Chapter 10

Supply Chain Management
Strategy and Design

Russell and Taylor
Operations and Supply Chain Management, 8th Edition
Lecture Outline

• Supply Chains – Slide 4
• The Management of Supply Chains – Slide 11
• Green Supply Chains – Slide 17
• Information Technology: A Supply Chain Enabler – Slide 19
• Supply Chain Integration – Slide 28
• Supply Chain Management (SCM) Software – Slide 31
• Measuring Supply Chain Performance – Slide 32
Learning Objectives

• Describe the key characteristics and management strategies of the modern supply chain
• Discuss sustainable supply chain practices and the impact of the environment on supply chain decisions
• Describe the role of information technology in supply chains, and the need for supply chain integration
• Present the SCOR model and calculate key performance indicators for monitoring supply chain performance
Supply Chains

• The facilities, functions, and activities involved in producing and delivering a product or service from suppliers to customers

• An integrated group of processes to “source,” “make,” and “deliver” products
The Supply Chain

[Diagram showing the supply chain with tiers and distribution centers.]
Supply Chain for Denim Jeans
Supply Chain for Denim Jeans

- Tier 1
- Retail Stores (Global)
- Shipping
- Inventory
- Denim Jeans Manufactured (U.S., China, India)
- Distribution Centers & Warehouses (U.S., France, Hong Kong)
- Demand

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Supply Chain Processes
Supply Chain for Service Providers

• More difficult than manufacturing
• Does not focus on the flow of physical goods
• Focuses on human resources and support services
• More compact and less extended
Value Chains

• Value chain
  • Broader than supply chain
  • Customer management
  • New product innovation
  • Post-sales support
  • Change management

• Demand-driven value chain
  • Supply management
  • Demand management
  • Product management
Supply Chain Management (SCM)

• Managing flow of information through supply chain in order to attain the level of synchronization that will make it more responsive to customer needs while lowering costs

• Keys to effective SCM
  • information
  • communication
  • cooperation
  • trust
Supply Chain
Uncertainty and Inventory

• A major objective of SCM:
  • respond to uncertainty in customer demand without creating costly excess inventory

• Negative effects of uncertainty
  • lateness
  • incomplete orders

• Inventory
  • insurance against supply chain uncertainty
Factors that contribute to uncertainty:
- inaccurate demand forecasting
- long variable lead times
- late deliveries
- incomplete shipments
- product changes
- batch ordering
- price fluctuations and discounts
- inflated orders
Bullwhip Effect

• Occurs when slight demand variability is magnified as information moves back upstream
Risk Management

• Formal process for coping with supply chain uncertainty
• Evaluate and anticipate likelihood of supply chain disruptions
• Plan for possible disruptions
Risk Pooling

• Risks are aggregated to reduce the impact of individual risks
  • Combine inventories from multiple locations into one
  • Reduce parts and product variability, thereby reducing the number of product components
  • Create flexible capacity
Supply Chain Sustainability

• “Going green”
• Meeting present needs without compromising the ability of future generations to meet their needs
• Sustaining human and social resources
• It can be cost effective and profitable
• Can provide impetus for product and process innovations
• Impetus comes from downstream in the supply chain and moves upstream to suppliers
Sustainability and Quality Management

- Reducing waste through quality programs helps achieve sustainability goals
- Improving fuel efficiency of vehicles
- Telecommuting
- Eco-friendly packing materials
- Energy-efficient facilities
- Changing thermostat settings
Information Technology: A Supply Chain Enabler

- Information links all aspects of supply chain
- E-business
  - replacement of physical business processes with electronic ones
- Electronic data interchange (EDI)
  - a computer-to-computer exchange of business documents
- Bar code and point-of-sale
  - data creates an instantaneous computer record of a sale
IT: Supply Chain Enabler

• Radio frequency identification (RFID)
  • technology can send product data from an item to a reader via radio waves

• Internet
  • allows companies to communicate with suppliers, customers, shippers and other businesses around the world instantaneously

• Build-to-order (BTO)
  • direct-sell-to-customers model via the Internet; extensive communication with suppliers and customer
Supply Chain Enablers

1. **Electronic Data Interchange (EDI)**—links supply chain members for order processing, accounting, production, inventory control and distribution.

2. **Radio Frequency Identification (RFID)**—uses radio waves to transfer data between a scanner and an item such as a package or shipping container.

3. **Bar codes**—contains identifying information about products as they flow through the supply chain, including product description, item number, source and destination, handling procedures, cost, order number, etc.

   - **France**
   - **India**
   - **China**

4. **Internet**—allows companies to communicate with suppliers, customers, shippers and other businesses around the world, instantaneously.
E-Business & Supply Chain Management

- Savings due to lower transaction costs
- Reduction of intermediary roles
- Shorter supply chain response times
- Wider presence and increased visibility
- Greater choices & more info for customers
- Improved service
- Collection & analysis of huge amounts of customer data & preferences
- Access to global markets, suppliers & distribution channels
Electronic Data Interchange

• Computer-to-computer exchange of documents in a standard format
• Purchasing, shipping and receiving
• Improve customer service
• Reduce paperwork
• Increase productivity
• Improve billing and cost efficiency
• Reduce bullwhip effect through information sharing
Bar Codes

- Automated data collection system
- Bar code contains identifying information
- Provide instantaneous tracking information
- Checkout scanners create point-of-sale data
  - Update inventory records
  - Identify trends
  - Order material
  - Schedule orders
  - Plan deliveries
Radio Frequency Identification (RFID)

- Use radio waves to transfer data from chip to a reader
- Provides complete visibility of product location
- Continuous inventory monitoring
- Reduce labor to manage inventory
- Reduce inventory costs

- RFID is not standardized yet
- Difficult to track between systems
RFID Capabilities

RFID directs packages through a conveyor system in distribution center

RFID reads item in inventory at a store or DC plus items in transit so company knows up-to-date inventory status and can synchronize supply chain

Employee finds items in bins or puts items in bins with RFID

RFID checks arriving truckloads for security and updates inventory
RFID Capabilities

RFID keeps track of items on ships and planes leaving global ports or coming into U.S. for security.

Customer finds pair of jeans with her size (with chip sewn into label) on store shelf with radio wand provided by store; pays with cell phone RFID technology.
Supply Chain Integration

- Share information among supply chain members
  - Reduced bullwhip effect
  - Early problem detection
  - Faster response
  - Builds trust and confidence
- Collaborative planning, forecasting, replenishment, and design
  - Reduced bullwhip effect
  - Lower costs (material, logistics, operating, etc.)
  - Higher capacity utilization
  - Improved customer service levels
Supply Chain Integration

• Coordinated workflow, production and operations, procurement
  • Production efficiencies
  • Fast response
  • Improved service
  • Quicker to market

• Adopt new business models and technologies
  • Penetration of new markets
  • Creation of new products
  • Improved efficiency
  • Mass customization
Collaborative Planning, Forecasting, and Replenishment (CPFR)

- Two or more companies in a supply chain to synchronize their demand forecasts into a single plan to meet customer demand
- Parties electronically exchange:
  - past sales trends
  - point-of-sale data
  - on-hand inventory
  - scheduled promotions
  - forecasts
SCM Software

- Enterprise resource planning (ERP)
  - software that integrates the components of a company by sharing and organizing information and data
Measuring Supply Chain Performance

• Key performance indicators
  – Metrics used to measure supply chain performance

• Inventory turnover

  \[
  \text{Inventory turns} = \frac{\text{Cost of goods sold}}{\text{Average aggregate value of inventory}}
  \]

• Total value (at cost) of inventory

  \[
  \text{Average aggregate value of inventory} = \sum (\text{average inventory for item } i) \times (\text{unit value item } i)
  \]
Measuring Supply Chain Performance

• Days of supply

\[
\text{Days of supply} = \frac{\text{Average aggregate value of inventory}}{(\text{Cost of goods sold})/(365 \text{ days})}
\]

• Fill rate: fraction of orders filled by a distribution center within a specific time period
The Tomahawk Motorcycle Company manufactures motorcycles. Last year the cost of goods sold was $425 million. The company had the following average value of production materials and parts, work-in-process, and finished goods inventory:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production materials and parts</td>
<td>$ 4,629,000</td>
</tr>
<tr>
<td>Work-in-process</td>
<td>17,465,000</td>
</tr>
<tr>
<td>Finished goods</td>
<td>12,322,000</td>
</tr>
<tr>
<td>Total average aggregate value of inventory</td>
<td>$34,416,000</td>
</tr>
</tbody>
</table>

The company wants to know the number of inventory turns and days of supply being held in inventory.

**Solution**

Inventory turns = \( \frac{\text{Cost of goods sold}}{\text{Average aggregate value of inventory}} \)

= \( \frac{425,000,000}{34,416,000} \)

= 12.3

Days of supply = \( \frac{\text{Average aggregate value of inventory}}{(\text{Cost of goods sold})/(365 \text{ days})} \)

= \( \frac{34,416,000}{(425,000,000)/(365)} \)

= 29.6
Process Control and SCOR

- Process Control
  - not only for manufacturing operations
  - can be used in any processes of supply chain
- Supply Chain Operations Reference (SCOR)
  - a cross industry supply chain diagnostic tool maintained by the Supply Chain Council
SCOR Model Processes

- **Plan**: Develop a course of action that best meets sourcing, production and delivery requirements.
- **Source**: Procure goods and services to meet planned or actual demand.
- **Make**: Transform product to a finished state to meet planned or actual demand.
- **Deliver**: Provide finished goods and services to meet planned or actual demand, including order management, transportation and distribution.
- **Return**: Return products, post-delivery customer support.
### SCOR Performance Metrics

<table>
<thead>
<tr>
<th>Performance Attribute</th>
<th>Performance Metric</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer Facing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply chain delivery reliability</td>
<td>Delivery performance</td>
<td>Percentage of orders delivered on time and in full to the customer</td>
</tr>
<tr>
<td></td>
<td>Fill rate</td>
<td>Percentage of orders shipped within 24 hours of order receipt</td>
</tr>
<tr>
<td></td>
<td>Perfect order fulfillment</td>
<td>Percentage of orders delivered on time and in full, perfectly matched with order with no errors</td>
</tr>
<tr>
<td>Supply chain responsiveness</td>
<td>Order fulfillment lead time</td>
<td>Number of days from order receipt to customer delivery</td>
</tr>
<tr>
<td>Supply chain flexibility</td>
<td>Supply chain response time</td>
<td>Number of days for the supply chain to respond to an unplanned significant change in demand without a cost penalty</td>
</tr>
<tr>
<td></td>
<td>Production flexibility</td>
<td>Number of days to achieve an unplanned 20% change in orders without a cost penalty</td>
</tr>
<tr>
<td><strong>Internal Facing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply chain cost</td>
<td>Supply chain management costs</td>
<td>The direct and indirect cost to plan, source and deliver products and services</td>
</tr>
<tr>
<td></td>
<td>Cost of goods sold</td>
<td>The direct cost of material and labor to produce a product or service</td>
</tr>
<tr>
<td></td>
<td>Value-added productivity</td>
<td>Direct material cost subtracted from revenue and divided by the number of employees, similar to sales per employee</td>
</tr>
<tr>
<td></td>
<td>Warranty/return processing cost</td>
<td>Direct and indirect costs associated with returns including defective, planned maintenance and excess inventory</td>
</tr>
<tr>
<td>Supply Chain Asset Management Efficiency</td>
<td>Cash-to-cash cycle time</td>
<td>The number of days that cash is tied up as working capital</td>
</tr>
<tr>
<td></td>
<td>Inventory days of supply</td>
<td>The number of days that cash is tied up as inventory</td>
</tr>
<tr>
<td></td>
<td>Asset turns</td>
<td>Revenue divided by total assets including working capital and fixed assets</td>
</tr>
</tbody>
</table>