



15

Sourcing Decisions in a Supply Chain

*PowerPoint presentation to accompany
Chopra and Meindl Supply Chain Management, 5e*



Learning Objectives

1. Understand the role of sourcing in a supply chain
2. Discuss factors that affect the decision to outsource a supply chain function
3. Identify dimensions of supplier performance that affect total cost
4. Structure successful auctions and negotiations
5. Describe the impact of risk sharing on supplier performance and information distortion
6. Design a tailored supplier portfolio



The Role of Sourcing in a Supply Chain

- Sourcing is the set of business processes required to purchase goods and services
 - Outsourcing
 - Offshoring



The Role of Sourcing in a Supply Chain

- Outsourcing questions
 1. Will the third party increase the supply chain surplus relative to performing the activity in-house?
 2. How much of the increase in surplus does the firm get to keep?
 3. To what extent do risks grow upon outsourcing?



The Role of Sourcing in a Supply Chain

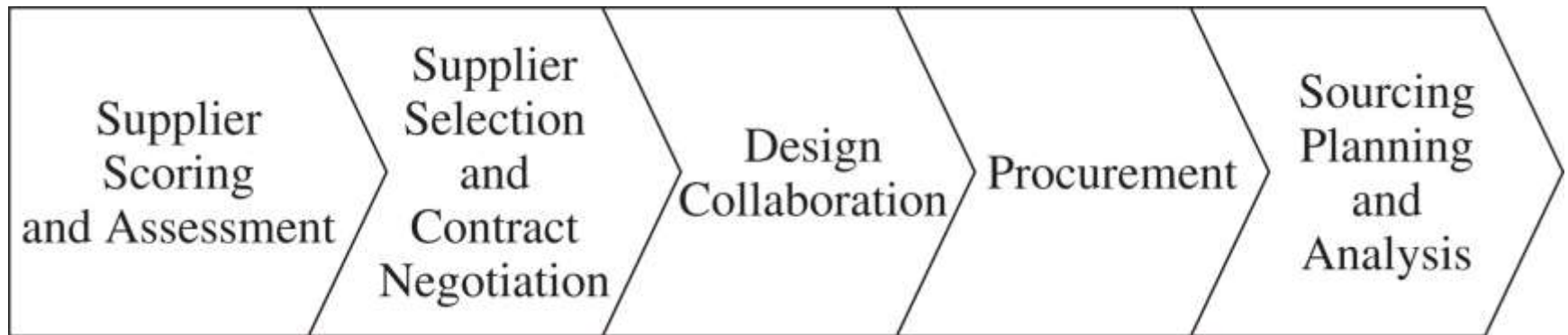


Figure 15-1



Supplier Scoring and Assessment

- Supplier performance should be compared on the basis of the supplier's impact on total cost
- There are several other factors besides purchase price that influence total cost



Supplier Selection

- Identify one or more appropriate suppliers
- Contract should account for all factors that affect supply chain performance
- Should be designed to increase supply chain profits in a way that benefits both the supplier and the buyer



Design Collaboration

- About 80% of the cost of a product is determined during design
- Suppliers should be actively involved at this stage



Procurement

- A supplier sends product in response to orders placed by the buyer
- Orders placed and delivered on schedule at the lowest possible overall cost



Sourcing Planning and Analysis

- Analyze spending across various suppliers and component categories
- Identify opportunities for decreasing the total cost



Cost of Goods Sold

- Cost of goods sold (COGS) represents well over 50 percent of sales for most major manufacturers
- Purchased parts a much higher fraction than in the past
- Companies have reduced vertical integration and outsourced



Benefits of Effective Sourcing Decisions

- Better economies of scale through aggregated
- More efficient procurement transactions
- Design collaboration can result in products that are easier to manufacture and distribute
- Good procurement processes can facilitate coordination with suppliers
- Appropriate supplier contracts can allow for the sharing of risk
- Firms can achieve a lower purchase price by increasing competition through the use of auctions



In-House or Outsource

- Increase supply chain surplus through
 1. Capacity aggregation
 2. Inventory aggregation
 3. Transportation aggregation by transportation intermediaries
 4. Transportation aggregation by storage intermediaries
 5. Warehousing aggregation
 6. Procurement aggregation
 7. Information aggregation
 8. Receivables aggregation
 9. Relationship aggregation
 10. Lower costs and higher quality



Factors Influencing Growth of Surplus by a Third Party

- Scale
 - Large scale it is unlikely that a third party can achieve further scale economies and increase the surplus
- Uncertainty
 - If requirements are highly variable over time, third party can increase the surplus through aggregation
- Specificity of assets
 - If assets required are specific to a firm, a third party is unlikely to increase the surplus



Factors Influencing Growth of Surplus by a Third Party

		Specificity of Assets Involved in Function	
		Low	High
Firm scale	Low	High growth in surplus	Low to medium growth in surplus
	High	Low growth in surplus	No growth in surplus unless cost of capital is lower for third party
Demand uncertainty for firm	Low	Low to medium growth in surplus	Low growth in surplus
	High	High growth in surplus	Low to medium growth in surplus

Table 15-1



Risks of Using a Third Party

1. The process is broken
2. Underestimation of the cost of coordination
3. Reduced customer/supplier contact
4. Loss of internal capability and growth in third-party power
5. Leakage of sensitive data and information
6. Ineffective contracts
7. Loss of supply chain visibility
8. Negative reputational impact



Third- and Fourth-Party Logistics Providers

- *Third-party logistics* (3PL) providers performs one or more of the logistics activities relating to the flow of product, information, and funds that could be performed by the firm itself
- A 4PL (fourth-party logistics) designs, builds and runs the entire supply chain process



Third- and Fourth-Party Logistics Providers

Service Category	Basic Service	Some Specific Value-Added Services
Transportation	Inbound, outbound by ship, truck, rail, air	Tendering, track/trace, mode conversion, dispatch, freight pay, contract management
Warehousing	Storage, facilities management	Cross-dock, in-transit merge, pool distribution across firms, pick/pack, kitting, inventory control, labeling, order fulfillment, home delivery of catalog orders
Information technology	Provide and maintain advanced information/computer systems	Transportation management systems, warehousing management, network modeling and site selection, freight bill payment, automated broker interfaces, end-to-end matching, forecasting, EDI, worldwide track and trace, global visibility
Reverse logistics	Handle reverse flows	Recycling, used-asset disposition, customer returns, returnable container management, repair/refurbish
Other 3PL services		Brokering, freight forwarding, purchase-order management, order taking, loss and damage claims, freight bill audits, consulting, time-definite delivery
International		Customs brokering, port services, export crating, consolidation
Special skills/handling		Hazardous materials, temperature controlled, package/parcel delivery, food-grade facilities/equipment, bulk

Table 15-2



Using Total Cost to Score and Assess Suppliers

Performance Category	Category Components	Quantifiable?
Supplier price	Labor, material, overhead, local taxes, and compliance costs	Yes
Supplier terms	Net payment terms, delivery frequency, minimum lot size, quantity discounts	Yes
Delivery costs	All transportation costs from source to destination, packaging costs	Yes
Inventory costs	Supplier inventory, including raw material, in process and finished goods, in-transit inventory, finished goods inventory in supply chain	Yes
Warehousing cost	Warehousing and material handling costs to support additional inventory	Yes
Quality costs	Cost of inspection, rework, product returns	Yes
Reputation	Reputation impact of quality problems	No
Other costs	Exchange rate trends, taxes, duties	Yes
Support	Management overhead and administrative support	Difficult
Supplier capabilities	Replenishment lead time, on-time performance, flexibility, information coordination capability, design coordination capability, supplier viability	To some extent

Table 15-3



Comparing Suppliers Based on Total Cost

Annual material cost	$= 1,000 \times 52 \times 1 = \$52,000$
Average cycle inventory	$= 2,000/2 = 1,000$
Annual cost of holding cycle inventory	$= 1,000 \times 1 \times 0.25 = \250
Standard deviation of ddt	$= \sqrt{2 \times 300^2 + 1,000^2 \times 1^2} = 1,086.28$
Safety inventory required with current supplier	$= \text{NORMSINV}(0.95) \times 1,086.28 = 1,787$
Annual cost of holding safety inventory	$= 1,787 \times 1 \times 0.25 = \447
Annual cost of using current supplier	$= 52,000 + 250 + 447 = \$52,697$



Comparing Suppliers Based on Total Cost

Annual material cost	$= 1,000 \times 52 \times 0.97 = \$50,440$
Average cycle inventory	$= 8,000/2 = 4,000$
Annual cost of holding cycle inventory	$= 4,000 \times 0.97 \times 0.25 = \970
Standard deviation of ddt	$= \sqrt{6 \times 300^2 + 1,000^2 \times 4^2} = 4,066.94$
Safety inventory required with current supplier	$= \text{NORMSINV}(0.95) \times 4,066.94 = 6,690$
Annual cost of holding safety inventory	$= 6,690 \times 0.97 \times 0.25 = \$1,622$
Annual cost of using current supplier	$= 50,440 + 970 + 1,622 = \$53,032$



Supplier Selection – Auctions and Negotiations

- Supplier selection can be performed through competitive bids, reverse auctions, and direct negotiations
- Supplier evaluation is based on total cost of using a supplier
- Auctions:
 - Sealed-bid first-price auctions
 - English auctions
 - Dutch auctions
 - Second-price (Vickery) auctions



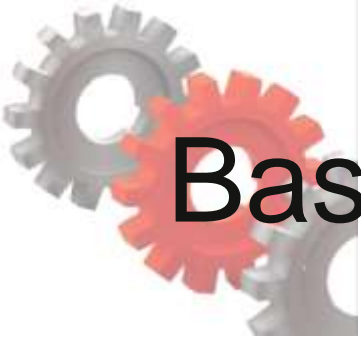
Supplier Selection – Auctions and Negotiations

- Factors influence the performance of an auction
 - Is the supplier's cost structure private (not affected by factors that are common to other bidders)?
 - Are suppliers symmetric or asymmetric; that is, ex ante, are they expected to have similar cost structures?
 - Do suppliers have all the information they need to estimate their cost structure?
 - Does the buyer specify a maximum price it is willing to pay for the supply chain?



Supplier Selection – Auctions and Negotiations

- Collusion among bidders
- Second-price auctions are particularly vulnerable
- Can be avoided with any first-price auction



Basic Principles of Negotiation

- The difference between the values of the buyer and seller is the *bargaining surplus*
- The goal of each negotiating party is to capture as much of the bargaining surplus as possible
 - Have a clear idea of your own value and as good an estimate of the third party's value as possible
 - Look for a fair outcome based on equally or equitably dividing the bargaining surplus
 - A win-win outcome



Contracts, Risk Sharing, and Supply Chain Performance

1. How will the contract affect the firm's profits and total supply chain profits?
2. Will the incentives in the contract introduce any information distortion?
3. How will the contract influence supplier performance along key performance measures?



Contracts for Product Availability and Supply Chain Profits

- Independent actions taken by two parties in a supply chain often result in profits that are lower than those that could be achieved if the supply chain were to coordinate its actions
- Three contracts that increase overall profits by making the supplier share some of the buyer's demand uncertainty are
 1. Buyback or returns contracts
 2. Revenue-sharing contracts
 3. Quantity flexibility contracts



Buyback Contracts

- Allows a retailer to return unsold inventory up to a specified amount at an agreed upon price
- The manufacturer specifies a wholesale price c and a buyback price b
- The manufacturer can salvage s_M for any units that the retailer returns
- The manufacturer has a cost of v per unit produced and the retail price is p

Expected manufacturing profit = $O^* (c - v) - (b - s_M)$

^ expected overstock at retailer



Buyback Contracts

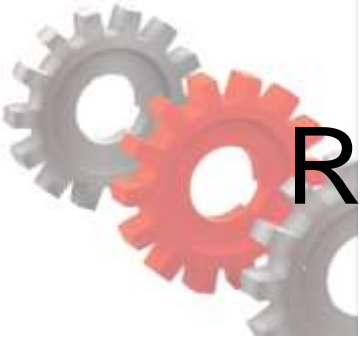
Wholesale Price c	Buyback Price b	Optimal Order Size for Music Store	Expected Profit for Music Store	Expected Returns to Supplier	Expected Profit for Supplier	Expected Supply Chain Profit
\$5	\$0	1,000	\$3,803	120	\$4,000	\$7,803
\$5	\$2	1,096	\$4,090	174	\$4,035	\$8,125
\$5	\$3	1,170	\$4,286	223	\$4,009	\$8,295
\$6	\$0	924	\$2,841	86	\$4,620	\$7,461
\$6	\$2	1,000	\$3,043	120	\$4,761	\$7,804
\$6	\$4	1,129	\$3,346	195	\$4,865	\$8,211
\$7	\$0	843	\$1,957	57	\$5,056	\$7,013
\$7	\$4	1,000	\$2,282	120	\$5,521	\$7,803
\$7	\$6	1,202	\$2,619	247	\$5,732	\$8,351

Table 15-4



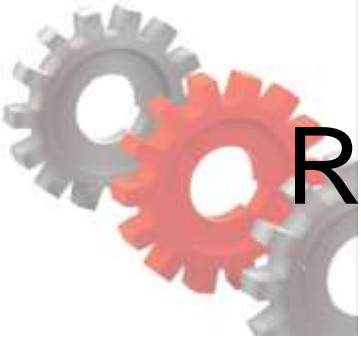
Buyback Contracts

- *Holding-cost subsidies*
 - Manufacturers pay retailers a certain amount for every unit held in inventory over a given period
 - Encourage retailers to order more
- *Price support*
 - Manufacturers share the risk of product becoming obsolete
 - Guarantee that in the event they drop prices they will lower prices for all current inventories



Revenue-Sharing Contracts

- Manufacturer charges the retailer a low wholesale price c and shares a fraction f of the retailer's revenue
 - Allows both the manufacturer and retailer to increase their profits
 - Results in lower retailer effort
 - Requires an information infrastructure
 - Information distortion results in excess inventory in the supply chain and a greater mismatch of supply and demand

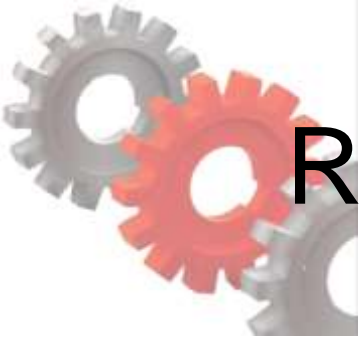


Revenue-Sharing Contracts

$$CSL^* = \text{probability (demand} \leq O^*) = \frac{C_u}{C_u + C_o} = \frac{(1-f)p - c}{(1-f)p - s_R}$$

$$\begin{aligned} \text{Expected manufacturers profits} &= (c - v)O^* \\ &+ fp(O^* - \text{expected overstock at retailer}) \end{aligned}$$

$$\begin{aligned} \text{Expected retailer profit} &= (1-f)p(O^* - \text{expected overstock at retailer}) \\ &+ s_R \text{ expected overstock at retailer} - cO^* \end{aligned}$$



Revenue-Sharing Contracts

Wholesale Price c	Revenue-Sharing Fraction f	Optimal Order Size for Music Store	Expected Overstock at Music Store	Expected Profit for Music Store	Expected Profit for Supplier	Expected Supply Chain Profit
\$1	0.30	1,320	342	\$5,526	\$2,934	\$8,460
\$1	0.45	1,273	302	\$4,064	\$4,367	\$8,431
\$1	0.60	1,202	247	\$2,619	\$5,732	\$8,350
\$2	0.30	1,170	223	\$4,286	\$4,009	\$8,295
\$2	0.45	1,105	179	\$2,881	\$5,269	\$8,150
\$2	0.60	1,000	120	\$1,521	\$6,282	\$7,803

Table 15-5



Quantity Flexibility Contracts

- Allows the buyer to modify the order (within limits) after observing demand
- Better matching of supply and demand
- Increased overall supply chain profits if the supplier has flexible capacity
- Lower levels of information distortion than either buyback contracts or revenue sharing contracts



Quantity Flexibility Contracts

Expected quantity purchased by retailer, Q_R

$$\begin{aligned}
 &= qF(q) + Q[1 - F(Q)] \\
 &\quad + mF_s \left[\frac{Q - m}{S} \right] - F_s \left[\frac{q - m}{S} \right] \\
 &= -S f_s \left[\frac{Q - m}{S} \right] - f_s \left[\frac{q - m}{S} \right]
 \end{aligned}$$

Expected quantity sold by retailer, D_R

$$\begin{aligned}
 &= Q[1 - F(Q)] \\
 &\quad + mF_s \left[\frac{Q - m}{S} \right] - S f_s \left[\frac{q - m}{S} \right]
 \end{aligned}$$



Quantity Flexibility Contracts

Expected quantity overstock

$$\text{at manufacturer} = Q_R - D_R$$

$$\text{Expected retailer profit} = D_R \cdot p + (Q_R - D_R) s_R - Q_R \cdot c$$

$$\text{Expected manufacturer profit} = Q_R \cdot c + (Q - Q_R) s_M - Q \cdot v$$



Quantity Flexibility Contracts

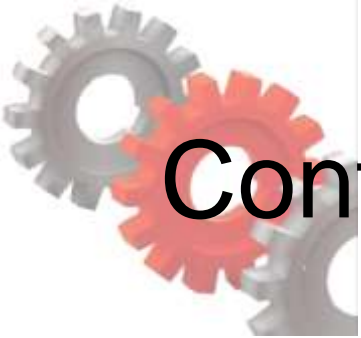
α	β	Wholesale Price c	Order Size O	Expected Purchase by Retailer	Expected Sale by Retailer	Expected Profits for Retailer	Expected Profits for Supplier	Expected Supply Chain Profit
0.00	0.00	\$5	1,000	1,000	880	\$3,803	\$4,000	\$7,803
0.05	0.05	\$5	1,017	1,014	966	\$4,038	\$4,004	\$8,416
0.20	0.20	\$5	1,047	1,023	967	\$4,558	\$3,858	\$8,416
0.00	0.00	\$6	924	924	838	\$2,841	\$4,620	\$7,461
0.20	0.20	\$6	1,000	1,000	955	\$3,547	\$4,800	\$8,347
0.30	0.30	\$6	1,021	1,006	979	\$3,752	\$4,711	\$8,463
0.00	0.00	\$7	843	843	786	\$1,957	\$5,056	\$7,013
0.20	0.20	\$7	947	972	936	\$2,560	\$5,666	\$8,226
0.40	0.40	\$7	1,000	1,000	987	\$2,873	\$5,600	\$8,473

Table 15-6



Contracts to Coordinate Supply Chain Costs

- Differences in costs at the buyer and supplier can lead to decisions that increase total supply chain costs
- A quantity discount contract may encourage the buyer to purchase a larger quantity which would result in lower total supply chain costs
- Quantity discounts lead to information distortion because of order batching



Contracts to Increase Agent Effort

- In many supply chains, agents act on behalf of a principal and the agents' efforts affect the reward for the principal
- A two-part tariff offers the right incentives for the dealer to exert the appropriate amount of effort
- Threshold contracts increase information distortion
- Offer threshold incentives over a rolling horizon



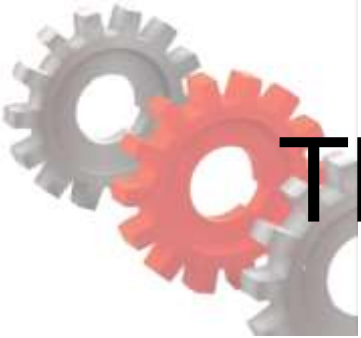
Contracts to Induce Performance Improvement

- A buyer may want performance improvement from a supplier who otherwise would have little incentive to do so
- *A shared-savings contract* provides the supplier with a fraction of the savings that result from performance improvement
- Effective in aligning supplier and buyer incentives when the supplier is required to improve performance and most of the benefits of improvement accrue to the buyer



Design Collaboration

- 50-70% of spending at a manufacturer comes from procurement
- 80% of the cost of a purchased part is fixed in the design phase
- Design collaboration with suppliers can result in reduced cost, improved quality, and decreased time to market
- Design for logistics, design for manufacturability
- *Modular, adjustable, dimensional customization*



The Procurement Process

- The process in which the supplier sends product in response to orders placed by the buyer
- Main categories of purchased goods
 - Direct materials
 - Indirect materials
- Procurement process for direct materials should be designed to ensure that components are available in the right place, in the right quantity, and at the right time
- Focus for indirect materials should be on reducing transaction cost



Differences Between Direct and Indirect Materials

	Direct Materials	Indirect Materials
Use	Production	Maintenance, repair, and support operations
Accounting	Cost of goods sold	Selling, general, and administrative expenses (SG&A)
Impact on production	Any delay will delay production	Less direct impact
Processing cost relative to value of transaction	Low	High
Number of transactions	Low	High

Table 15-7



Product Categorization

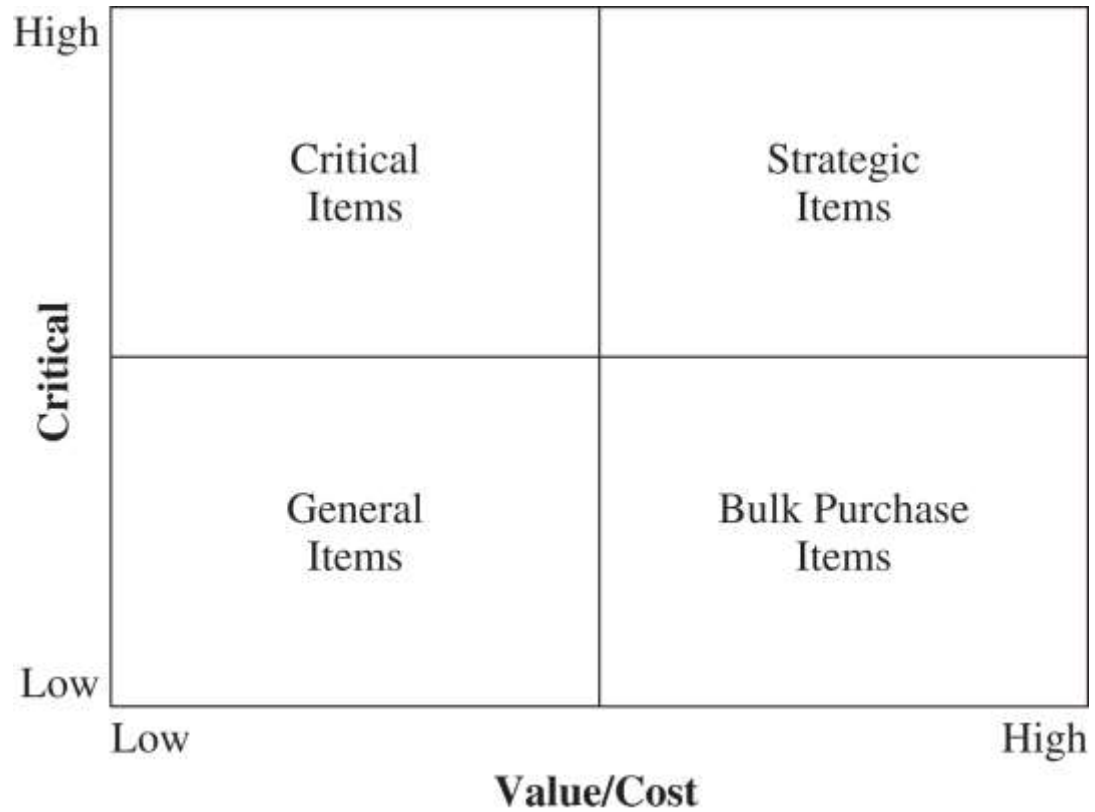


Figure 15-2



Designing a Sourcing Portfolio: Tailored Sourcing

- Options with regard to whom and where to source from
 - Produce in-house or outsource to a third party
 - Will the source be cost efficient or responsive
 - Onshoring, near-shoring, and offshoring
- Tailor supplier portfolio based on a variety of product and market characteristics



Designing a Sourcing Portfolio: Tailored Sourcing

	Responsive Source	Low-Cost Source
Product life cycle	Early phase	Mature phase
Demand volatility	High	Low
Demand volume	Low	High
Product value	High	Low
Rate of product obsolescence	High	Low
Desired quality	High	Low to medium
Engineering/design support	High	Low

Table 15-8



Designing a Sourcing Portfolio: Tailored Sourcing

	Onshore	Near-shore	Offshore
Rate of innovation/product variety	High	Medium to High	Low
Demand volatility	High	Medium to High	Low
Labor content	Low	Medium to High	High
Volume or weight-to-value ratio	High	High	Low
Impact of supply chain disruption	High	Medium to High	Low
Inventory costs	High	Medium to High	Low
Engineering/management support	High	High	Low

Table 15-9



Risk Management in Sourcing

- Inability to meet demand on time
- An increase in procurement costs
- Loss of intellectual property



Making Sourcing Decisions in Practice

1. Use multifunction teams
2. Ensure appropriate coordination across regions and business units
3. Always evaluate the total cost of ownership
4. Build long-term relationships with key suppliers



Summary of Learning Objectives

1. Understand the role of sourcing in a supply chain
2. Discuss factors that affect the decision to outsource a supply chain function
3. Identify dimensions of supplier performance that affect total cost
4. Structure successful auctions and negotiations
5. Describe the impact of risk sharing on supplier performance and information distortion
6. Design a tailored supplier portfolio



This work is protected by United States copyright laws and is provided solely for the use of instructors in teaching their courses and assessing student learning. Dissemination or sale of any part of this work (including on the World Wide Web) will destroy the integrity of the work and is not permitted. The work and materials from it should never be made available to students except by instructors using the accompanying text in their classes. All recipients of this work are expected to abide by these restrictions and to honor the intended pedagogical purposes and the needs of other instructors who rely on these materials.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.

Printed in the United States of America.