Supply Chain Management

- A key determinant of a company's ability to compete
- Today, competition is not “company vs. company but supply chain vs. supply chain”
- Companies spend nearly $18 trillion on goods and services each year

Source: Visa Commercial Consumption Expenditure Index.
Supply Chain Management

- Shaving 2% from a company’s CGS can increase net income by as much as 25%
- Aberdeen Group survey: 82% of companies had experienced a supply disruption or outage within the last two years
- Requires a sound purchasing plan

Components of a purchasing plan

- Right Quality
- Right Vendor
- Right Quantity
- Right Time
- Right Price

The Purchasing Plan

- Quality
  - Kaizen
  - Total Quality Management
    - Deming’s 14 Points
  - Six Sigma
- Quantity
  - Economic Order Quantity Analysis (EOQ)
  - Economic Order Quantity with Usage
Chapter 17: Purchasing, Quality, & Vendor Analysis

The Purchasing Plan

- Price
  - Purchase Discounts
- Time
  - Reorder Point Analysis
- Vendor
  - Sources of Supply
  - Vendor Rating Scale

Quality

- "Higher quality is less expensive to produce than lower quality." — W. Edwards Deming
- The endless pursuit of quality produces lower costs, higher productivity, greater market share, and more satisfied customers
- Kaizen, continuous improvement, is the most commonly used quality improvement strategy

Quality

- Total Quality Management (TQM) is a philosophy that strives for getting everything a company does for a customer right the first time
- TQM involves a lifelong process of continuous improvement; a successful TQM process requires a company to change everything it does
Implementing TQM

Success requires following 11 principles:

1. Use benchmarking to discover the best practices that will produce quality results
2. Shift from a management-driven culture to a participative, team-based one
3. Modify the reward system to encourage teamwork and innovation

4. Train workers constantly to give them the tools they need to produce quality and to upgrade the company's knowledge base
5. Train employees to measure quality with the tools of statistical process control (SPC)
6. Use Pareto's Law to focus TQM efforts
7. Share information with everyone in the organization
8. Focus quality improvements on astonishing the customer
9. Don't rely on inspection to produce quality products and services
10. Avoid using TQM to place blame on those who make mistakes
11. Strive for continuous improvement in processes as well as in products and services
Deming’s 14 Points

1. Constantly strive to improve products and services
2. Adopt a total quality philosophy
3. Correct defects as they happen rather than rely on mass inspection of end products
4. Don’t award business on price alone

5. Constantly improve the system of production and service
6. Institute training
7. Institute leadership
8. Drive out fear

9. Break down barriers among staff areas
10. Eliminate superficial slogans and goals
11. Eliminate standard quotas
Deming’s 14 Points

12. Remove barriers to pride in workmanship
13. Institute vigorous education and retraining
14. Take demonstrated management action to achieve transformation

Six Sigma

- Like TQM, Six Sigma uses data-driven statistical tools to improve quality
- Threshold: Just 3.4 defects per 1 million opportunities
- Built on the Quality DMAIC Process

<table>
<thead>
<tr>
<th>Principle</th>
<th>Process Improvement Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define</td>
<td>Identify the problem.</td>
</tr>
<tr>
<td></td>
<td>Define the requirements.</td>
</tr>
<tr>
<td></td>
<td>Set the goal for improvement.</td>
</tr>
<tr>
<td>Measure</td>
<td>Validate the process problem by mapping the process and gathering data about it.</td>
</tr>
<tr>
<td></td>
<td>Refine the problem statement and the goal.</td>
</tr>
<tr>
<td></td>
<td>Measure current performance by examining the relevant process inputs, steps, and output to establish a baseline.</td>
</tr>
<tr>
<td>Analyze</td>
<td>Develop a list of potential root causes.</td>
</tr>
<tr>
<td></td>
<td>Identify the root cause.</td>
</tr>
<tr>
<td></td>
<td>Use data analysis tools to validate the cause and effect connections between root causes and the quality problem.</td>
</tr>
<tr>
<td>Improve</td>
<td>Develop a solution to resolve root causes by making changes to the process.</td>
</tr>
<tr>
<td></td>
<td>Test potential solutions and develop a plan for implementing those that are successful.</td>
</tr>
<tr>
<td></td>
<td>Measure the results of the improved process.</td>
</tr>
<tr>
<td>Control</td>
<td>Establish standard measures for the new process.</td>
</tr>
<tr>
<td></td>
<td>Establish standard measures for the new process.</td>
</tr>
<tr>
<td></td>
<td>Review performance periodically and make adjustments as needed.</td>
</tr>
</tbody>
</table>

Chapter 17: Purchasing, Quality, & Vendor Analysis

**Four Tenets of Six Sigma**

1. Delight customers with quality and speed
2. Constantly improve the process
3. Use teamwork to improve the process
4. Make changes to the process based on facts, not guesses

**Economic Order Quantity**

... seeks to minimize total inventory costs

Three major inventory costs to consider:

- Cost of units = \( D \times C \)
- Holding (Carrying) costs = \( \frac{Q}{2} \times H \)
- Setup (Ordering) costs = \( \frac{D}{Q} \times S \)

**EOQ and Carrying Costs**

<table>
<thead>
<tr>
<th>Q (500)</th>
<th>( \frac{Q}{2} \times \text{Carrying Costs} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>$312.50</td>
</tr>
<tr>
<td>500</td>
<td>625</td>
</tr>
<tr>
<td>1,000</td>
<td>1,250</td>
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<tr>
<td>1,500</td>
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<td>11,875</td>
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<tr>
<td>10,000</td>
<td>12,500</td>
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</table>
EOQ and Ordering Costs

<table>
<thead>
<tr>
<th>Q is</th>
<th>D/Q, # Orders per Year</th>
<th>D/Q x S, Ordering Cost</th>
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<td>800</td>
<td>$7,200</td>
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<tr>
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<td>400</td>
<td>3,600</td>
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<td>200</td>
<td>1,800</td>
</tr>
<tr>
<td>3,000</td>
<td>134</td>
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<td>100</td>
<td>900</td>
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<td>67</td>
<td>603</td>
</tr>
<tr>
<td>7,000</td>
<td>56</td>
<td>522</td>
</tr>
<tr>
<td>8,000</td>
<td>45</td>
<td>450</td>
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<tr>
<td>9,000</td>
<td>34</td>
<td>395</td>
</tr>
<tr>
<td>10,000</td>
<td>30</td>
<td>380</td>
</tr>
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</table>

Solving for EOQ

\[
EOQ = \sqrt{\frac{2 \times D \times S}{H}}
\]

where

- \( D \) = Annual demand for product
- \( S \) = Setup (ordering) cost for a single run (order)
- \( H \) = Holding (carrying) cost per unit per year

EOQ and Total Costs

<table>
<thead>
<tr>
<th>Q is</th>
<th>D x C</th>
<th>Q/2 x H</th>
<th>D/Q x S</th>
<th>Total Costs</th>
</tr>
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<tr>
<td>500</td>
<td>$820,000</td>
<td>$313</td>
<td>$7,200</td>
<td>$627,513</td>
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<tr>
<td>1,000</td>
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<td>720</td>
<td>623,845</td>
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<td>$200,000</td>
<td>6,250</td>
<td>360</td>
<td>626,610</td>
</tr>
</tbody>
</table>
Calculating Total Cost

Total Cost = Cost of Units + Carrying Cost + Ordering Cost

Total Cost = (\(D \times C\)) + \(\left(\frac{Q}{2} \times H\right)\) + \(\left(\frac{D}{Q} \times S\right)\)

EOQ and Total Costs

EOQ with Usage

\[ EOQ = \sqrt{\frac{2 \times D \times S}{H \times \left(1 - \frac{U}{P}\right)}} \]

where
- D = Annual demand for product
- S = Setup (ordering) cost for a single run (order)
- H = Holding (carrying) cost per unit per year
- U = Usage rate
- P = Production rate
Price

Discounts:
- Trade discounts – established on a graduated scale and depend on a company’s position in the channel of distribution
- Quantity discounts – offer price breaks on large-volume purchases
- Cash discounts – offered as incentives to pay early. (e.g. “2/10, net 30”)

Trade Discount Structure

Manufacturer sells for $80.  
Customer buys at $175.

Wholesaler buys at $80; sells at $100.  
Retailer buys at $100; sells at $175.

Price

Discounts:
- Trade discounts – established on a graduated scale and depend on a company’s position in the channel of distribution
- Quantity discounts – offer price breaks on large-volume purchases
- Cash discounts – offered as incentives to pay early. (e.g. “2/10, net 30”)

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Chapter 17: Purchasing, Quality, & Vendor Analysis

**The Cost of Foregoing a Cash Discount**

$1,000 invoice 2/10, net 30

<table>
<thead>
<tr>
<th>Day</th>
<th>Amount</th>
<th>R = ( \frac{1}{T} \times \frac{P}{T} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$1,000</td>
<td>( \frac{20}{980 \times 20/360} ) = 36.735%</td>
</tr>
<tr>
<td>10</td>
<td>$980</td>
<td>( \frac{20}{980 \times 20/360} ) = 36.735%</td>
</tr>
<tr>
<td>30</td>
<td>$980</td>
<td>( \frac{20}{980 \times 20/360} ) = 36.735%</td>
</tr>
</tbody>
</table>

---

**Time - When to Order**

- **Lead time** - time gap between placing an order with a vendor and actually receiving the goods
- **Safety stock** - a cushion of extra merchandise built into inventory in case demand is greater than anticipated

---

**Simple Reorder Point Model**

Reorder Point = \( (L \times U) + S \)

where

- \( L \) = Lead time for an order (days)
- \( U \) = Usage rate for the item (units per day)
- \( S \) = Safety stock (units)
Simple Reorder Point Model

Reorder Point Model
(assuming normally distributed demand)

Reorder Point = \( \bar{D}_L + (SLF \times SD_L) \)

where

\( \bar{D}_L \) = Average demand during lead time for an order (units)

\( SLF \) = Service level factor (the appropriate Z score)

\( SD_L \) = Standard deviation during lead time (units)

Reorder Point without Safety Stock
Chapter 17: Purchasing, Quality, & Vendor Analysis

**Vendor Selection: Supply Chain Management**

- **Goals of Supply Chain Management**
  - Reduce inventory
  - Get products to market faster
  - Increase quality
  - Improve customer satisfaction

- **Payoff can be big**
  - A successful SCM system yields an average savings of 15%
  - Inventory levels decline as much as 60%
Vendor Selection: Managing the Supply Chain

- Web-based SCM - e-procurement
  - Share production plans, shipment schedules, inventory levels, sales forecasts, and actual sales real-time with vendors
  - IDC Study: Analytics applied to SCM produced 277% return over 5 years

A Supply Chain Should Be:

- Agile - fast, flexible, and responsive to changes in demand
- Adaptable - changes as the company's needs change and accommodates the company's growth
- Aligned - all of the companies that make up the supply chain work together as a team

Vendor Certification

1. Determine important criteria in selecting a vendor
2. Assign “weights” to each criterion to reflect its relative importance
3. Develop a grading scale for each criterion
4. Compute a weighted score for each vendor:
   \[ \text{Weighted Score} = \text{Weight} \times \text{Grade} \]
5. Choose the vendor with the highest weighted score
Selecting the Right Vendors

Factors to consider:
- Number of suppliers
- Reliability
- Proximity
- Services
- Collaboration
- Price

Legal Issues in Purchasing

The concept of title, the right to ownership of goods, has been replaced by:
- Identification - goods must be in existence and identifiable from all other similar goods
- Risk of loss - determines which party incurs the financial risk if the goods are damaged, destroyed, or lost before they are transferred

Risk of Loss

- Agreement - Risk of loss shifts according to the parties’ contract
- F.O.B. Seller (shipment contract) - Risk of loss shifts to buyer as soon as the seller delivers the goods into the care of a carrier
- F.O.B. Buyer (destination contract) - Risk of loss shifts to buyer when the seller delivers the goods to a designated destination
Legal Issues in Purchasing

The concept of title, the right to ownership of goods, has been replaced by:

- **Identification** - goods must be in existence and identifiable from all other similar goods
- **Risk of loss** - determines which party incurs the financial risk if the goods are damaged, destroyed, or lost before they are transferred
- **Insurable interest** - gives the right to either party to a sales contract to obtain insurance to protect against lost, damaged, or destroyed merchandise as long as he has a "sufficient interest" in them