Chapter 10

Supply Chain Management

Operations Management - 5th Edition

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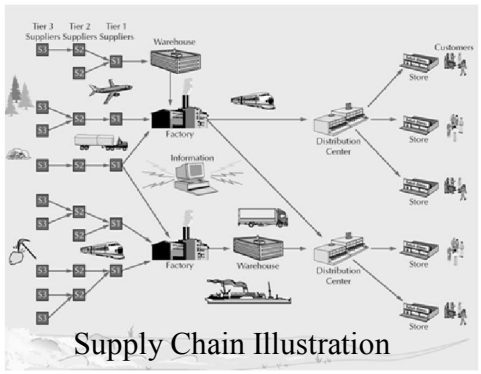
Supply Chain

- All facilities, functions, activities, associated with flow and transformation of goods and services from raw materials to customer, as well as the associated information flows
- An integrated group of processes to "source," "make," and "deliver" products

Lecture Outline

- Supply Chain Management
- Information Technology: A Supply Chain Enabler
- Supply Chain Integration
- Suppliers

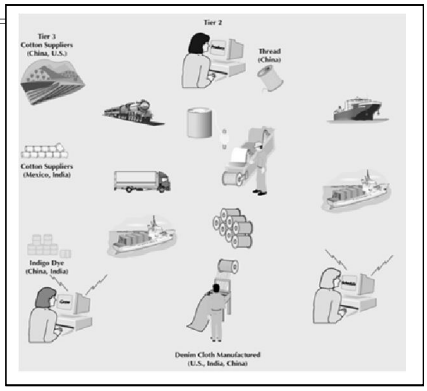


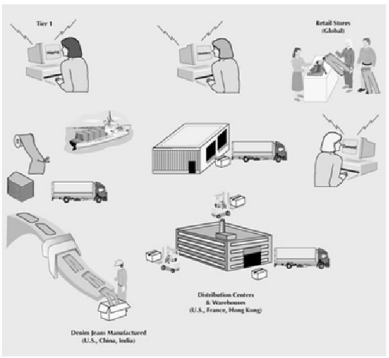
Supply Chain Illustration

Lecture Outline (cont.)

- E-Procurement
- Distribution
- Supply Chain Management Software
- Measuring Supply Chain Performance
- Global Supply Chain

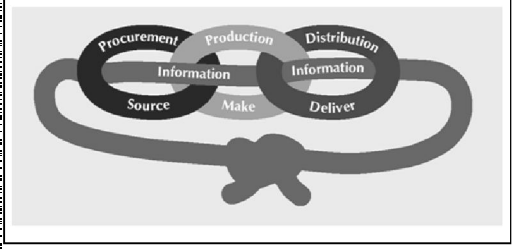
Supply Chain for Denim Jeans





Supply Chain for Denim Jeans (cont.)

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 vs. Supply Chain

- Value chain
  - every step from raw materials to the eventual end user
  - ultimate goal is delivery of maximum value to the end user
- Supply chain
  - activities that get raw materials and subassemblies into manufacturing operation
- Terms are used interchangeably

Supply Chain Management (SCM)

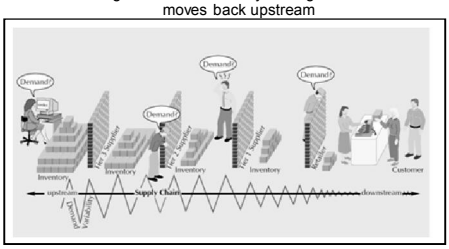
- Managing flow of information through supply chain in order to attain the level of synchronization that will make it more responsive to customer needs while lowering costs
- Keys to effective SCM
  - information
  - communication
  - cooperation
  - trust

Supply Chain Uncertainty

- One goal in 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



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
- 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

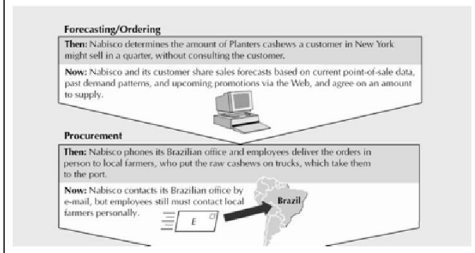
E-business and Supply Chain

- Cost savings and price reductions
- Reduction or elimination of the role of intermediaries
- Shortening supply chain response and transaction times
- Gaining a wider presence and increased visibility for companies
- Greater choices and more information for customers

E-business and Supply Chain (cont.)

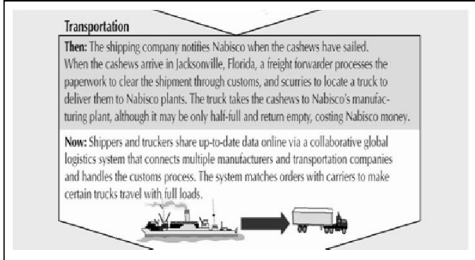
- Improved service as a result of instant accessibility to services
- Collection and analysis of voluminous amounts of customer data and preferences
- Creation of virtual companies
- Leveling playing field for small companies
- Gaining global access to markets, suppliers, and distribution channels

Supply Chain Evolution at Nabisco



Source: F. Keenan, "Logistics Gets a Little Respect," *Business Week* (November 20, 2000), pp. 112–115.

Supply Chain Evolution at Nabisco (cont.)



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Supply Chain Evolution at Nabisco (cont.)

Distribution

Then: The nuts are roasted and packed, and trucks take them to Nabisco's 12 warehouses across the country, where they are ready to be shipped to stores. However, they may not be near the store where the customer needs them because regional demand has not been discussed.

Now: After the nuts are roasted and packed at the plant, Nabisco sends the cashews to a third-party distributor, which relieves Nabisco of a supply chain activity not among its core competencies. The distributor consolidates the nuts on trucks with other products from Nabisco's competitors going to a customer resulting in full loads.

Customer

Then: If Nabisco ordered too many cashews they will turn soft in the warehouses, and if they ordered too few the customer will buy cashews elsewhere.

Now: Nabisco correctly knows the customer's needs so there is neither a shortage nor an oversupply of cashews. Transportation, distribution, warehousing, and inventory costs drop, and product and service quality improve.

Source: F. Keenan, "Logistics Gets a Little Respect," *Business Week* (November 20, 2000), pp. 112–115.

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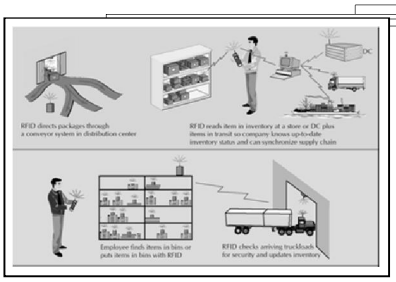
RFID Capabilities



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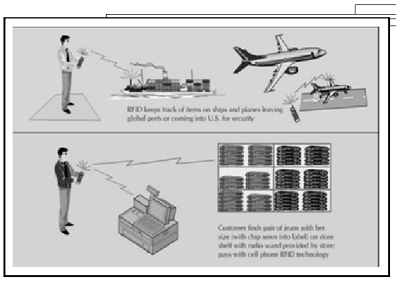
RFID Capabilities (cont.)



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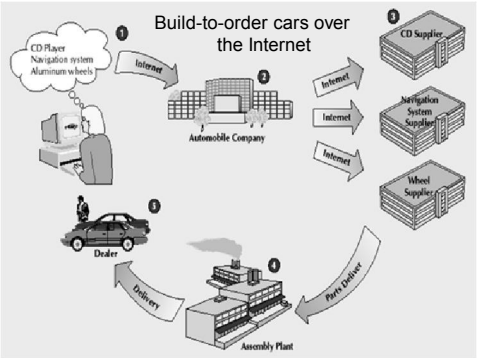
Build-to-order cars over the Internet



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E-automotive Supply Chain

Supply Chain Processes	Automotive Past	E-Automotive
◆ Customer sales ◆ Production	◆ Push—sell from inventory stock ◆ Goal of even and stable production	◆ Pull—build-to-order ◆ Focus on customer demand, respond with supply chain flexibility
◆ Distribution	◆ Mass approach	◆ Fast, reliable, and customized to get cars to specific customer location
◆ Customer relationship	◆ Dealer-owned	◆ Shared by dealers and manufacturers

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E-automotive Supply Chain (cont.)

Supply Chain Processes	Automotive Past	E-Automotive
◆ Managing uncertainty	◆ Large car inventory at dealers	◆ Small inventories with shared information and strategically placed parts inventories
◆ Procurement	◆ Batch-oriented; dealers order based on allocations	◆ Orders made in real time based on available-to-promise information
◆ Product design	◆ Complex products don't match customer needs	◆ Simplified products based on better information about what customers want

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Supply Chain Integration

- Information sharing 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 (cont.)

- 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

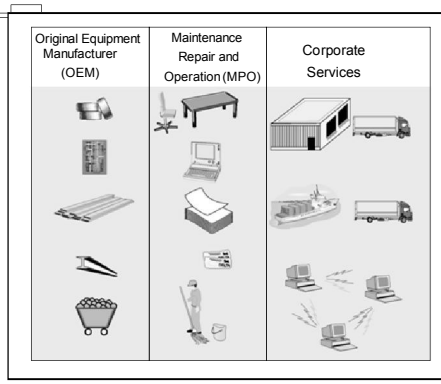
- Process for two or more companies in a supply chain to synchronize their demand forecasts into a single plan to meet customer demand
- Parties electronically exchange
  - past sales trends
  - point-of-sale data
  - on-hand inventory
  - scheduled promotions
  - forecasts

Suppliers

- Procurement
  - purchase of goods and services from suppliers
- On-demand (direct response) delivery
  - requires supplier to deliver goods when demanded by customer
- Continuous replenishment
  - supplying orders in a short period of time according to a predetermined schedule
- Cross-enterprise teams coordinate processes between company and supplier

Outsourcing

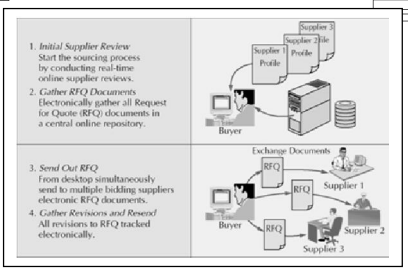
- Sourcing
  - selection of suppliers
- Outsourcing
  - purchase of goods and services from an outside supplier
- Core competencies
  - what a company does best
- Single sourcing
  - a company purchases goods and services from only a few (or one) suppliers



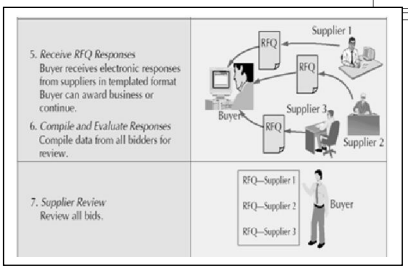
E-Procurement

- Direct purchase from suppliers over the Internet
- Direct products go directly into production process a product, indirect products not
- E-marketplaces
  - web sites where companies and suppliers conduct business-to-business activities
- Reverse auction
  - a company posts orders on the Internet for suppliers to bid on

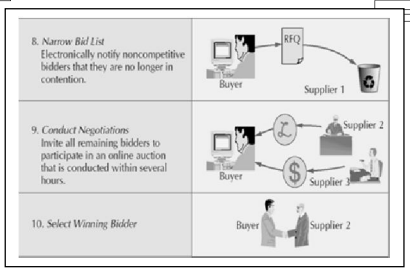
Online Sourcing/ Procurement Process



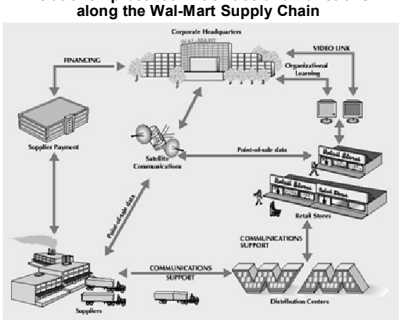
Online Sourcing/ Procurement Process (cont.)



Online Sourcing/ Procurement Process (cont.)



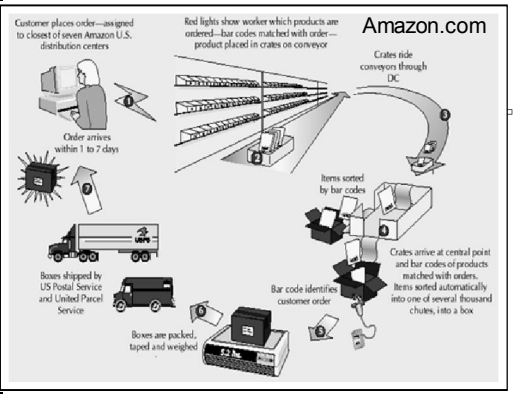
Relationship between Facilities and Functions along the Wal-Mart Supply Chain



Source: Adapted from Garrison Wieland for "Wal-Mart's Supply Chain," *Harvard Business Review* 70(2; March–April 1992), pp. 60–71.

Distribution

- Encompasses all channels, processes, and functions, including warehousing and transportation, that a product passes on its way to final customer
- Often called logistics
- Logistics
  - transportation and distribution of goods and services
- Driving force today is speed
- Particularly important for Internet dot-coms

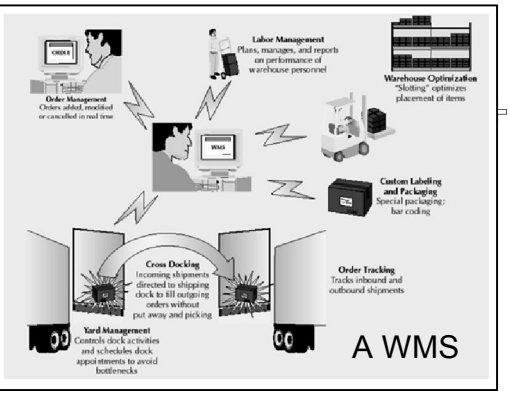


Distribution Centers (DC) and Warehousing

- DCs are some of the largest business facilities in the United States
- Trend is for more frequent orders in smaller quantities
- Flow-through facilities and automated material handling
- Postponement
  - final assembly and product configuration may be done at the DC

Warehouse Management Systems

- Highly automated system that runs day-to-day operations of a DC
- Controls item putaway, picking, packing, and shipping
- Features
  - transportation management
  - order management
  - yard management
  - labor management
  - warehouse optimization



Vendor-Managed Inventory

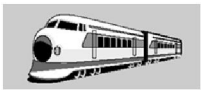
- Manufacturers generate orders, not distributors or retailers
- Stocking information is accessed using EDI
- A first step towards supply chain collaboration
- Increased speed, reduced errors, and improved service

Collaborative Logistics and Distribution Outsourcing

- Collaborative planning, forecasting, and replenishment create greater economies of scale
- Internet-based exchange of data and information
- Significant decrease in inventory levels and more efficient logistics
- Companies focus on core competencies

Transportation

- **Rail**
  - low-value, high-density, bulk products, raw materials, intermodal containers
  - not as economical for small loads, slower, less flexible than trucking
- **Trucking**
  - main mode of freight transport in U.S.
  - small loads, point-to-point service, flexible
  - More reliable, less damage than rails; more expensive than rails for long distance

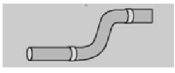


Transportation (cont.)

- Air
  - most expensive and fastest, mode of freight transport
  - lightweight, small packages <500 lbs
  - high-value, perishable and critical goods
  - less theft
- Package Delivery
  - small packages
  - fast and reliable
  - increased with e-Business
  - primary shipping mode for Internet companies

Transportation (cont.)

- Water
  - low-cost shipping mode
  - primary means of international shipping
  - U.S. waterways
  - slowest shipping mode
- Intermodal
  - combines several modes of shipping-truck, water and rail
  - key component is containers
- Pipeline
  - transport oil and products in liquid form
  - high capital cost, economical use
  - long life and low operating cost

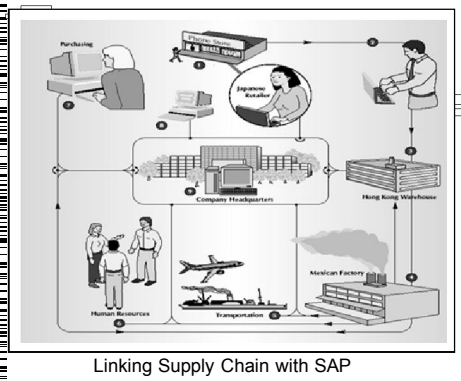


Internet Transportation Exchanges

- Bring together shippers and carriers
- Initial contact, negotiations, auctions
- Examples
  - www.nte.com
  - www.freightquote.com

SCM Software

- Enterprise Resource Planning (ERP)
  - software that integrates components of a company by sharing and organizing information and data
  - SAP was first ERP software
  - mySAP.com
    - web enabled modules that allow collaboration between companies along the supply chain



Linking Supply Chain with SAP

Measuring Supply Chain Performance

- Key performance indicators
  - inventory turnover
    - cost of annual sales per inventory unit
  - inventory days of supply
    - total value of all items being held in inventory
  - fill rate
    - fraction of orders filled by a distribution center within a specific time period

Key Performance Indicators

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

Average aggregate value of inventory =

= ☜(average inventory for item *i*) X (unit value item *i*)

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

Key Performance Indicators: Example

1. Cost of goods sold: $425 million
2. Production materials and parts: $4,629,000
3. Work-in-process: $17,465,000
4. Finished goods: $12,322,000
5. Total average aggregate value of inventory (2+3+4): $34,416,000

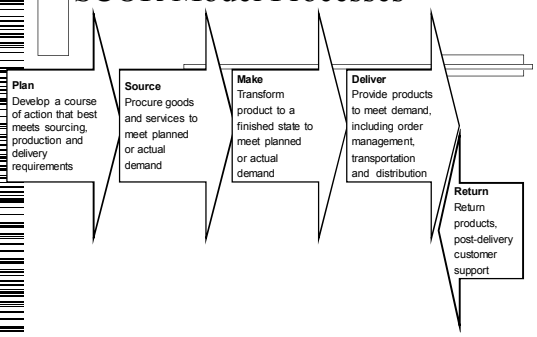
$$\text{Inventory turns} = \frac{\$425,\ 000,\ 000}{\$34,416,000} = 12.3$$

$$\text{Days of supply} = \frac{\$34,416,000}{(\$425,000,000)/(365)} = 29.6$$

Other Measures of Supply Chain Performance

- Process Control
  - used to monitor and control any process in supply chain
- Supply Chain Operations Reference (SCOR)
  - establish targets to achieve “best in class” performance

SCOR Model Processes



SCOR: Customer Facing

Performance Attribute	Performance Metric	Definition
Supply Chain Delivery Reliability	Delivery performance	Percentage of orders delivered on time and in full to the customer
	Fill rate	Percentage of orders shipped within24 hours of order receipt
	Perfect order fulfillment	Percentage of orders delivered on time and in full, perfectly matched with order with no errors
Supply Chain Responsiveness	Order fulfillment lead time	Number of days from order receipt to customer delivery
Supply Chain Flexibility	Supply chain response time	Number of days for supply chain to respond to an unplanned significant change in demand without a cost penalty
	Production flexibility	Number of days to achieve an unplanned 20% change in orders without a cost penalty

SCOR: Internal Facing

Performance Attribute	Performance Metric	Definition
Supply Chain Cost	Supply chain management cost	Direct and indirect cost to plan, source and deliver products and services
	Cost of goods sold	Direct cost of material and labor to produce a product or service
	Value-added productivity	Direct material cost subtracted from revenue and divided by the number of employees, similar to sales per employee
	Warranty/returns processing cost	Direct and indirect costs associated with returns including defective, planned maintenance and excess inventory
Supply Chain Asset Management Efficiency	Cash-to-cash cycle time	Number of days that cash is tied up as working capital
	Inventory days of supply	Number of days that cash is tied up as inventory
	Asset turns	Revenue divided by total assets including working capital and fixed assets

Global Supply Chain

- To compete globally requires an effective supply chain
- Information technology is an "enabler" of global trade
- Nations form trading groups
- No tariffs or duties

Obstacles to Global Chain Transactions

- Increased documentation for invoices, cargo insurance, letters of credit, ocean bills of lading or air waybills, and inspections
- Ever changing regulations that vary from country to country that govern the import and export of goods
- Trade groups, tariffs, duties, and landing costs
- Limited shipping modes
- Differences in communication technology and availability

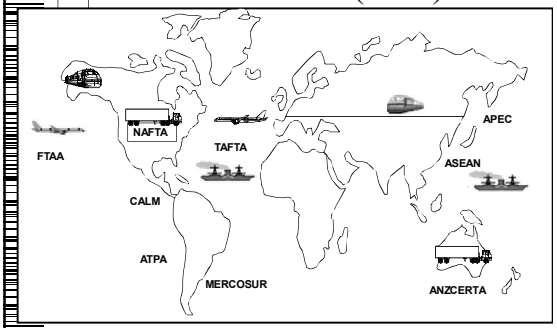
Obstacles to Global Chain Transactions (cont.)

- Different business practices as well as language barriers
- Government codes and reporting requirements that vary from country to country
- Numerous players, including forwarding agents, custom house brokers, financial institutions, insurance providers, multiple transportation carriers, and government agencies
- Since 9/11, numerous security regulations and requirements

Duties and Tariffs

- Proliferation of trade agreements
- Group members charge uniform tariffs
- Member nations have a competitive advantage within the group
- Trade specialists
  - include freight forwarders, customs house brokers, export packers, and export management and trading companies

Duties and Tariffs (cont.)



Landed Cost

- Total cost of producing, storing, and transporting a product to the site of consumption or another port
- Value added tax (VAT)
  - an indirect tax assessed on the increase in value of a good at any stage of production process from raw material to final product
- Clicker shock
  - Occurs when an ordered is placed with a company that does not have the capability to calculate landed cost

Web-based International Trade Logistic Systems

- International trade logistics web-based software systems reduce obstacles to global trade
  - convert language and currency
  - provide information on tariffs, duties, and customs processes
  - attach appropriate weights, measurements, and unit prices to individual products ordered over the Web
  - incorporate transportation costs and conversion rates
  - calculate shipping costs online while a company enters an order
  - track global shipments

Recent Trends in Globalization for U.S. Companies

- Two significant changes
  - passage of NAFTA
  - admission of China in WTO
- Electronic Industry
  - 70% of cost is in components
  - major supply chains have moved to China
- Proliferation of counterfeit parts

Effects of 9/11 on Global Chains

- Increase security measures
  - added time to supply chain schedules
  - Increased supply chain costs
- 24 hours rules for "risk screening"
  - extended documentation
  - extend time by 3-4 days
- Inventory levels have increased 5%
- Other costs include:
  - new people, technologies, equipment, surveillance, communication, and security systems, and training necessary for screening at airports and seaports around the world

