through the supply chain
- **Money** flows upstream from the customer to the source
- **Information** flows both ways
Enterprise Supply Chain View

- Tier 2
- Tier 1
- Production/operations
- Sales and Distribution
- Distributors/Wholesalers/Dealers
- Reverse Product Flows
- Parts and Service

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So, what’s supply chain analysis?

• Studying and analyzing issues related to how a supply chain is designed and operated
• Important step to enable effective supply chain management
Why is supply chain *management* important?

- Heightened competition with respect to
  - Productivity
  - Quality
  - Flexibility/Responsiveness
- More complexity
- Integration instead of managing individual pieces
- Alignment with overall company strategy
Some Tangible Benefits of Good Supply Chain Management

- Procurement cost reduction
- Inventory reduction
- Maintenance reduction
- Productivity improvement
- Order management improvement
- Transportation logistics cost reduction
- On-time delivery improvement
- Financial-close cycle improvements
- Cash management improvements
- Personnel reduction
- IT cost reduction

**Bottom Line: It is essential!**
There are many examples of inefficiencies that can be addressed

- It is estimated that the grocery industry could save $30 billion (~10% of operating cost) by using effective logistics strategies

  • A typical box of cereal spends 104 days getting from factory to supermarket

- A typical new car spends an average of 15 days traveling from the factory to the dealership, although the real travel time is on average less than 5 days
Examples of Winning Supply Chain Strategies

- Less than 3 days worth of inventory (2 hours worth of inv. at the server manufacturing facility in Austin, TX)
- High flexibility in manufacturing due to worker cross training, teamwork, vastly reduced setups, effective use of IT, automation/system support
- Sony monitors shipped directly; no inventory at Dell
- Steer customers in real time towards PC configurations that can be built given the components available \(\Rightarrow\) matching supply and demand
- Sophisticated information exchanges at Dell \(\Rightarrow\) customized web pages for suppliers
- Collects cash from customers, on average, more than a week before it has to pay its suppliers

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Examples of Winning Supply Chain Strategies

- UPS repairs laptops for Toshiba
- Why UPS? Because Challenge is more *logistical* than *technical* (actual service takes an average of 1 hour), and UPS loves logistics!
- Much shorter lead time for customers (repair facility adjacent to UPS air hub in Louisville, KY)
- UPS has also been servicing Lexmark and HP printers since 1996
The objective of a supply chain is to maximize overall value created minus revenue: what the final product is worth to the customer minus cost: of raw materials, and flow of information and materials for making the products = SUPPLY CHAIN VALUE
There are three distinct supply chain planning and decision-making phases:

- **Planning Horizon measured in years**: Strategic Planning
- **Planning Horizon measured in months**: Tactical Planning
- **Planning Horizon measured in weeks/days**: Operational Planning

Source: at-scm.com
PHASE 1: Strategic Decisions: Strategy

- Facilities (plants, factories, distribution centers, warehouses): Locations & capacities
- Products made/stored at various locations
- Modes of transportation & logistics
- Information systems infrastructure & enterprise software
- Partnerships and alliances
- Customer service policies and infrastructure

Typically made by senior management
PHASE 2: Tactical Decisions: Planning

These are constrained by Phase 1 decisions and include:

- Demand Forecasting
- Which facility will supply which market?
- Aggregate production planning
- Subcontracting of manufacturing
- Inventory control policies
- Timing and size of market promotions

Typical made by engineers and mid-level managers
PHASE 3: Operational Decisions: Execution

These are constrained by Phase 2 decisions and include:

– Decisions on individual customer orders
– Allocation of production/inventory to specific orders
– Scheduling of operations, trucks, etc.
– Order picking in warehouses
– Allocating orders to shipments and shipping modes
– Inventory replenishment decision

Typical made by line supervisors and floor personnel
How a supply chain is designed and operated should be compatible with company strategy

VS.

Cannot have the same supply chain even though they sell similar products!
You cannot be everything to everybody; “one size” does not fit all!

Step 1: Understand the customer around whom company strategy is designed: what things does the customer value most? Price, responsiveness, service, quality, flexibility?

Step 2: Engineer and operate the supply chain so that it is aligned with company strategy and customer priorities.
Broadly speaking, a supply chain can focus on either responsiveness or efficiency

- Responsiveness has two determinants:
  1. the *speed* with which the supply chain can respond to a customer’s requirements and expectations
  2. the *flexibility* with which it can handle changes in these requirements and expectations

- Efficiency refers to the *cost* at which a supply chain can accommodate customer requirements

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# Responsiveness vs. Efficiency

<table>
<thead>
<tr>
<th>Responsiveness</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emphasis on the ability to</td>
<td>Emphasis on the ability to reduce various costs</td>
</tr>
<tr>
<td>• respond to wide ranges of quantities demanded</td>
<td>• Raw materials costs</td>
</tr>
<tr>
<td>• meet short delivery times</td>
<td>• Manufacturing costs</td>
</tr>
<tr>
<td>• handle a large variety of products and customization</td>
<td>• Inventory holding costs</td>
</tr>
<tr>
<td>• develop and build highly innovative products</td>
<td>• Transportation and distribution costs</td>
</tr>
<tr>
<td>• meet a very high service level</td>
<td>• Operating costs</td>
</tr>
<tr>
<td>• handle uncertainty</td>
<td></td>
</tr>
</tbody>
</table>

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# Efficient vs. Responsive Supply Chains

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Efficient</th>
<th>Responsive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary goal</td>
<td>Lowest possible cost</td>
<td>Quickest possible response</td>
</tr>
<tr>
<td>Product design strategy</td>
<td>Minimize product cost</td>
<td>Modularity to allow postponement</td>
</tr>
<tr>
<td>Pricing strategy</td>
<td>Lower margins</td>
<td>Higher margins</td>
</tr>
<tr>
<td>Manufacturing strategy</td>
<td>High utilization</td>
<td>Capacity flexibility</td>
</tr>
<tr>
<td>Inventory strategy</td>
<td>Minimize inventory</td>
<td>Buffer inventory</td>
</tr>
<tr>
<td>Lead time strategy</td>
<td>Reduce but not at expense of greater cost</td>
<td>Aggressively reduce even if costs are significant</td>
</tr>
<tr>
<td>Supplier selection strategy</td>
<td>Cost and lowest acceptable quality</td>
<td>Speed, flexibility, quality, reliability</td>
</tr>
<tr>
<td>Transportation strategy</td>
<td>Greater reliance on low cost modes</td>
<td>Greater reliance on responsive (fast) modes</td>
</tr>
</tbody>
</table>

Source: Chopra & Meindl
# Drivers of Supply Chain Performance

<table>
<thead>
<tr>
<th><strong>Driver</strong></th>
<th><strong>Efficiency (Cost)</strong></th>
<th><strong>Responsiveness</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inventory</strong></td>
<td>Cost of holding</td>
<td>Availability</td>
</tr>
<tr>
<td>• Raw materials, WIP, finished goods</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>Consolidation</td>
<td>Speed</td>
</tr>
<tr>
<td>• Many combinations of modes and routes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Facilities</strong></td>
<td>Consolidation / Dedicated</td>
<td>Proximity / Flexibility</td>
</tr>
<tr>
<td>• Production &amp; storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Performance impacted by location, capacity and flexibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td>Low cost / slow</td>
<td>High cost / streamlined / reliable</td>
</tr>
<tr>
<td>• Data on facilities, inventory, transportation &amp; customers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Chopra & Meindl

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