Principles of Operations Management: Sustainability and Supply Chain Management

Twelfth Edition, Global Edition

Chapter 11

Supply Chain Management

Outline

- **Global Company Profile:** *Red Lobster*
- The Supply Chain's Strategic Importance
- Sourcing Issues: Make-or-Buy and Outsourcing
- Six Sourcing Strategies
- Supply Chain Risk
- Managing the Integrated Supply Chain

Outline (continued)

- Building the Supply Base
- Logistics Management
- Distribution Management
- Ethics and Sustainable Supply Chain Management
- Measuring Supply Chain Performance

Red Lobster's Supply Chain

- World's largest seafood restaurant company
- Serves 140 million meals annually from over 700 restaurants
- A winning operations strategy requires a winning supply chain
- Committed to seafood sustainability
- Sources food from five continents and thousands of suppliers
- Supply chains incorporate *supplier qualification*, *product tracking*, *independent audits*, and *just-in-time delivery*

Learning Objectives

When you complete this chapter you should be able to:

11.1 ***Explain*** the strategic importance of the supply chain

11.2 ***Identify*** six sourcing strategies

11.3 ***Explain*** issues and opportunities in the supply chain

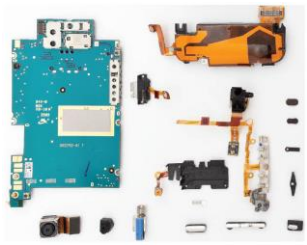
11.4 ***Describe*** the steps in supplier selection

11.5 ***Explain*** major issues in logistics management

11.6 ***Compute*** percentage of assets committed to inventory and inventory turnover

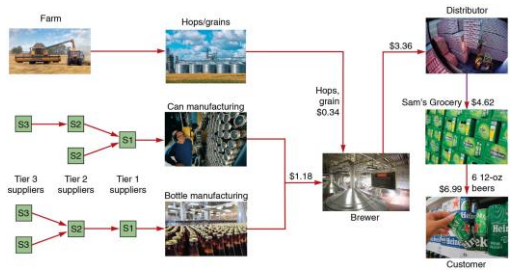
Supply-Chain Management

The objective of supply chain management is to structure the supply chain to maximize its competitive advantage and benefits to the ultimate consumer



A Supply Chain for Beer

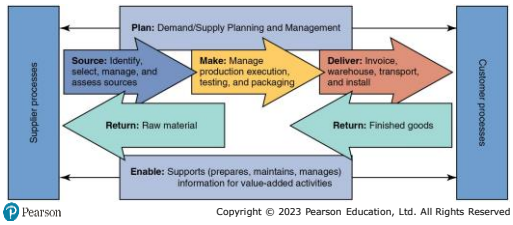
Figure 11.1



7

The Supply Chain's Strategic Importance

- The coordination of all supply chain activities, starting with raw materials and ending with a satisfied customer
- Includes suppliers, manufacturers and/or service providers, distributors, wholesalers, retailers, and final customers



8

The Supply Chain's Strategic Importance (continued)

- Large portion of sales dollars spent on purchases
- Supplier relationships increasingly integrated and long term
- Improve innovation, speed design, reduce costs
- Managing supplier relationships has added emphasis

9

Supply Chain Costs

Table 11.1 Supply Chain Costs as a Percentage of Sales

INDUSTRY	% PURCHASED
Automobiles	67
Beverages	52
Chemical	62
Food	60
Lumber	61
Metals	65
Paper	55
Petroleum	79
Restaurants	35
Transportation	62

10

Supply Chain vs. Sales Strategy

Hau Lee Furniture

60% of sales $ in supply chain

Current gross profit = $10,000

Increase profits to $15,000 (50%)

	CURRENT SITUATION	SUPPLY CHAIN STRATEGY	SALES STRATEGY
Sales	$100,000	$100,000	$125,000
Cost of materials	$60,000 (60%)	$55,000 (55%)	$75,000 (60%)
Production costs	$20,000 (20%)	$20,000 (20%)	$25,000 (20%)
Fixed costs	$10,000 (10%)	$10,000 (10%)	$10,000 (8%)
Profit	$10,000 (10%)	$15,000 (15%)	$15,000 (12%)

11

Supply Chain Management

Table 11.2 How Corporate Strategy Impacts Supply Chain Decisions

	LOW-COST STRATEGY	RESPONSE STRATEGY	DIFFERENTIATION STRATEGY
Primary supplier selection criteria	• Cost	• Capacity • Speed • Flexibility	• Product development skills • Willing to share information • Jointly and rapidly develop products
Supply chain inventory	• Minimize inventory to hold down costs	• Use buffer stocks to ensure speedy supply	• Minimize inventory to avoid product obsolescence
Distribution network	• Inexpensive transportation • Sell through discount distributors/retailers	• Fast transportation • Provide premium customer service	• Gather and communicate market research data • Knowledgeable sales staff
Product design characteristics	• Maximize performance • Minimize cost	• Low setup time • Rapid production ramp-up	• Modular design to aid product differentiation

12

Sourcing Issues

- **Make-or-buy decisions**
  - Choosing between obtaining products and services externally as opposed to producing them internally
- **Outsourcing**
  - Transfer traditional internal activities and resources to outside vendors
  - Efficiency in specialization
  - Focus on core competencies

13

Six Sourcing Strategies

- Many suppliers
- Few suppliers
- Vertical integration
- Joint ventures
- *Keiretsu* networks
- Virtual companies

14

Many Suppliers

- Commonly used for commodity products
- Purchasing is typically based on price
- Suppliers compete with one another
- Supplier is responsible for technology, expertise, forecasting, cost, quality, and delivery

15

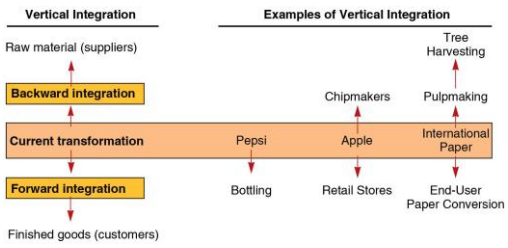
Few Suppliers

- Buyer forms long-term relationships with fewer suppliers
- Create value through economies of scale and learning curve improvements
- Suppliers more willing to participate in JIT programs and contribute design and technological expertise
- Cost of changing suppliers is huge
- Trade secrets and other alliances may be at risk

16

Vertical Integration

Figure 11.2



17

Vertical Integration (continued)

- Developing the ability to produce goods or services previously purchased
- Integration may be *forward*, towards the customer, or *backward*, towards suppliers
- Can improve cost, quality, delivery, and inventory but requires capital, managerial skills, and demand
- Risky in industries with rapid technological change

18

Joint Ventures

- Formal collaboration
  - Enhance skills
  - Secure supply
  - Reduce costs
- The challenge is to cooperate without diluting brand or conceding competitive advantage

Keiretsu Networks

- Developed in Japan, these represent a middle ground between few suppliers and vertical integration
- Supplier becomes part of the company coalition
- Often provide financial support for suppliers through ownership or loans
- Members expect long-term relationships and provide technical expertise and stable deliveries
- May extend through several levels of the supply chain
- South Korean *chaebols* are similar but more family-controlled networks

Virtual Companies

- Rely on a variety of supplier relationships to provide services on demand
- Fluid organizational boundaries that allow the creation of unique enterprises to meet changing market demands
- Relationships may be short- or long-term
- Exceptionally lean performance, low capital investment, flexibility, and speed

Supply Chain Risk

- More reliance on supply chains means more risk
- Fewer suppliers increase dependence
- Compounded by globalization and logistical complexity
- Vendor reliability and quality risks
- Political and currency risks

Risk and Mitigation Tactics (1 of 6)

- Research and assess possible risks
- Innovative planning
- Reduce potential disruptions
- Prepare responses to negative events
- Flexible, secure supply chains
- Diversified supplier base

Risk and Mitigation Tactics (2 of 6)

Table 11.3 Supply Chain Risks and Tactics

RISK	RISK REDUCTION TACTICS	EXAMPLE
Supplier failure to deliver	Use multiple suppliers; effective contracts with penalties; subcontractors on retainer; preplanning	**McDonald's** planned its supply chain 6 years before its opening in Russia. Every plant—bakery, meat, chicken, fish, and lettuce—is closely monitored to ensure strong links.
Supplier quality failures	Careful supplier selection, training, certification, and monitoring	**Darden Restaurants** has placed extensive controls, including third-party audits, on supplier processes and logistics to ensure constant monitoring and reduction of risk.

Risk and Mitigation Tactics (3 of 6)

Table 11.3 Supply Chain Risks and Tactics

RISK	RISK REDUCTION TACTICS	EXAMPLE
Outsourcing	Take over production; provide or perform the service yourself	**Tyson** took over chicken farm production in China to mitigate product quality and safety concerns related to using independent farmers.
Logistics delays or damage	Multiple/redundant transportation modes and warehouses; secure packaging; effective contracts with penalties	**Walmart**, with its own trucking fleet and numerous distribution centers located throughout the U.S., finds alternative origins and delivery routes bypassing problem areas.

25

Risk and Mitigation Tactics (4 of 6)

Table 11.3 Supply Chain Risks and Tactics

RISK	RISK REDUCTION TACTICS	EXAMPLE
Distribution	Careful selection, monitoring, and effective contracts with penalties	**Toyota** trains its dealers around the world, invoking principles of the Toyota Production System to help dealers improve customer service, used-car logistics, and body and paint operations.
Information loss or distortion	Redundant databases; secure IT systems; training of supply chain partners on the proper interpretations and uses of information	**Boeing** utilizes a state-of-the-art international communication system that transmits engineering, scheduling, and logistics data to Boeing facilities and suppliers worldwide.

26

Risk and Mitigation Tactics (5 of 6)

Table 11.3 Supply Chain Risks and Tactics

RISK	RISK REDUCTION TACTICS	EXAMPLE
Political	Political risk insurance; cross-country diversification; franchising and licensing	**Hard Rock Cafe** reduces political risk by franchising and licensing, rather than owning, when the political and cultural barriers seem significant.
Economic	Hedging to combat exchange rate risk; purchasing contracts that address price fluctuations	**Honda and Nissan** are moving more manufacturing out of Japan as the exchange rate for the yen makes Japanese-made autos more expensive.

27

Risk and Mitigation Tactics (6 of 6)

Table 11.3 Supply Chain Risks and Tactics

RISK	RISK REDUCTION TACTICS	EXAMPLE
Natural catastrophes	Insurance; alternate sourcing; cross-country diversification	**Toyota**, after its experience with fires, earthquakes, and tsunamis, now attempts to have at least two suppliers, each in a different geographical region, for each component.
Theft, vandalism, and terrorism	Insurance; patent protection; security measures including RFID and GPS; diversification	**Domestic Port Radiation Initiative:** The U.S. government has set up radiation portal monitors that scan nearly all imported containers for radiation.

28

Security and JIT

- Shipments get misrouted, stolen, damaged, or excessively delayed
- Technological innovations are improving security and inventory management
  - Location, motion sensors, broken seals, temperature, radioactivity
- Tracking can help expedite shipments

29

Managing the Integrated Supply Chain (1 of 5)

- Issues
  - **Local optimization** can magnify fluctuations
  - **Incentives** push merchandise into the supply chain for sales that have not occurred
  - **Large lots** reduce shipping and production costs but increase inventory holding and do not reflect actual sales

30

Managing the Integrated Supply Chain (2 of 5)

- Issues
  - **Local optimization** can magnify fluctuations
  - **Incentives** push merchandise into the supply chain for sales that have not occurred
  - **Large lots** reduce shipping and production costs but increase inventory holding and do not reflect actual sales

Bullwhip effect occurs when orders are relayed through the supply chain with fluctuations increasing at each step

31

Managing the Integrated Supply Chain (3 of 5)

- Opportunities
  - **Accurate "pull" data,** shared information
  - **Lot size reduction, shipping,** discounts, reduced ordering costs
  - **Single stage control of replenishment**
    - Single supply chain member responsible for ordering
  - **Vendor managed inventory (VMI)**

32

Managing the Integrated Supply Chain (4 of 5)

- Opportunities
  - **Collaborative planning, forecasting, and replenishment (CPFR)** throughout the supply chain
  - **Blanket orders** against which actual orders are released
  - **Standardization**
  - **Postponement** withholds modification as long as possible

33

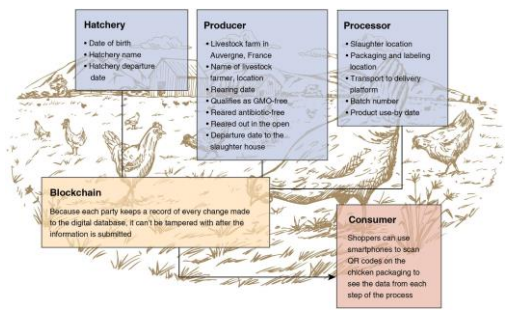
Managing the Integrated Supply Chain (5 of 5)

- Opportunities
  - **Electronic ordering and funds transfer** speed transactions and reduce paperwork
  - **Omnichannel Strategy** provide multiple integrated channels of both communication and shipping
  - **Drop shipping and special packaging** bypass the seller and reduce costs
  - **Blockchain** aids tracking and verification
  - **Digitalization and the Internet-of-Things (IoT)** provides improved visibility, enabling managers to make decisions in real time based on accurate current data

34

Tracing Food via Blockchain

Figure 11.3



35

Building the Supply Base (1 of 5)

- Supplier evaluation
  - Finding potential suppliers
  - Determine likelihood of their becoming good suppliers
  - **Supplier certification**
    1. Qualification
    2. Education
    3. Certification

36

Building the Supply Base (2 of 5)

- Supplier development
  - Integrate the supplier into the system
    - Quality requirements
    - Product specifications
    - Schedules and delivery
    - Procurement policies
    - Training
    - Engineering and production help
    - Information transfer procedures

37

Building the Supply Base (3 of 5)

- Negotiation
  - A significant element in purchasing
  - Highly valued skills
    - **Cost-based price model**
      - Supplier opens books
    - **Market-based price model**
      - Based on published, auction, or indexed prices
    - **Competitive bidding**
      - Common policy for many purchases
      - Does not generally foster long-term relationships

38

Building the Supply Base (4 of 5)

- Contracting
  - Share risks, benefits, create incentives
- Centralized purchasing
  - Leverage volume
  - Develop specialized staff
  - Develop supplier relationships
  - Maintain professional control
  - Devote resources to selection and negotiation
  - Reduce duplication of tasks
  - Promote standardization

39

Building the Supply Base (5 of 5)

- Electronic-Procurement
  - Speeds purchasing, reduces costs, integrates supply chain
  - **Online catalogs and exchanges**
    - Standard items or industry-specific web sites
  - **Online auctions**
    - Low barriers to entry
    - Reverse auctions for buyers
    - Price not always the most important factor

40

Logistics Management

- Objective is to obtain efficient operations through the integration of all material acquisition, movement, and storage activities
- Is a frequent candidate for outsourcing
- Allows competitive advantage to be gained through reduced costs and improved customer service

41

Shipping Systems (1 of 3)

- **Trucking**
  - Most vulnerable to accidents
  - Moves the vast majority of manufactured goods
  - Chief advantage is flexibility
- **Railroads**
  - Capable of carrying large loads
  - Containers and piggybacking have helped improve flexibility

- Four critical points in the logistics process are point of origin, warehousing, transit, and destination
- Sensors, as part of a digital network, can alert managers to problems

42

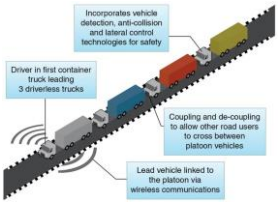
Shipping Systems (2 of 3)

- **Airfreight**
  - Fast and flexible for light loads
  - May be expensive
- **Waterways**
  - Typically used for bulky, low-value cargo
  - Used when shipping cost is more important than speed

Shipping Systems (3 of 3)

- **Pipelines**
  - Used for transporting oil, gas, and other chemical products
- **Multimodal**
  - Combines shipping methods
  - Common, especially in international shipments
  - Aided by standardized containers

Truck Platooning System



Cost and Speed of Shipments

- Faster shipping is generally more expensive than slower shipping
- Faster methods tend to involve smaller shipment sizes while slower methods involve very large shipment sizes

Warehousing

- May be expensive, but alternatives may be more so
- Fundamental purpose is to store goods
- May provide other functions
  - *Consolidation*
  - *Break-bulk*
  - *Cross-docking*
  - *Postponement*

Warehousing (continued)

- Channel assembly
  - Implementation of postponement
  - Ship components or modules
  - Distributors become manufacturing partners
  - Finished goods inventory reduced
  - Better market response with less investment

Third-Party Logistics (3PL)

- Outsourcing logistics can reduce inventory, costs, and improve delivery reliability and speed
- Coordinate supplier inventory with delivery services
- May provide warehousing, assembly, testing, shipping, customs

Distribution Management (1 of 5)

- The outbound flow of products
  1. *Rapid response*
  2. *Product choice*
  3. *Service*
- Increasing the number of facilities generally improves response time and customer satisfaction

49

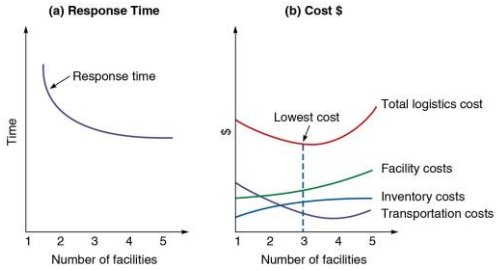
Distribution Management (2 of 5)

- Total costs are important
  - *Inventory costs*
  - *Transportation costs*
  - *Facility costs*
- *Total logistics costs*

50

Distribution Management (3 of 5)

Figure 11.4 (a) and (b)



51

Distribution Management (4 of 5)

Figure 11.4 (c)

52

Distribution Management (5 of 5)

- Facilities, packaging, and logistics
- Selection and development of dealers or retailers
- *Downstream* management is as important as *upstream* management

53

Ethics and Sustainable Supply Chain Management

- Personal ethics
  - Critical to long-term success of an organization
  - Supply chains particularly susceptible
- Ethics within the supply chain
- Ethical behavior regarding the environment

54

Institute for Supply Management Principles and Standards

- *Promote and uphold* responsibilities to one's employer; positive supplier and customer relationships; sustainability and social responsibility; protection of confidential and proprietary information; applicable laws, regulations, and trade agreements; and development of professional competence
- *Avoid* perceived impropriety; conflicts of interest; behaviors that negatively influence supply chain decisions; and improper reciprocal agreements

55

Establishing Sustainability in Supply Chains

- Return or **reverse logistics**
  - Sending returned products back up the supply chain for resale, repair, reuse, remanufacture, recycling, or disposal
- **Closed-loop supply chain**
  - Proactive design of a supply chain that tries to optimize all forward and reverse flows
  - Prepares for returns prior to product introduction

56

Establishing Sustainability in Supply Chains (continued)

Table 11.4 Management Challenges of Reverse Logistics

ISSUE	FORWARD LOGISTICS	REVERSE LOGISTICS
Forecasting	Relatively straightforward	More uncertain
Product quality	Uniform	Not uniform
Product packaging	Uniform	Often damaged
Pricing	Relatively uniform	Dependent on many factors
Speed	Often very important	Often not a priority
Distribution costs	Easily visible	Less directly visible
Inventory management	Consistent	Not consistent

57

Measuring Supply-Chain Performance (1 of 6)

- Assets committed to inventory

$$\text{Percentage invested in inventory} = \left(\frac{\text{Average inventory investment}}{\text{Total assets}}\right) \times 100$$

- Home Depot had $12.5b inventory, total assets of $42.9b

$$\text{Percentage invested in inventory} = \left(\frac{12.5}{42.9}\right) \times 100 = 29.1\%$$

58

Measuring Supply-Chain Performance (2 of 6)

Table 11.5 Inventory as Percentage of Total Assets (with examples of exceptional performance)

Manufacturer (Toyota 5%)	15%
Wholesale (Coca-Cola 2.9%)	34%
Restaurants (McDonald's .05%)	2.9%
Retail (Home Depot 25.7%)	27%

59

Measuring Supply-Chain Performance (3 of 6)

- **Inventory turnover**

$$\text{Inventory turnover} = \left(\frac{\text{Cost of goods sold}}{\text{Average inventory investment}}\right)$$

- Inventory investment
  - Average of several periods
  - (beginning plus ending)/2
  - Ending inventory

60

Measuring Supply-Chain Performance (4 of 6)

- From PepsiCo, Inc. Annual Report

Net revenue		$63.5
Cost of goods sold		$28.7
Inventory:		
Raw material inventory	$1.32	
Work-in-process inventory	$0.15	
Finished goods inventory	$1.26	
Total inventory investment		$2.73

$$\text{Inventory turnover} = \frac{28.7}{2.73} = 10.5$$

61

Measuring Supply-Chain Performance (5 of 6)

Table 11.6 Examples of Annual Inventory Turnover

FOOD, BEVERAGE, RETAIL	
Anheuser Busch	15
Coca-Cola	5
Home Depot	5
McDonald's	112
MANUFACTURING	
Dell Computer	90
Johnson controls	22
Toyota (overall)	13
Nissan (assembly)	150

62

Measuring Supply-Chain Performance (6 of 6)

- Weeks of supply

$$\text{Weeks of supply} = \frac{\text{Average inventory investment}}{\left(\frac{\text{Annual cost of goods sold}}{52 \text{ weeks}}\right)}$$

- For PepsiCo

Inventory investment = $2.73b

Average weekly cost of goods sold = $28.7b/52 = $.55b

Weeks of supply = 2.73/.55 = 4.96 weeks

63

Benchmarking the Supply Chain

Comparison with benchmark firms

Table 11.7 Supply Chain Metrics in the Consumer Packaged Goods Industry

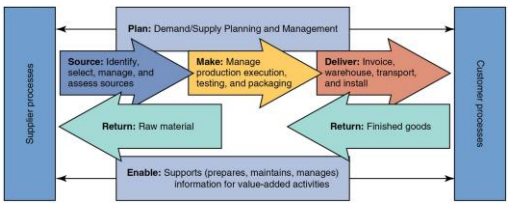
	TYPICAL FIRMS	BENCHMARK FIRMS
Order fill rate	71%	98%
Order fulfillment lead time (days)	7	3
Cash-to-cash cycle time (days)	100	30
Inventory days of supply	50	20

64

The SCOR Model

Processes, metrics, and best practices

Figure 11.5



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The SCOR Model (continued)

Table 11.8 SCOR Model Metrics Help Firms Benchmark Performance Against the Industry

SUPPLY CHAIN PERFORMANCE ATTRIBUTE	SAMPLE METRIC	CALCULATION
Reliability	Perfect order fulfillment	(Total perfect orders) / (Total number of orders)
Responsiveness	Average order fulfillment cycle time	(Sum of actual cycle times for all orders delivered) / (Total number of orders delivered)
Agility	Upside supply chain flexibility	Time required to achieve an unplanned 20% increase in delivered quantities
Costs	Supply chain management costs	Cost to plan + Cost to source + Cost to deliver + Cost to return
Asset management	Cash-to-cash cycle time	Inventory days of supply + Days of receivables outstanding – Days of payables outstanding

66

Benchmarking the Supply Chain (continued)

- Benchmarking useful
- May not be adequate
- Audits may be necessary
  - Continuing communication, understanding, trust, performance, corporate strategy
- Foster a mutual belief that “we are in this together”

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