Supply Chain Management

**Supply Chain:**
- the sequence of organizations - their facilities, functions, and activities - that are involved in producing and delivering a product or service
- Sometimes referred to as value chains

**Facilities**
- The sequence of the supply chain begins with basic suppliers and extends all the way to the final customer
  - Warehouses
  - Factories
  - Processing centers
  - Distribution centers
  - Retail outlets
  - Offices

**Functions and Activities**
- Forecasting
- Purchasing
- Inventory management
- Information management
- Quality assurance
- Scheduling
- Production and delivery
- Customer service

**Supply Chain Management (SCM)**
- The strategic coordination of business functions within a business organization and throughout its supply chain for the purpose of integrating supply and demand management
Supply Chain Management

Need for Supply Chain Management

- Supply chain management (SCM) represents one of the most significant paradigm shifts of modern business management by recognizing that individual businesses no longer compete as solely autonomous entities, but rather as supply chains (Chen and Paulraj, JOM, 2004).

Supply Chain Management

- Synchronize a firm's functions and activities and those of its suppliers to match the flow of materials, services, and information with customer demand.
- Poor coordination among supply chain partners in the U.S. food industry wastes about $30 billion per year.

SCM Managers

- SCM Managers
  - People at various levels of the organization who are responsible for managing supply and demand both within and across business organizations.
  - Involved with planning and coordinating activities
    - Sourcing and procurement of materials and services
    - Transformation activities
    - Logistics

Key SCM Issues

- The goal of SCM is to match supply to demand as effectively and efficiently as possible
- Key issues:
  - Determining appropriate levels of outsourcing
  - Managing procurement
  - Managing suppliers
  - Managing customer relationships
  - Being able to quickly identify problems and respond to them
  - Managing risk

Trends in Supply Chain Management

- Reevaluation of Outsourcing
  - Outsourcing for the reasons of lower labor and materials costs, insufficient capacity, lack of expertise/competency, etc.
  - Firms are realizing other costs such as transportation, inventory, duty costs, and the issues of long lead time (lack of flexibility), intellectual property theft, which all should be considered in outsourcing decisions.
- Risk Management
  - Supplier quality and product safety (e.g., toys recall).
  - Long lead time and security issues increase the potential for disruption.

- Lean Supply Chains
  - Use Pull rather than Push systems to better match supply with demand.
  - Using a limited number of certified suppliers can eliminate the need for inspection and strengthen relationships for continuous improvement.
- Sustainability
  - Outsourcing significantly increases carbon footprint (corporate social responsibility)
Benefits of Supply Chain Management

<table>
<thead>
<tr>
<th>Organization</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campbell Soup</td>
<td>Doubled inventory turnover rate</td>
</tr>
<tr>
<td>Hewlett-Packard</td>
<td>Cut supply costs 75%</td>
</tr>
<tr>
<td>Sport Obermeyer</td>
<td>Doubled profits and increased sales 60%</td>
</tr>
<tr>
<td>National Bicycle</td>
<td>Increased market share from 5% to 29%</td>
</tr>
<tr>
<td>Wal-Mart</td>
<td>Largest and most profitable retailer in the world</td>
</tr>
</tbody>
</table>

Benefits of Supply Chain Management

- Lower inventories  
- Higher productivity  
- Greater agility  
- Shorter lead times  
- Higher profits  
- Greater customer loyalty

Procurement

- The purchasing department is responsible for obtaining the materials, parts, and supplies and services needed to produce a product or provide a service.
- The goal of procurement
  - Develop and implement purchasing plans for products and services that support operations strategies

Duties of Purchasing

- Identifying sources of supply  
- Negotiating contracts  
- Maintaining a database of suppliers  
- Obtaining goods and services  
- Managing supplies

Purchasing Interfaces

Purchasing Cycle

1. Requisition received  
2. Supplier selected  
3. Order is placed  
4. Monitor orders  
5. Receive orders
**E-Business**

- **E-business**
  - the use of electronic technology to facilitate business transactions

- Applications include
  - Internet buying and selling
  - E-mail
  - Order and shipment tracking
  - Electronic data interchange
  - Product and service promotion
  - Provide information about products and services

**Advantages of E-Business**

- Companies can:
  - Have a global presence
  - Improve competitiveness and quality
  - Analyze customer interests
  - Collect detailed information
  - Shorten supply chain response times
  - Realize substantial cost savings

- Also allows the:
  - Creation of virtual companies
  - Leveling of the playing field for small companies

**E-Business Order Fulfillment Problems**

- Customer expectations
  - Order quickly

- Demand variability creates order fulfillment problems

- Sometimes Internet demand exceeds an organization’s ability to fulfill orders

- Inventory
  - Outsourcing order fulfillment
    - Loss of control
    - Build large warehouses
    - Internal holding costs

**Suppliers Management**

- Choosing suppliers
  - Supplier audits
  - Supplier certification
  - Supplier relationship management
  - Supplier partnerships
  - CPFR
  - Strategic partnering

**Choosing Suppliers**

- **Vendor analysis**
  - Evaluating the sources of supply in terms of price, quality, reputation, and service

**Suppliers Audits and Certification**

- **Supplier audit**
  - A means of keeping current on suppliers’ production (or service) capabilities, quality and delivery problems and resolutions, and performance on other criteria

- **Supplier certification**
  - Involves a detailed examination of a supplier’s policies and capabilities
  - The process verifies the supplier meets or exceeds the requirements of a buyer
Supplier Relationship Management

- Type of relationship is often governed by the duration of the trading relationship
  - Short-term
    - Often involves competitive bidding
    - Minimal interaction
  - Medium-term
    - Often involves an ongoing relationship
  - Long-term
    - Often involves greater cooperation that evolves into a partnership

Buyer-Supplier Relations

- **Competitive Orientation:**
  - Zero-sum between seller and buyer
  - When a buyer has more clout?
    - Big share of suppliers’ sales
    - Item is standardized (substitute offered by other suppliers)
    - Buyer can integrate BACKWARD to supplier’s business
    - Supplier can’t integrate FORWARD to buyer’s business
  - Switching cost is low

- **Cooperative Orientation:**
  - Seller and buyers are partners
  - Becomes popular with dramatic JIT success
  - A smaller number of suppliers
  - Longer term commitment
  - Early supplier involvement in value analysis
  - Supplier development and certification
  - Sole sourcing: requires continuous improvement targets to avoid potential drawbacks

Buyer-Supplier Relations - Supplier as a Partner

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Adversary</th>
<th>Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of suppliers</td>
<td>Many</td>
<td>One or a few</td>
</tr>
<tr>
<td>Length of relationship</td>
<td>May be brief</td>
<td>Long-term</td>
</tr>
<tr>
<td>Low price</td>
<td>Major consideration</td>
<td>Moderately important</td>
</tr>
<tr>
<td>Reliability</td>
<td>May not be high</td>
<td>High</td>
</tr>
<tr>
<td>Openness</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Quality</td>
<td>May be unreliable; buyer inspects</td>
<td>At the source; vendor certified</td>
</tr>
<tr>
<td>Volume of business</td>
<td>May be low</td>
<td>High</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Relatively low</td>
<td>Relatively high</td>
</tr>
<tr>
<td>Location</td>
<td>Widely dispersed</td>
<td>Nearness is important</td>
</tr>
</tbody>
</table>

Collaborative Forecasting, Planning, and Replenishment (CFPR)

- Recall uncertainty and the Bullwhip effects.
- CPFR is a supply chain initiative designed to improve competitiveness by focusing on communication and information sharing among supply chain trading partners in planning, forecasting, and inventory

CPFR

- **Goal:** reducing variance between supply and demand
- Eliminates typical order processing.
- Forecasts can be frozen and then converted into a shipping plan.
- Developed by the Voluntary Interindustry Commerce Standards Association (VICS)
• Background:
  • Wal-Mart has long been known for its careful analysis of cash register receipts and for working with suppliers to reduce inventories. In the past, like most other retailers, Wal-Mart did not share its forecasts with its suppliers. The result was forecast errors as much as 60% of actual demand.
  • Retailers ordered more than they needed in order to avoid product shortages and lost sales, and suppliers produced more than they could sell.

• Background:
  • Benchmarking Partners, Inc. was funded by Wal-Mart, IBM, SAP, and Manugistics to develop a software package called CFAR (pronounced “see far”), which stands for collaborative forecasting and replenishment.
  • Wal-Mart initiated CFAR with Warner-Lambert’s Listerine product. Wal-Mart and Warner-Lambert independently calculated the demand they expected for Listerine 6 months into the future. They then exchanged their forecasts, and if the forecasts differed by more than a predetermined %, the parties exchange written comments and supporting data.

• Background:
  • The parties went through as many cycles as needed to converge on an acceptable forecast.
  • Wal-Mart benefits: 1. in-stock position from 85% to 98%, 2. increases in sales and reduction in inventory costs.
  • Warner-Lambert benefits:

• Background:
  • Nabisco and Wegmans
    ➢ 50% increase in category sales
  • Wal-Mart and Sara Lee
    ➢ 14% reduction in store-level inventory
    ➢ 32% increase in sales

• Background:
  • Sears and Michelin
    ➢ 25% combined inventory reduction
  • Campbell Soup
    ➢ reduced the inventories of retailers from 4 to 2 weeks’ supply – savings of 1% of retail sales.

• Background:
  • OfficeMax
    Supply Chain was a competitive disadvantage in 2005 with:
    ➢ High Out of Stocks
    ➢ High Inventory Levels
    ➢ Low Supplier Fill Rates
    ➢ High Cost to Serve
    ➢ Lack of Agility
    ➢ Suppliers had no visibility to their in stocks in OfficeMax stores

After CPFR and S&OP implementation:
Inventory Management

- Inventory issues in SCM
  - Inventory location
    - Centralized inventories
    - Decentralized inventories
  - Inventory velocity
    - The speed at which goods move through a supply chain
  - The bullwhip effect
    - Inventory oscillations that become increasingly larger looking backward through the supply chain

The Bullwhip Effect

- Variations in demand cause inventory fluctuations to fluctuate and get out of control
  - Inventory fluctuation can be magnified by
    - Periodic ordering
    - Reactions to shortages
    - Forecast inaccuracies
    - Order batching
    - Sales incentives and promotions
    - Liberal product return policies
  - Results in
    - Higher costs
    - Lower customer satisfaction

Bullwhip Effect

Mitigating the Bullwhip Effect

- Good supply chain management can overcome the bullwhip effect
  - Strategic buffering
    - Holding inventory at a distribution center rather than at retail outlets
  - Replenishment based on need
  - Vendor-managed inventory
    - Vendors monitor goods and replenish retail inventories when supplies are low

Order Fulfillment

- Order fulfillment
  - The process involved in responding to customer orders
  - Often a function of the degree of customization required
    - Common approaches
      - Engineer-to-order (ETO)
      - Make-to-order (MTO)
      - Assemble-to-order (ATO)
      - Make-to-stock (MTS)

Logistics

- Logistics
  - Refers to the movement of materials and information within a facility and to incoming and outgoing shipments of goods and materials in a supply chain
Supply Chain Management

Movement within a Facility

- Traffic management
  - Overseeing the shipment of incoming and outgoing goods
  - Handles schedules and decisions on shipping method and times, taking into account:
    - Costs of shipping alternatives
    - Government regulations
    - Needs of the organization
    - Shipping delays or disruptions

Incoming and Outgoing Shipments

- Radio frequency identification (RFID)
  - A technology that uses radio waves to identify objects, such as goods in supply chains
  - Similar to barcodes but
    - Are able to convey much more information
    - Do not require line-of-sight for reading
    - Do not need to be read one at a time
  - Types:
    - Active
    - Passive

RFID

- Third-party logistics (3-PL)
  - The outsourcing of logistics management
  - Includes
    - Warehousing and distribution

3-PL

Managing Returns

- Reverse Logistics
  - The process of transporting returned items
  - Products are returned to companies or third party handlers for a variety of reasons and in a variety of conditions
  - Elements of return management
    - Gatekeeping
      - Screening returned goods to prevent incorrect acceptance of goods
    - Avoidance
      - Finding ways to minimize the number of items that are returned

Creating an Effective Supply Chain

- It begins with strategic sourcing
  - Analyzing the procurement process to lower costs by reducing waste and non-value-added activities, increase profits, reduce risks, and improve supplier performance
  - There must be
    - Trust
    - Effective communication
      - Information velocity
    - Event management capability
    - Performance metrics
1. Accounts receivable cycle time measures the length of time it takes to convert a sale into cash, calculated as the number of days of sales invested in accounts receivable:

\[
S_d = \frac{S}{d} \quad \text{where,} \quad S = \text{sales over } d \text{ days}
\]

Thus,

\[
AR_d = \frac{AR}{S_d} \quad \text{where,} \quad AR_d = \text{average days of account receivable}
\]

\[AR = \text{account receivable}\]

2. Inventory cycle time measures the number of days of inventory relative to the cost of sales:

\[
C_J = S_d \times CS
\]

where, \(C_J = \text{average daily cost of sales}\)

\[CS = \text{cost of sales (percent)}\]

Thus,

\[
I_d = \frac{I}{C_J} \quad \text{where,} \quad I = \text{current value of total inventory}
\]

\[I_d = \text{average days of inventory}\]

3. Account Payable cycle time measures the level of accounts payable relative to the cost of sales:

\[
AP_d = \frac{AP}{C_J} \quad \text{where,} \quad AP = \text{accounts payable}
\]

\[AP_d = \text{average days of account payable}\]

4. Cash-to-cash cycle time =

Cash-to-cash Example

Sales over last 30 days = $1,020,000
Accounts receivable at the end of the month = $200,000
Cost of sales = 60% of total sales
Inventory value at the end of the month = $400,000
Accounts payable at the end of the month = $160,000

Cash-to-cash cycle time =

Challenges

- Barriers to integration of organizations
- Getting top management on board
- Dealing with trade-offs
- Small businesses
- Variability and uncertainty
- Response time
• Lot-size-inventory trade-off
  • Large lot sizes yield benefits in terms of quantity discounts and lower annual setup costs, but it increases the amount of safety stock (and inventory carrying costs) carried by suppliers
  • Inventory-transportation costs
  • Suppliers prefer to ship full truckloads instead of partial loads to spread shipping costs over as many units as possible. This leads to greater holding costs for customers
  • Cross-docking
  • A technique whereby goods arriving at a warehouse from a supplier are unloaded from the supplier’s truck and loaded onto outbound truck, thereby avoiding warehouse storage

• Lead time-transportation costs
  • Suppliers like to ship in full loads, but waiting for sufficient orders and/or production to achieve a full load may increase lead time

• Product variety-inventory
  • Greater product variety usually means smaller lot sizes and higher setup costs, as well as higher transportation and inventory management costs
  • Delayed differentiation
  • Production of standard components and subassemblies which are held until late in the process to add differentiating features

• Cost-customer service
  • Producing and shipping in large lots reduces costs, but increases lead time
  • Disintermediation
  • Reducing one or more steps in a supply chain by cutting out one or more intermediaries

<table>
<thead>
<tr>
<th>Problem</th>
<th>Potential Improvement</th>
<th>Benefits</th>
<th>Possible Drawbacks</th>
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<tbody>
<tr>
<td>Large inventories</td>
<td>Smaller, more frequent deliveries</td>
<td>Reduced holding costs</td>
<td>Traffic congestion, increased costs</td>
</tr>
<tr>
<td>Long lead times</td>
<td>Delayed differentiation Disintermediation</td>
<td>Quick response</td>
<td>May not be feasible, may need absorb functions</td>
</tr>
<tr>
<td>Large number of parts</td>
<td>Modular</td>
<td>Fewer parts, simpler ordering</td>
<td>Less variety</td>
</tr>
<tr>
<td>Cost/Quality</td>
<td>Outsourcing</td>
<td>Reduced cost, higher quality</td>
<td>Less of control</td>
</tr>
<tr>
<td>Variability</td>
<td>Shorter lead times, better forecasts</td>
<td>Able to match supply and demand</td>
<td>Less variety</td>
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</table>