Introduction to OM & SCM

Source: Heizer et al. (2017)

Outline

- Definition of Operations Management
- Decision areas in Operations Management
- The supply chain strategic importance
- Sourcing strategies
- Supply chain risk and mitigation
- Managing the integrated supply chain
- Logistics and distribution management

What Is Operations Management?

Production is the creation of goods and services

Operations management (OM) is the set of activities that create value in the form of goods and services by transforming inputs into outputs

The Strategic Decisions

1. Design of goods and services

- Defines what is required of operations
- Product design determines quality, sustainability and human resources

2. Managing quality

- Determine the customer's quality expectations
- Establish policies and procedures to identify and achieve that quality

Table 1.2 (cont.)

The Strategic Decisions

3. Process and capacity design

- How is a good or service produced?
- Commits management to specific technology, quality, resources, and investment

4. Location strategy

- Nearness to customers, suppliers, and talent
- Considering costs, infrastructure, logistics, and government

Table 1.2 (cont.)

The Strategic Decisions

5. Layout strategy

- Integrate capacity needs, personnel levels, technology, and inventory
- Determine the efficient flow of materials, people, and information

6. Human resources and job design

- Recruit, motivate, and retain personnel with the required talent and skills
- Integral and expensive part of the total system design

Table 1.2 (cont.)

The Strategic Decisions

7. Supply chain management

- Integrate supply chain into the firm's strategy
- Determine what is to be purchased, from whom, and under what conditions

8. Inventory management

- Inventory ordering and holding decisions
- Optimize considering customer satisfaction, supplier capability, and production schedules

Table 1.2 (cont.)

The Strategic Decisions

9. Scheduling

- Determine and implement intermediate- and short-term schedules
- Utilize personnel and facilities while meeting customer demands

10. Maintenance

- Consider facility capacity, production demands, and personnel
- Maintain a reliable and stable process

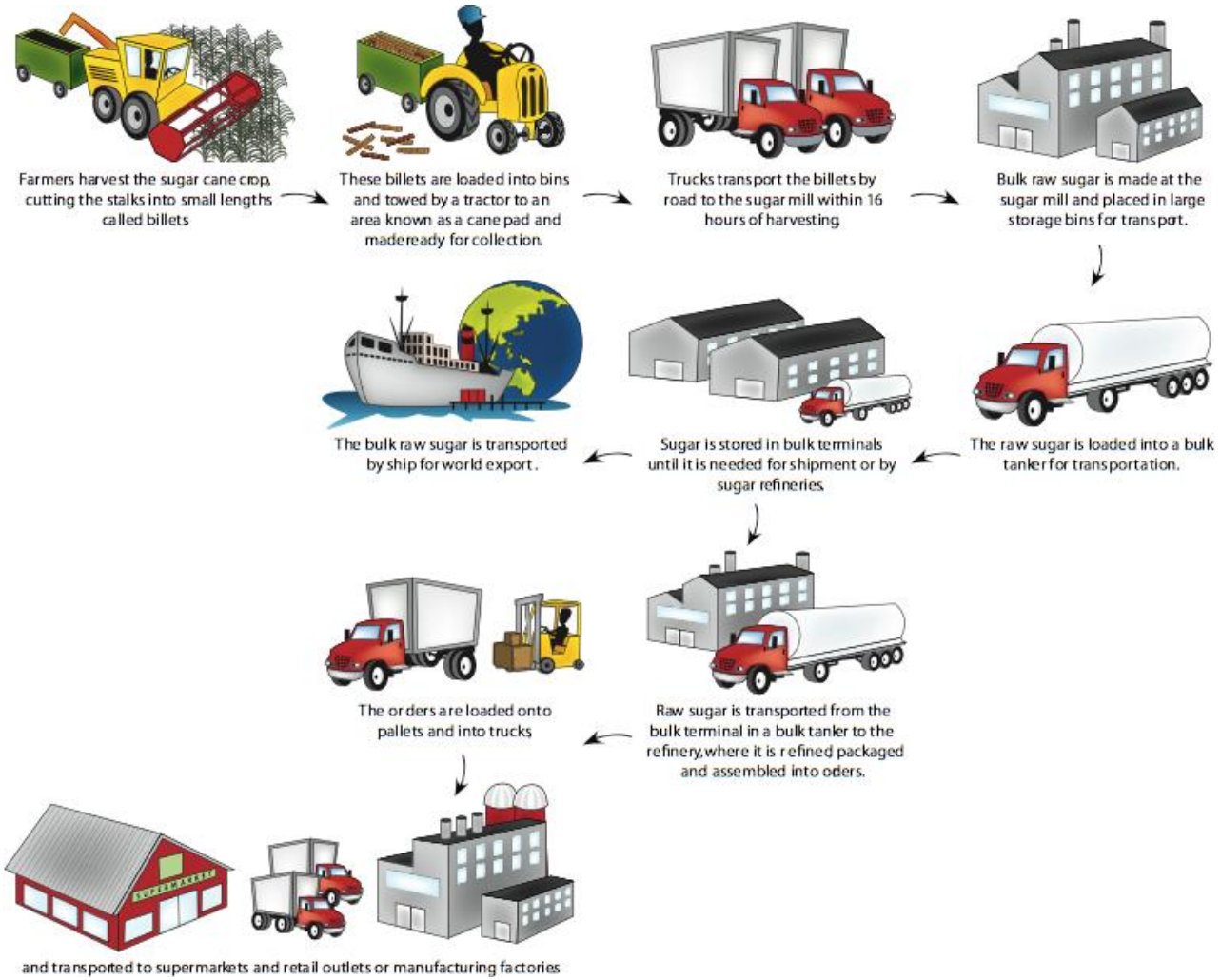
Table 1.2 (cont.)

The Supply Chain

- A global network of organizations and activities that supply a firm with goods and services
- Members of the supply chain collaborate to achieve high levels of customer satisfaction, efficiency and competitive advantage

Figure 1.2

A Supply Chain for Sugar



Source: https://rightmoves.tdtvictoria.org.au/activity5.htm

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

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

The Supply Chain's Strategic Importance

- 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

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

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

Six Sourcing Strategies

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

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

Few Suppliers

- Buyer forms longer 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

Vertical Integration

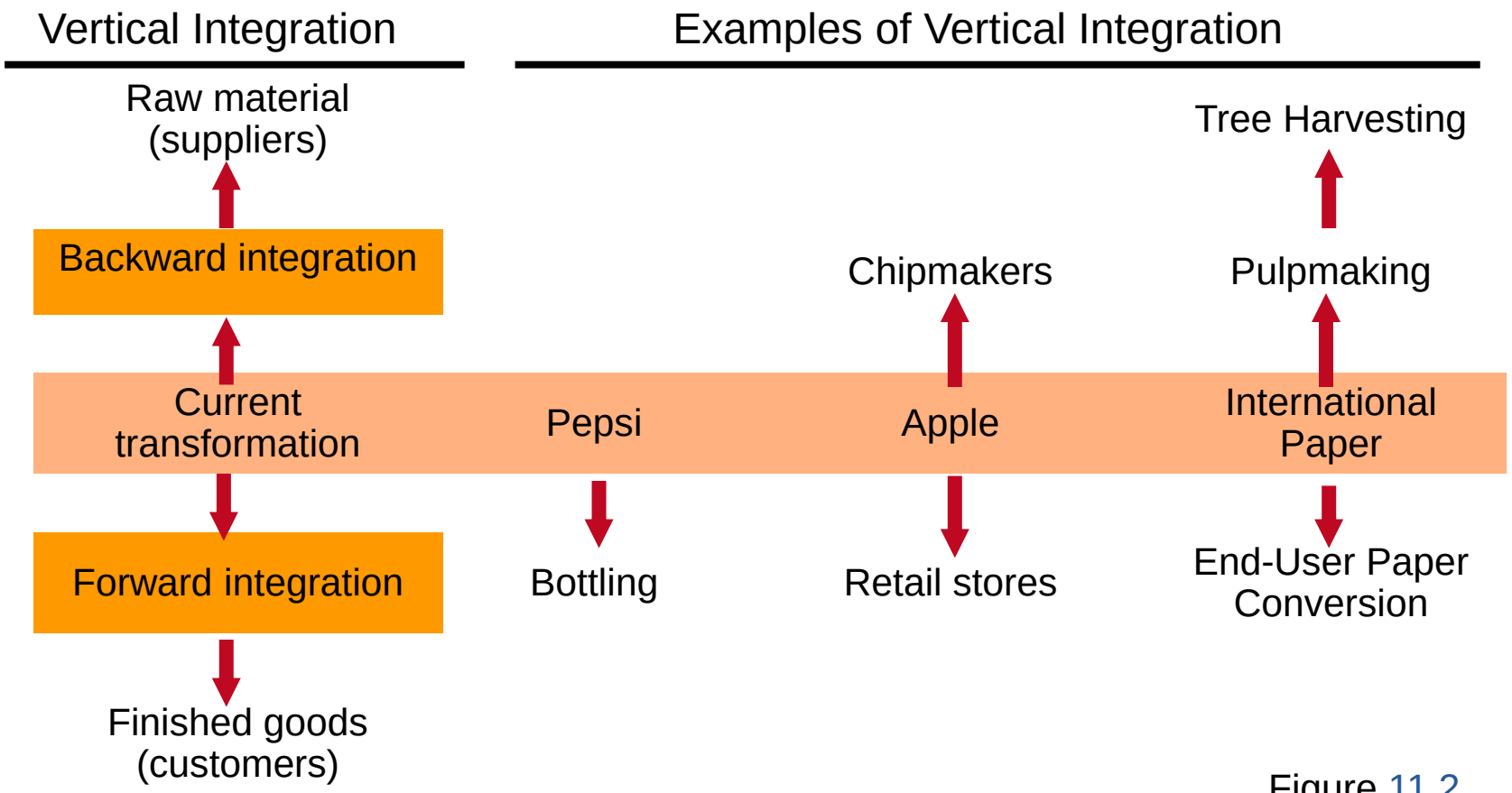


Figure 11.2

Vertical Integration

- 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

Joint Ventures

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

Keiretsu Networks

- 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

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

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

Risk and Mitigation Tactics

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; pre-planning	**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

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.

Risk and Mitigation Tactics

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.

Risk and Mitigation Tactics

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 Café** 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.

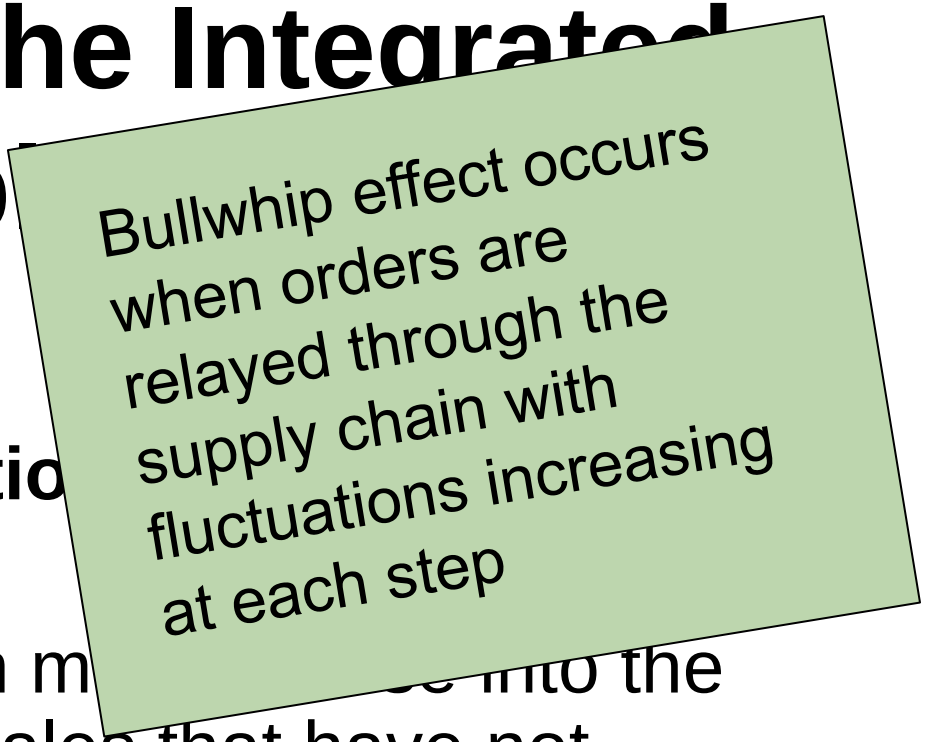
Risk and Mitigation Tactics

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.

Managing the Integrated Supply Chain

- 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

Managing the Integrated Supp



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Managing the Integrated Supply Chain

- 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)**

Managing the Integrated Supply Chain

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

Managing the Integrated Supply Chain

- Opportunities
  - **Postponement** withholds modification as long as possible
  - **Electronic ordering and funds transfer** speed transactions and reduce paperwork
  - **Drop shipping and special packaging** bypasses the seller and reduces costs

Supplier Selection Analysis

- Many factors play a role
- Choosing lowest bid is becoming rare
- Factor weighting techniques consider multiple criteria
  - Each factor is assigned a weight and a score
  - Choose the supplier with the best weighted score

Factor Weighting Approach

		FABER PAINT		SMITH DYE	
CRITERION	WEIGHT	SCORE (1-5) (5 HIGHEST)	WEIGHT x SCORE	SCORE (1-5) (5 HIGHEST)	WEIGHT x SCORE
Engineering/innovation skills	.20	5	1.0	5	1.0
Production process capability	.15	4	0.6	5	0.75
Distribution capability	.05	4	0.2	3	0.15
Quality performance	.10	2	0.2	3	0.3
Facilities/location	.05	2	0.1	3	0.15
Financial strength	.15	4	0.6	5	0.75
Information systems	.10	2	0.2	5	0.5
Integrity	.20	5	1.0	3	0.6
Total	1.00		3.9		4.2

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

Shipping Systems

- **Trucking**
  - Moves the vast majority of manufactured goods
  - Chief advantage is flexibility
- **Railroads**
  - Capable of carrying large loads
  - Little flexibility though containers and piggybacking have helped with this

Shipping Systems

- **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

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

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

Transportation Mode Analysis

- Evaluate holding verses shipping options
  - Ship connectors from San Jo
  - Value of connectors = $1,750
  - Holding cost = 40% per year
  - One carrier is 1 day faster but $20 more expensive

$1.92 < $20.00
Choose slower shipping

$$\text{Daily cost of holding the product} = \left(\text{Annual holding cost} \times \text{Product value}\right)$$

$$= (.40 \times \$1{,}750)/365$$
$$= \$1.92$$

Warehousing

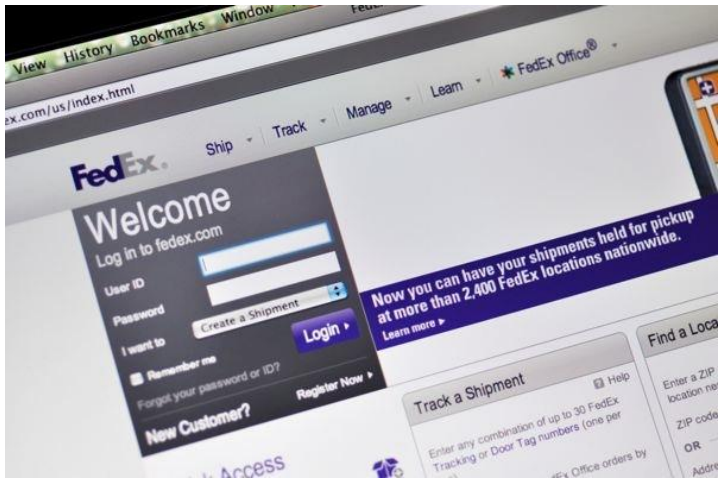
- May be expensive, but alternatives may be more so
- Fundamental purpose is to store goods
- May provide other functions
  - *Consolidation*
  - *Break-bulk*
  - *Cross-docking*
  - *Postponement*

Warehousing

- 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

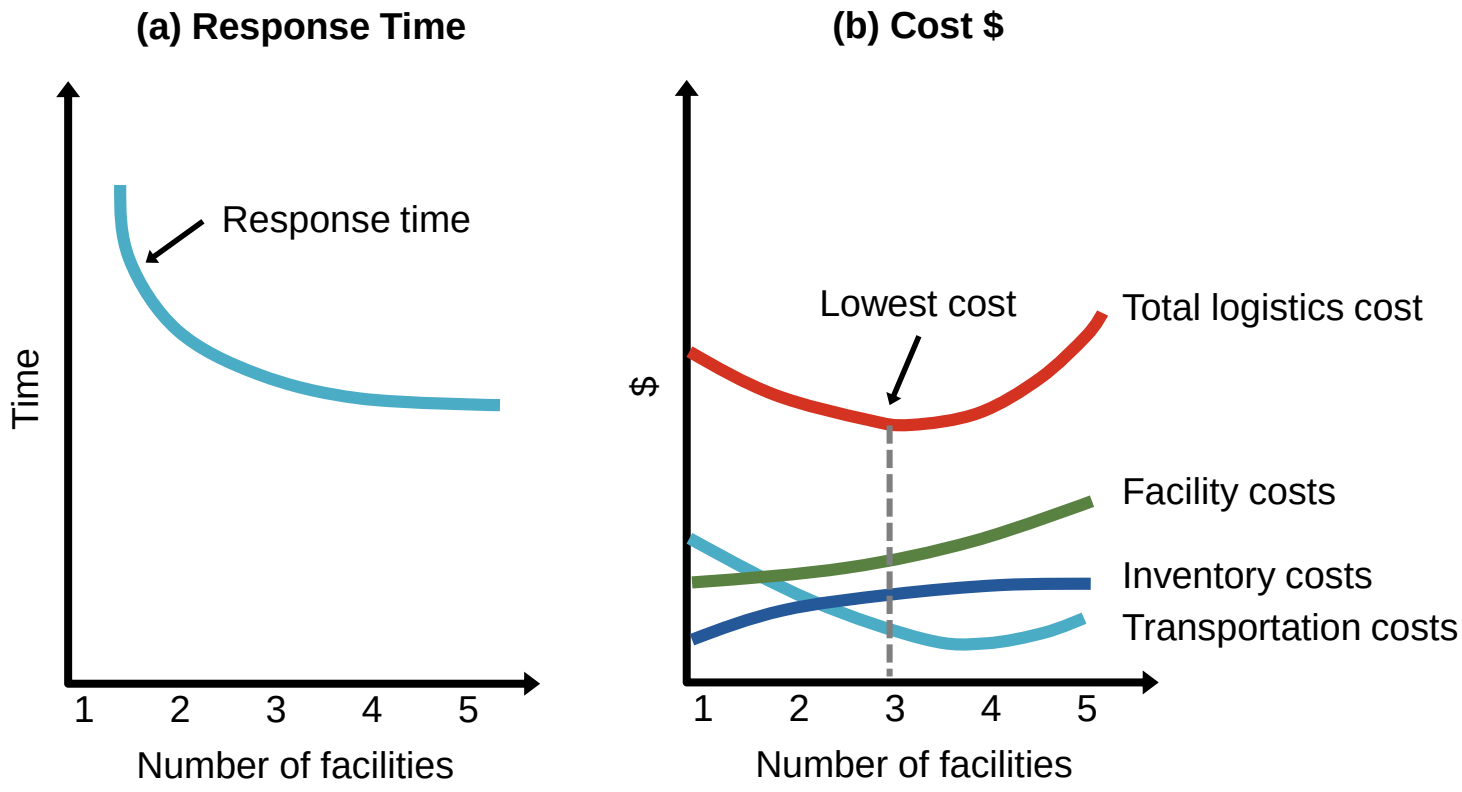
- The outbound flow of products
  1) *Rapid response*
  2) *Product choice*
  3) *Service*
- Increasing the number of facilities generally improves response time and customer satisfaction

Distribution Management

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

Distribution Management

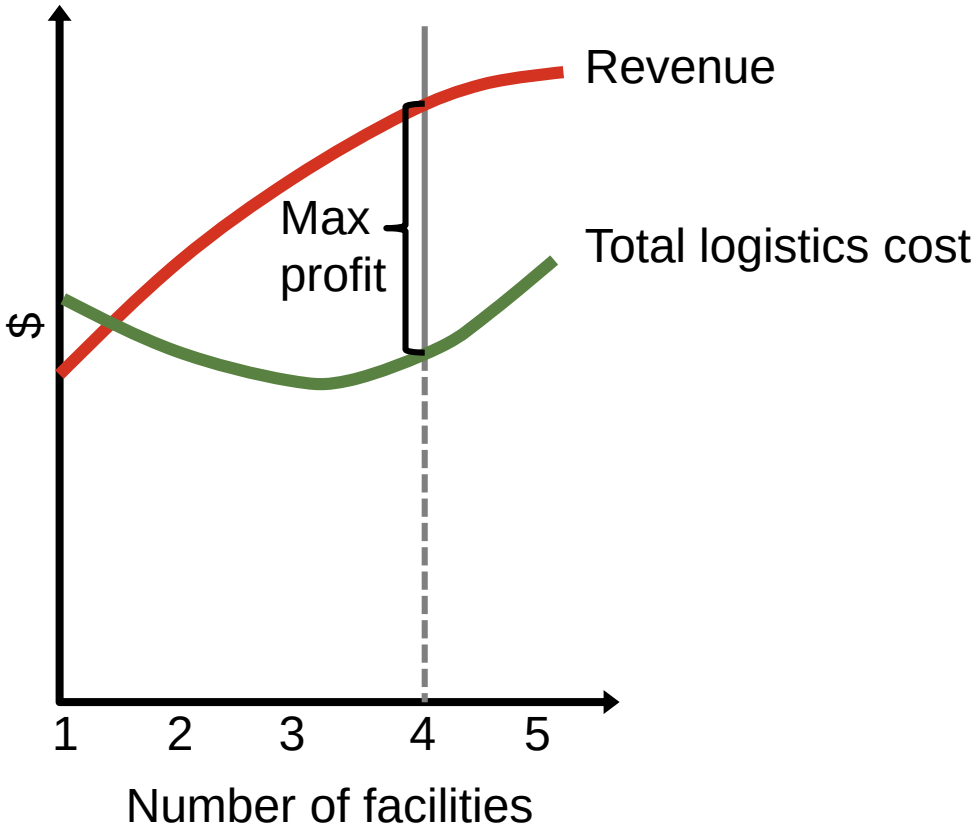
Figure 11.3



Distribution Management

(c) Cost, Revenue, and Profit

Figure 11.3



Distribution Management

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

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

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

Establishing Sustainability in Supply Chains

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

Measuring Supply-Chain Performance

- Assets committed to inventory

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

- Home Depot had $11.4b inventory, total assets of $44.4b

$$\text{Percentage invested in inventory} = \left(\frac{11.4}{44.4}\right) \times 100 = 25.7\%$$

Measuring Supply-Chain Performance

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%

Measuring Supply-Chain Performance

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

Measuring Supply-Chain Performance

- From PepsiCo, Inc. Annual Report

Net revenue		$32.5
Cost of goods sold		$14.2
Inventory:		
Raw material inventory	$.74	
Work-in-process inventory	$.11	
Finished goods inventory	$.84	
Total inventory investment		$1.69

$$\text{Inventory turnover} = \frac{14.2}{1.69} = 8.4$$

Measuring Supply-Chain Performance

TABLE 11.6	Examples of Annual Inventory Turnover
FOOD, BEVERAGE, RETAIL	
Anheuser Busch	15
Coca-Cola	14
Home Depot	5
McDonald's	112
MANUFACTURING	
Dell Computer	90
Johnson controls	22
Toyota (overall)	13
Nissan (assembly)	150

Measuring Supply-Chain Performance

- 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 = $1.69b
Average weekly cost of goods sold = $14.2b / 52 = $.273b

Weeks of supply = 1.69 / .273 = 6.19 weeks

Benchmarking the Supply Chain

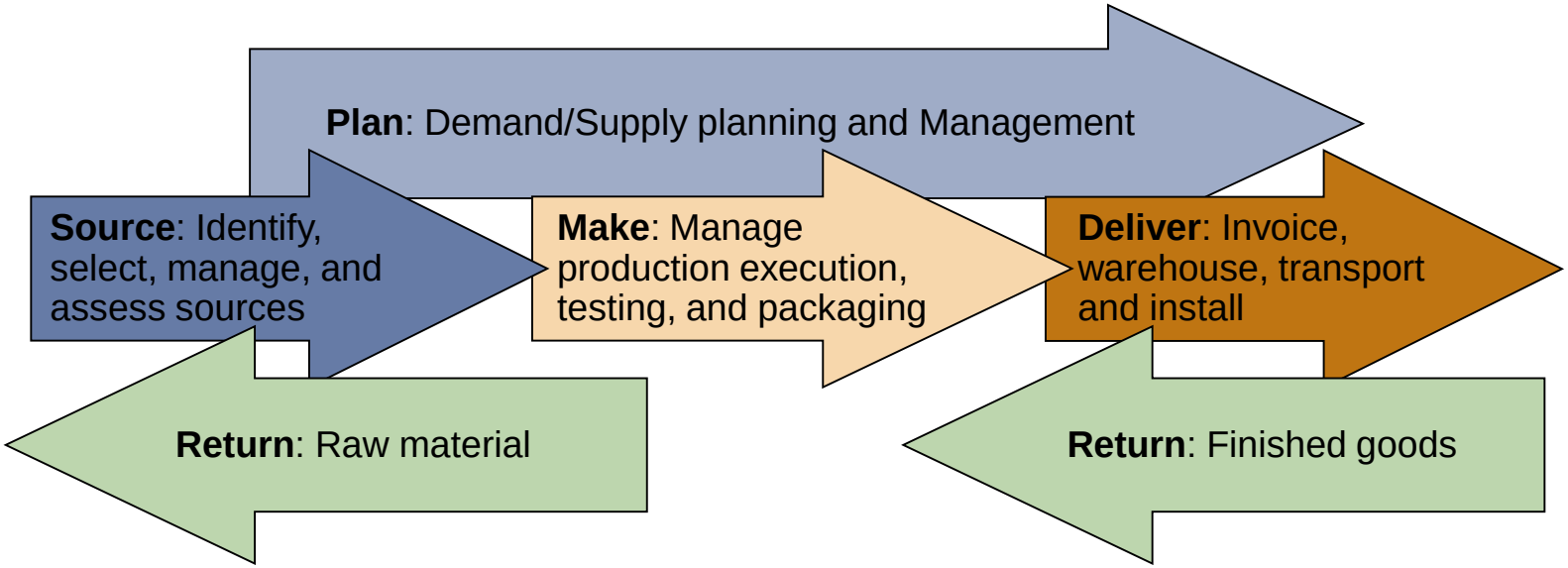
- Comparison with benchmark firms

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

The SCOR Model

- Processes, metrics, and best practices

Figure 11.4



The SCOR Model

TABLE 11.8	SCOR Model Metrics to Help Firms Benchmark Performance Against the Industry	
PERFORMANCE ATTRIBUTE	**SAMPLE METRIC**	**CALCULATION**
Supply chain reliability	Perfect order fulfillment	(Total perfect orders) / (Total number of orders)
Supply chain responsiveness	Average order fulfillment cycle time	(Sum of actual cycle times for all orders delivered) / (Total number of orders delivered)
Supply chain agility	Upside supply chain flexibility	Time required to achieve an unplanned 20% increase in delivered quantities
Supply chain costs	Supply chain management costs	Cost to plan + Cost to source + Cost to deliver + Cost to return
Supply chain asset management	Cash-to-cash cycle time	Inventory days of supply + Days of receivables outstanding – Days of payables outstanding