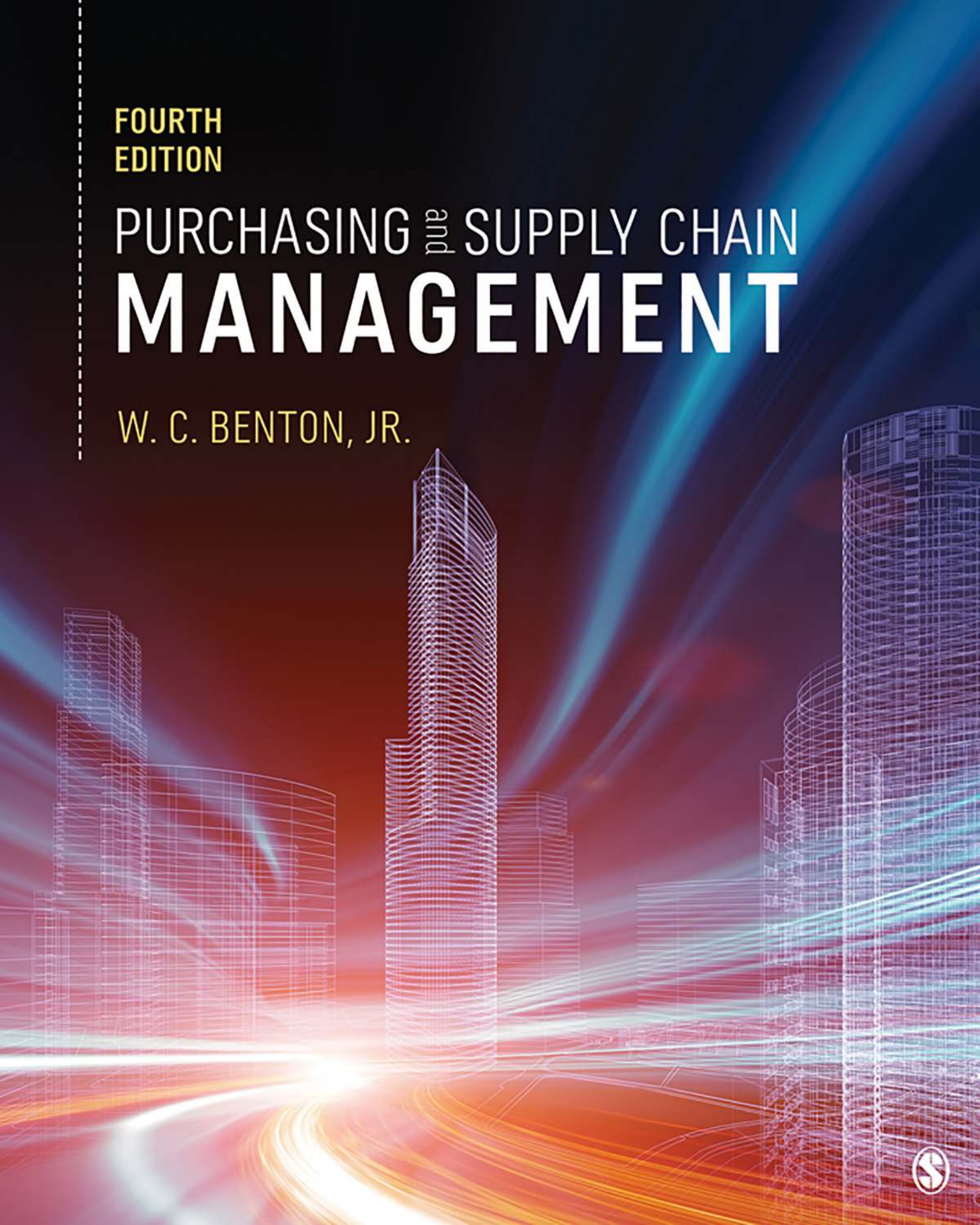
FOURTH EDITION

PURCHASING and SUPPLY CHAIN MANAGEMENT

W. C. BENTON, JR.



Purchasing and Supply Chain Management

Fourth Edition

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Purchasing and Supply Chain Management

Fourth Edition

W. C. Benton, Jr.
The Max M. Fisher College of Business
The Ohio State University

SAGE

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SAGE Publications, Inc.
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SAGE Publications Ltd.
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55 City Road
London, EC1Y 1SP
United Kingdom

SAGE Publications India Pvt. Ltd.
B 1/I 1 Mohan Cooperative Industrial Area
Mathura Road, New Delhi 110 044
India

SAGE Publications Asia-Pacific Pte. Ltd.
18 Cross Street #10-10/11/12
China Square Central
Singapore 048423

Printed in the United States of America

Library of Congress Cataloging-in-Publication Data

Names: Benton, W. C., 1948- author.

Title: Purchasing and supply chain management / W.C. Benton, Jr., Max M. Fisher College of Business, The Ohio State University.

Description: Fourth edition. | Thousand Oaks, California : SAGE Publications, Inc., [2021] | Includes bibliographical references and index.

Identifiers: LCCN 2020017837 | ISBN 9781071804759 (paperback) | ISBN 9781071804766 (epub) | ISBN 9781071804773 (epub) | ISBN 9781071804780 (ebook)

Subjects: LCSH: Business logistics.

Classification: LCC HD38.5 .B44 2021 | DDC 658.7—dc23

LC record available at https://lccn.loc.gov/2020017837

This book is printed on acid-free paper.

Acquisitions Editor: Maggie Stanley
Content Development Editor: Darcy M. Scelsi
Production Editor: Astha Jaiswal
Copy Editor: Mark Bast
Typesetter: Hurix Digital
Proofreader: Jennifer Grubba
Indexer: Integra
Cover Designer: Candice Harman
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20 21 22 23 24 10 9 8 7 6 5 4 3 2 1

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Preface

As the role of purchasing and supply chain management continues to evolve, a new set of objectives is coming into focus, namely, the need to elevate procurement's role to more of a trusted member of the executive team.

The material in this book is intended as an introduction to the field of purchasing and supply chain management. It is suitable for both undergraduate and graduate students. The field of purchasing has turned over many times during the past 40 years. The traditional purchasing function has evolved from a narrowly defined transactional activity into a professional supply chain management function driven by people and technology. The role of supply chain management is concerned with is cost containment, profitability, and relationship building. The supply chain has become a determining factor that defines a company's business model. Most of today's supply chains are more globally focused, technologically infused, interactive, and collaborative. The discipline of supply management is the core component of an effective supply chain. This book is based on more than 30 years of practice, teaching, research, and consulting experience. This book is different from other purchasing textbooks in that it focuses on an *analysis-driven purchasing practice*. The learning objectives in this book can be implemented immediately.

Interest in purchasing and supply chain management both in industry and in academia is growing at an increasing rate. Purchasing is recognized as having an overwhelming impact on the bottom line of the organization. It has a direct impact on the two forces that drive the bottom line: sales and costs. Several factors have driven the *purchasing revival*. First, many companies are becoming more profitable by increasing throughput, lowering inventories, and minimizing operational expenses. Second, supply chain information is becoming the primary driver throughout the supply chain management system. Third are the recent trends in outsourcing, and, finally, buying organizations are using interorganizational *power* to manage their supply chain. The purchasing/supply chain skill levels for the next decade must include (1) an understanding of the value drivers: technology, velocity, and globalization; (2) becoming more strategically involved in decisions; and (3) becoming proficient in business analytics.

The information in this book provides state-of-the-art concepts, analysis, and supply management solutions. The topical matter includes purchasing decisions and business strategy, the legal aspects of purchasing, materials management, inventory management, just-in-time (lean) purchasing, purchasing procedures, e-purchasing, systems contracting, supplier selection and evaluation, strategic outsourcing, global sourcing, purchasing supply partnership, supply chain power, total quality management (TQM) and purchasing, price determination, bargaining and negotiations, purchasing transportation services, equipment acquisition and disposal, health care purchasing, and purchasing professional services. Most purchasing, logistics, and supply management students will be directly employed in purchasing or related supply chain management areas. The book focuses on the interrelationships of purchasing with the rest of the functional and system areas of the organization, with particular emphasis on the interface with accounting, finance, marketing, logistics, supply chain management, and operations management. However, each chapter is designed to be self-contained, so the reader can easily refer to the topic of interest. There are 29 real-world cases and exercises

based on practical organizational situations. Each case has been tested by industrial implementation and through in-class usage. The cases are intended to reinforce the lessons learned from the chapters.

The treatment of purchasing and supply chain management in this book is extensive and complete. The contents in the book can be covered in a one-semester course. The textbook is intended to be used for undergraduate- and graduate-level courses in purchasing management, supply management, procurement management, contract management, logistics, and supply chain management. The book is also an excellent resource for executive education and training seminars. Depending on the pedagogy, the book also could be used in operations management, marketing/fashion, and industrial engineering courses. The book is an excellent resource for the Certified Purchasing Manager (C.P.M.) program sponsored by the Institute of Supply Management (ISM) and the certification program sponsored by the Association for Operations Management (APICS).

CHANGES TO THIS EDITION

Business is a complex field. A company can spend from 60% to 80% of its revenue buying goods and services. Purchasing and supply chain management professionals oversee the business's buying activities. The fourth edition of *Purchasing and Supply Chain Management* focuses on the next generation of purchasing and supply professionals. Today, supply professionals must possess a comprehensive skill set. They must have excellent technology and negotiation skills in order to add value to their organization. Supply professionals must also be analytical problem solvers. In today's global arena, purchasing and supply professionals must be able to interact with potential sources of materials and services throughout the world.

This edition is a comprehensive, easy-to-follow authoritative guide to state-of-the-art purchasing and supply methods, perfect for both students and supply professionals. Some of the highlights include the following new and expanded topical coverage:

- New coverage of supplier and opportunistic supplier behavior
- New coverage on selecting, managing, and monitoring complex global outsourcing services
- New coverage on the relationship between the hospitals and group purchasing organizations
- Expanded coverage of health care purchasing and supply chain management
- New coverage on purchasing strategy and the development of strategic purchasing plans for competitive advantage
- Expanded coverage of e-procurement technology
- New coverage on professional service sector procurement
- Expanded coverage of price/cost analysis, negotiations, and the competitive bidding trap
- Expanded coverage of markup versus margin
- New coverage on professionalism, ethics, and the law

- Expanded coverage of supply chain relationship management
- New coverage on project pricing
- Twenty new real-world case studies
- A comprehensive set of new exercises and problems

The fourth edition is both timely and topical and intended to help the new generation of students and supply professionals to become more effective supply management professionals.

An Overview of the Text Highlighting Changes in This Edition

Part I. Introduction to Purchasing and Supply Chain Management

Chapter 1 establishes that now is the best time for the next generation of managers to pursue a career in purchasing and supply management. Supply management professionals must possess a diverse skill set. First, the successful supply manager must have excellent technology, people, and negotiations skills in order to add value to his or her organization. Supply professionals must also be analytical problem solvers. In today's global business arena, supply management professionals must be able to interact with potential sources of materials and services throughout the world.

In this edition we show how supply management professionals must learn how to adapt to new sources of supply chain uncertainty. The European Union (EU) is just one example of global uncertainty now affecting U.S. firms. There is a high level of direct investment and trade between the EU and the world's two largest economies (i.e., the United States and China). Many American firms have subsidiaries and business partners located in the United Kingdom, and these companies served as portals into the European Single Market (within which there is free movement of goods, capital, services, and labor). In 2016, the United Kingdom voted to leave the EU, an event known as "Brexit" or British exit. Brexit was finalized on January 31, 2020.

To manage supply chain risk, we must first determine specifically where the risk exists in the supply chain. Any companies with footprints in the United Kingdom must evaluate and adapt their supply management function based on the realities of Brexit. More generally, any company with a global footprint must evaluate and adapt its supply management function based on the global uncertainties to which it is exposed. An effective supply chain organization with critical and strategic suppliers and customers in a vulnerable or changing part of the world must devise plans for qualifying alternative strategic supply chain relationships. Keeping a watchful eye on inventory levels and conducting site visits is broadly recommended.

In **Chapter 2** we show how purchasing can play a significant role in making a firm competitive. Purchased inputs constitute a large portion of the company's resources. In most industrial firms, material constitutes 60% to 80% of the total revenue dollars. Purchased inputs offer a potential source for helping a company develop leverage against its competitors. Purchasing actions designed to reinforce the firm's competitive priorities can give the firm advantages over its competitors. In essence, firms must design their purchasing actions to emphasize the competitive strategy. In this new edition, an enhanced framework for linking purchasing decisions with the firm's competitive strategy is presented. Specifically, we show how an effective purchasing framework includes four important decision areas: (1) supply management, (2) buying, (3) supplier development, and the (4) degree of supply

chain integration. The primary tactical tools used for implementation of the strategic framework are the total cost of ownership (TCO) and SWOT analysis.

The legal aspects have been expanded in **Chapter 3**. The purchasing professional in an organization must be able to understand the legal aspects of the purchasing function. In a free democracy, the law can only codify and enforce the most egregious violations as defined by society. The elimination of fraud and exploitation does not regulate aggressive negotiations and other business practices. However, purchasing professionals must strive to conduct honest negotiations. The relationship between ethics and the law is complex. Many violators of ethical conduct maintain that their actions are perfectly legal under the law. The societal norms must also be considered. Perhaps the most significant change of the legal aspects of purchasing is the impact of contracts and transactions in the information age.

Part II. Materials Management

Chapter 4 focuses on materials management in support of the transformation of raw materials and component parts into throughput (sales). The functions included in the materials management concept include (1) materials planning and control, (2) production scheduling, (3) receiving, (4) stores, (5) traffic, (6) disposal of scrap, (7) quality control, and (8) inventory control. In the fourth edition we show how the concept throughput time (TPT) applies to the efficiency. Specifically, the longer an order for material stays in the plant, the larger the work-in-process inventory will be, the larger the storage area required, and the more likely the material will be damaged, lost, or stolen. Work-in-process inventory has little market value except to the salvage yard. The firm is not in the business of making and inventorying work in process. The adage is, "Move it out; ship it; bill the customer."

Inventory management is presented in **Chapter 5**. Inventory is the lifeblood of any business. Most firms store thousands of different items. There are many inexpensive supply or operating type items. The type of business a firm is in will usually determine how much of the firm's assets are invested in inventories. Hospitals carry beds and surgical instruments, as well as food, pharmaceuticals, and other miscellaneous items. On the other hand, manufacturing firms carry office supplies, raw materials, component parts, finished products, and many other industry-related items. In this chapter we also discuss the nature of demand. The nature of demand is perhaps the most important attribute. The nature of demand can be either independent or dependent. *Independent* demand is unrelated to the demand for other items. In other words, demand for an independent item must be forecasted independently. *Dependent* demand is directly derived from demand for another inventoried item demand. In manufacturing firms, raw materials, component parts, and subassemblies depend on the final item's demand. Thus, demand for a dependent item should not be forecasted independently. In this edition we have increased the example problems. There are also 25 new exercises at the end of the chapter.

Just-in-time (JIT) or lean purchasing is introduced in **Chapter 6**. The current shift toward the so-called "lean thinking" manufacturing environment is one of the major motivations for JIT purchasing. JIT has changed the role of purchasing from merely placing orders to investigating the supplier's technical and process capabilities. Perhaps the most important realization is the fact that suppliers should become an extremely important consideration for the purchasing function, wherein they should be viewed as partners and not adversaries. The function of purchasing is to provide a firm with component parts and raw materials. Purchasing also must ensure that high-quality products are provided on time, at a reasonable price. Specifically, the implementation of JIT purchasing assists the purchasing function in

its major objectives of improving quality of incoming materials and supplier delivery performance, along with reducing lead times and cost of materials.

Part III. Fundamentals of Purchasing and Supply Chain Management

Chapter 7 has been updated significantly in the fourth edition. Today, the acquisition of supplies from the company storerooms in most cases is a relatively simple process. The requisitioner creates a requisition in the appropriate software, commonly an ERP system such as SAP. The system automatically checks whether the requisitioner has the authority to make a purchase of that value and/or under that budget line and sends requests for additional approval if necessary. If the materials are available in stock, the requisition can be filled quickly and with little further processing. Many companies have adopted catalogs (also called e-catalogs) of approved products for users to browse; this is partly done to encourage requisitioners to request items that are readily available by making it easier to request a standard item than it is to request something not normally kept in stock. Anything that requires human handling can lead to productivity losses. Many high-technology manufacturing firms purchase fully assembled component systems electronically. The new information age forces both large and small firms to consider the competitive advantages of online reverse auctions and RFID technology. Businesses that use reverse auctions have made testimonials of savings of more than $800 million from online bidding.

Supplier selection is addressed in **Chapter 8.** The supplier selection problem is much easier to describe than carry out. One purpose of this chapter in the fourth edition is to shed light on selecting only the most compatible supplier for firms in specific industries. The buying firm may be highly skilled at (1) specifying product attributes, (2) forecasting expected requirements, and (3) ensuring the right quality at a reasonable price. However, unless the buying firm selects the right supplier, the prepurchase planning is meaningless. The selection of the correct supplier is perhaps the most important purchasing activity. The buying firm must spend extensive time analyzing and carefully selecting the correct supplier. Once the correct supplier is chosen, succeeding orders will by definition meet quality, delivery, and price expectations. Of course, there should be periodic supplier evaluations to ensure continuous supplier performance achievement. In the next two chapters we address the supplier sourcing process.

Strategic outsourcing is addressed in **Chapter 9**. Outsourcing is the complete transfer of a business process that has been traditionally operated and managed internally to an independently owned external service provider. A complete transfer means that the people, facilities, equipment, technology, and other assets are no longer maintained once the business process is outsourced. Strategic outsourcing has rapidly become a building block for globalization. The conventional motivation for outsourcing is commonly driven by the savings in direct labor.

In the coming decade, more and more firms will be expanding their operations into international markets. The subject of **Chapter 10** is global sourcing. Global sourcing is the trend of the future. Supply management is becoming very important to the survival of both American and offshore firms. In certain industries, using foreign suppliers can reduce costs, thus making a company more competitive. As firms' competition heats up, firms will become more global minded. To be a global firm, management must be able to critically evaluate foreign markets. In the current business environment, firms are beginning to develop global procurement strategies. The electronic, chemical, and metal industries are leading the global procurement charge. In this chapter a detailed total cost analysis is presented to show the

hidden costs associated with global sourcing. The buying firm must also know how to negotiate in foreign countries. There are two germane forms of opportunism associated with both domestic and global outsourcing: shirking and poaching. *Shirking* represents the extent to which the service provider is inclined to deliberately underperform or withhold resources should the customer be unable to detect such action. Shirking is often associated with the problem of moral hazard and is frequently cited as a typical form of passive yet intentional opportunism. *Poaching* is the extent to which the service provider is inclined to use information gained through its relationship with the customer for its own, perhaps unauthorized, benefit should the customer be unable to detect such action.

Chapter 11 is "Supply Partnerships and Supply Chain Power." In the fourth edition partnering concepts are applied to supply chain relationships. Recognizing partnerships between buyer and supplier as a fundamental driver for the supply chain success, firms have begun to emulate these supplier alliances. Supply alliances, however, extend well beyond this notion to an even more relational level of exchange in which partners create an intensive, interdependent relationship from which both can mutually benefit. Supply partnerships emphasize direct, long-term association, encouraging mutual planning and problem-solving efforts. However, the influences of power affect critical interfirm relationship elements as well as firm performance and satisfaction.

Chapter 12 is "Total Quality Management (TQM) and Purchasing." Total quality management (TQM) expands beyond the traditional view of quality. Purchasing is a critical process that total quality management should focus on. Without high-quality raw materials or component parts from suppliers, a quality management program will not be successful. Therefore, any firm that wishes to achieve a high level of total quality management must carefully examine its purchasing process. TQM expands the traditional view of quality—looking only at the quality of the final product or services—to looking at the quality of *every aspect* of the process that produces the product or service. TQM systems are intended to prevent poor quality from occurring. Effective TQM requires the integration of production planning, marketing, engineering, distribution, and field service.

Part IV. Price/Cost Analysis and Negotiation Strategies

Chapter 13 focuses on price determination, which is one of the most important decisions that successful organizations make. The purchasing professional must become an expert on the product or services for which they are responsible. Given the complexity of the buying decision, the purchasing professional must be prepared to analyze each significant buying situation based on the conceptual and economic impact of various buying decisions. The foundations for price determination are rooted in the economics and psychology disciplines. It is conceivable that a powerful buyer could force a supplier to eliminate its overhead from the ultimate price. Price determination is becoming the most important competitive weapon necessary to ensure survival in today's competitive environment. Companies are spending an increasingly larger percentage of their revenue dollars for the acquisition of goods and services. Finally, in today's competitive construction market, markup and margin are sometimes used interchangeably. However, gross margin and markup are not the same. A clear understanding of markup versus gross margin is an important concept when estimating and bidding jobs in the construction industry.

Chapter 14 examines the important human interactions called bargaining and negotiation in a business setting. Bargaining occurs between individuals, groups, organizations,

and countries. In this chapter we consider bargaining between two parties, each possessing resources the other side desires. When two parties are involved in distributed bargaining, the parties are in basic conflict and competition because of a clash of goals: the more one party gets, the less the other gets. Integrative bargaining is a situation where some areas of mutual concern and complementary interest exist. The situation is a varying-sum schedule such that by working together both parties can increase the total profits available to be divided between them. The distributive bargaining situation has been fully explored by psychologists. Economists, on the other hand, have spent most of their efforts in examining bargaining on integrative bargaining situations. An experiment in distributive bargaining is also included to better illustrate both effects of economic and psychological aspects on the outcome of bargaining situations. The experiment examines the effect of contingency compensation on both buyers and sellers. It also allows speculation about the differences in the power system of buyers and sellers and how they affect the outcome of bargaining situations.

Part V. Special Purchasing Applications

Chapter 15 is updated and expanded in the fourth edition. Transportation is often the most costly and time-consuming component of purchasing management. Its planning is also critical in meeting manufacturing and customer delivery scheduling requirements. Transportation involves facilitating the movements of raw materials and component parts from suppliers through the firm's manufacturing process to the ultimate customers. The management of the purchasing/transportation interface is complex and requires the buying organization to gain knowledge of basic transportation decision-making activities. The initial decision requires the buying firm to select the appropriate shipment mode. Each of the modes has specific operating and cost characteristics, and the buying professional must weigh them in selecting the most appropriate transportation mode.

In **Chapter 16** a step-by-step capital acquisition process is given. The acquisition of capital equipment is a major decision in most firms. The capital acquisition decision has a significant effect on numerous aspects of the firm's financial health. The tax-planning process is also a significant component of this decision. Most high-value capital equipment purchases are usually processed at the vice president level and above. However, the purchasing professional serves a critical role in the acquisition process. The steps in the acquisition process are based on (1) requisition, (2) company objectives, (3) new product ideas, (4) cash flow analysis, (4) an economic evaluation, (5) a financial plan analysis, and (6) expenditure control. Next, an extensive lease-versus-buy decision is discussed and illustrated. When does it make more sense to buy capital equipment? When does it make more sense to lease? A detailed tutorial on the lease-versus-buy decision is given in the chapter supplement.

Chapter 17 is a special feature of the textbook. Hospitals are complex organizations providing a multitude of services to patients, physicians, and staff. These services include dietary, housekeeping, physical plant engineering, pharmacy, laboratory, inpatient treatment (nursing units), surgery, radiology, administration, and others. There are critical differences between the health care supply chain and industrial supply chain, such as the automotive supply chain. One difference is the manner in which revenue is generated. The cost of health care is expected to increase exponentially. Many businesses and health care organizations will be driven from the market because of uncontrollable nonsalary costs and declining profits. This radical shift is the result of increased price competition and the regulatory environment. The focus of this chapter in the fourth edition is on the relationship between group purchasing

organization OEMs and hospitals. As hospitals outsource part of their procurement process on a large scale to GPOs, they will save money by not having to employ the necessary support staff to test, research, negotiate, and purchase items on their own. However, a smaller purchasing staff and consequently less purchasing expertise increase the hospitals' dependence on a GPO. The chapter concludes with the impact of COVID-19 disruption on the global health care supply chain.

Chapter 18 focuses on sourcing professional services. Over the past 60 years, the service sector has taken on an increasingly important role in the world economy. Jobs in the service sector have increased from just less than 50% of the total jobs in the U.S. economy to nearly 80% of the total jobs in the U.S. economy. In the past 20 years, much of this growth has occurred in professional and business services, private education and health care, and leisure and hospitality industries. Many organizations in the service sector, especially those offering transportation, financial, and communication services, have encountered changes in their regulatory environment and technological structure. These changes have opened up new global markets but at the same time forced service industries to determine ways in which to remain competitive, or they would cease to exist. If pursuing a career in purchasing professional services, students should focus on acquiring relevant technical expertise and a good reputation to get the best work from their future suppliers.

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Acknowledgments

The development, writing, and revision of a textbook is a monumental project that requires the help of many dedicated people. I am especially grateful for the confidence, creative energy, support, and friendship of my content development editor, Darcy Scelsi. Darcy contributed numerous suggestions, comments, and ideas that dramatically improved the fourth edition. I also thank executive editor Robert Farrell at SAGE. Bob was the driving force that convinced me to become a member of the SAGE team. Special thanks to Linda F. McHenry, Esq., who contributed (Chapter 3) the legal aspects of purchasing and supply chain management. I am also indebted to reviewers of the fourth edition, including Linda F. McHenry, Esq., W. C. Benton and Associates, Inc.; Beverly Osborn, the Ohio State University; Calvin Scheidt, Tidewater Community College/Naval War College; Jennifer Richards, Ivy Tech Community College; Adburrezzak Sener, Duquesne University; Mariah McMurran Jeffery, Northwestern State University of Louisiana; Joni Koegel, Cazenovia College; Benito Garza, South Texas College; Ahren Johnston, North Carolina A&T State University; Varun Gupta, Penn State Behrend; Kurk Anderson, Lakeshore Technical College; Jim Bryant, University of Maryland Global Campus; John Mello, Arkansas State University; Benedict Uzochukwu, Virginia State University; John Bowman, Florida State College at Jacksonville; Pamela Rogers, Stephen F. Austin State University; Kevin Hale, San Jacinto College; David Wallace, Illinois Wesleyan University; Corey Jones, Tarrant County College; and Brian Addington, Truckee Meadows Community College. They contributed numerous suggestions and offered excellent comments. Special thanks to Linda McHenry who contributed significantly to Chapter 3. We offer our sincere thanks to these colleagues and hope that they are satisfied with their contribution to the fourth edition of *Purchasing and Supply Chain Management*.

My greatest appreciation goes to the hundreds of students who have shared classrooms with me from whom I have learned more than I have ever taught. If you have any comments or suggestions you would like to share with me, I welcome them.

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W. C. Benton, Jr.
Semper Fidelis

About the Author

W. C. Benton, Jr. is the Edwin D. Dodd Professor of Management and Distinguished Research Professor of Operations and Supply Chain Management in the Max M. Fisher College of Business at the Ohio State University. Professor Benton teaches courses in supply chain management to undergraduates, MBAs, and doctoral candidates. Dr. Benton received his doctorate in both operations and systems management and quantitative business analysis from Indiana University, Bloomington, Indiana.

Ranked number one out of 753 operations management researchers in terms of quality and quantity, Dr. Benton's vast research and writing accomplishments include more than 180 articles in the areas of health care performance issues, economics of cardiovascular surgery, purchasing management, inventory control, supply chain management, quality assurance, and materials management that have appeared in *The Encyclopedia of Operations Research*, *The New England Journal of Medicine*, *Annals of Thoracic Surgery*, *American College of Physician Executives*, *Decision Sciences*, *Journal of Operations Management*, *Naval Research Logistics*, *IEE Transactions*, *European Journal of Operational Research*, *Quality Progress*, *Naval Research Logistics*, *The Journal of Business Logistics*, *The Journal of Purchasing and Supply Chain Management*, *Production and Operations Management*, *Interfaces*, *Journal of Supply Chain Management*, *Production and Operations Management*, and *Healthcare Management Science*. Dr. Benton has published five textbooks and has authored "Bargaining, Negotiations, and Personal Selling" for the *Handbook of Economic Psychology*. He currently serves as a senior editor in two departments for the *Production and Operations Management Journal* and serves on the editorial review board for the *Journal of Operations Management*. He also serves as an associate editor for the *Decision Sciences Journal*, *Journal of Supply Chain Management*, *Journal of Business Logistics*, *Business of Service Industries Journal*, and *International Journal of Productivity and Quality Management*; he is a special issue editor for the *European Journal of Operational Research*. For the Engineer and Manufacturing and Service Enterprise Systems Divisions at the National Science Foundation, he is a research panel member.

Professor Benton's expert contribution to the business and governmental arena includes consultancy for Grant Hospital, Ashland, IBM, RCA, Frigidaire, the Ohio Department of Transportation, the Florida Department of Transportation, the Indiana Department of Transportation, the South Carolina Department of Transportation, the Alabama Department of Transportation, the Kentucky Department of Transportation, the Federal Highway Administration, Battelle Institute, the United States Air Force, Gelzer Automated Assembly Systems, Bitronics, the Ohio Bureau of Disability Determination, BioOhio, the Carter Group Canada, and others.

He serves on the board of directors for the Healthcare Accreditation Colloquium, the Sleep Medicine Foundation, Academic Council for Healthcare Research, the House of Hope, and the Supply Chain Management Research Group. He is a member of the Decision Sciences Institute, the Institute of Management Sciences, the Institute of Supply Management, the Production and Inventory Control Society, the Operations Management Association, American Society for Quality Control, Society of Logistics Engineers, the Mathematical Association of America, and others.

Dr. Benton served with the 3rd Marine Aircraft Wing, MCAS, El Toro, California, and the 3rd Marine Amphibious Force West Pacific.

PART I

Introduction to Purchasing and Supply Chain Management

1 Purchasing and Supply Chain Management

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

1.1 Identify the role of the purchasing manager, buyer, and purchasing agent in an organization.

1.2 Describe the evolution of the purchasing and supply management function as organizations become more globalized.

1.3 Explain the relationship between the purchasing function and inventory, ordering, and transportation costs.

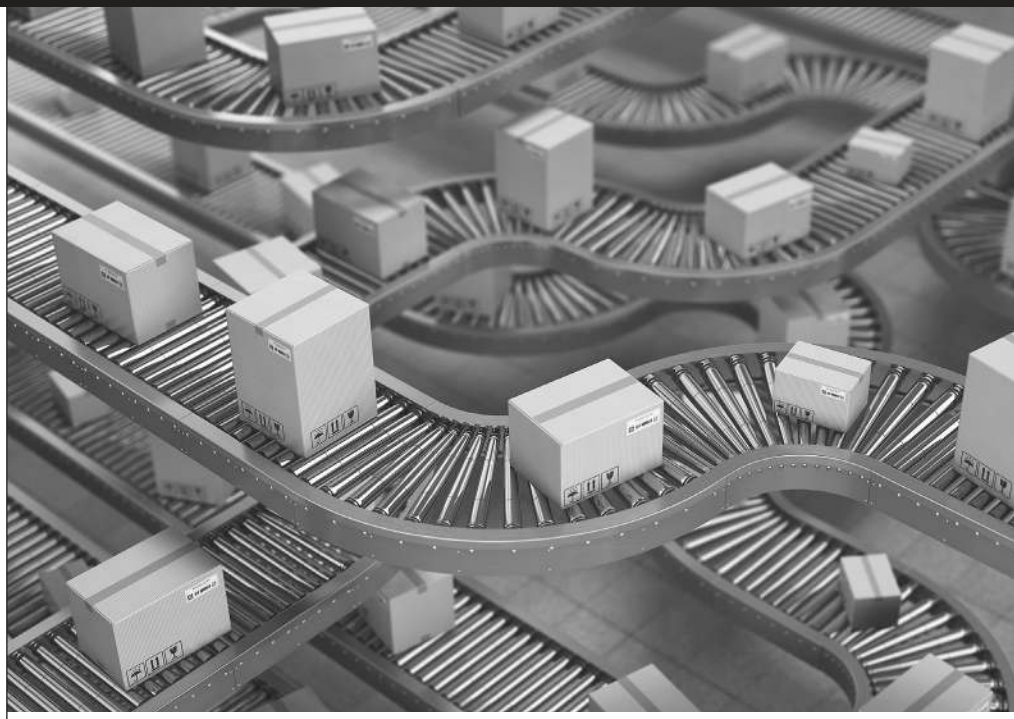
1.4 Explain the purchasing function's contribution to profitability.

1.5 Identify the relationship between the purchasing function and other functional areas.

1.6 Identify the advantages and disadvantages of various purchasing organizational designs.

1.7 Describe the reporting structures common in the purchasing profession.

1.8 Identify careers in purchasing and supply management.



Asia Spruell, a junior at Abilene Christian University (ACU), is having a terrific college experience. She is an officer in her sorority and is a member of the marching band. But she still has no idea what she wants to do in 2 years. She figured she would go to graduate school so she could continue working with the band and sorority. Basically, she wanted to remain at ACU for at least 6 more years. However, recently her parents made it clear they would only support her (financially) for the next 2 years.

This fall Asia enrolled in a course titled Purchasing and Supply Chain Management. It wasn't long before a light came on—this is it! "If I have to work for a living it should be in a profession with both challenges and potential for great satisfaction . . . supply chain management. It's a perfect way to enhance my relationship management skills, and it's stimulating enough to provide the fulfillment I need!"

After this aha moment, Asia met with her councilor to change her major from accounting to purchasing and supply chain management.

She plans to take the other courses in the PSM curricular. She also joined the Purchasing and Supply Chain Association (PSMA) and applied for a purchasing internship.

Asia's parents are visiting for Parents Weekend. Although she is certain she will pursue a career in purchasing and supply chain management, she would like her parents' approval. Both of her parents are accountants, and they expected Asia to follow in their footsteps. If you were Asia, what arguments would you present in favor of your decision?

.....

INTRODUCTION

After millennia of unchallenged success, business and governments around the world entered a new era of unprecedented openness. Three powerful forces underlie this trend: economics, technology, and zeitgeist (the mood of the time period). Global economies have become tightly integrated, enabling faster economic growth; the World Trade Organization lists 295 regional trade agreements presently in force. Yet, a decade ago, the entire world experienced a deep recession, causing some to raise new questions on the value of these supranational ties. The Internet has revolutionized the speed and power of data analysis and dissemination. Yet the unique scale of data collection has also led to new concerns about privacy and data ownership.

In general, the business world has become increasingly interconnected. Financial crises in one region of the world now have profound effects on the economies of other continents.

Supply management professionals must learn to adapt to new sources of supply chain uncertainty. The European Union (EU) is just one example of global uncertainty that is now affecting U.S. firms. There is a high level of direct investment and trade between the EU and the world's two largest economies (i.e., the United States and China). Many American firms have subsidiaries and business partners located in the United Kingdom, and these companies served as portals into the European Single Market (within which there is free movement of goods, capital, services, and labor). In 2016, the United Kingdom voted to leave the EU, an event known as "Brexit" or British exit. How Brexit will unfold, and which firms will be affected, remains uncertain today. Journalists and commentators speculate that the United Kingdom's currency will fall dramatically, that firms will relocate from London to Frankfurt or Paris, and that tensions in Ireland might boil over again as they did in the past.

To manage supply chain risk, we must first determine specifically where the risk exists in the supply chain. Any companies with footprints in the United Kingdom must evaluate and adapt their supply management function based on the realities of Brexit. More generally, any company with a global footprint must evaluate and adapt its supply management function based on the global uncertainties to which it is exposed. An effective supply chain organization with critical and strategic suppliers and customers in a vulnerable or changing part of the world must devise plans for qualifying alternative strategic supply chain relationships. Keeping a watchful eye on inventory levels and conducting site visits is broadly recommended.

In certain industries, Asian manufacturers dominate the U.S. consumer market. Nations in Central and South America and Southeast Asia continue to attract U.S. manufacturers seeking low wages for laborious tasks. In the midst of this changing world, the United States

is a giant consumer base with an enormous command of technology, but one steadily losing the infrastructure needed to create jobs.

In addition to significant events that have impacted the world's business environment, individual firms have had to change radically in response to burgeoning technologies. Historically, the management of materials and component parts was the most neglected element in the production process. Only when the cost of materials and subassemblies increased did management attempt to investigate alternative methods to the planning and control of the acquisition and transformation functions in the organization. Instead, most firms emphasized minimizing the cost of capital and labor. The focus on labor was logical because the industrial revolution had generated many labor-intensive manufacturers. Producing large standardized batches represented the norm for some manufacturers. Some firms have embraced new technologies and invested in technology-driven manufacturing systems. Although these new systems are up and running, too frequently they are being operated just like the old models, thus defeating the very purpose the system was designed to achieve. The reality is that technology is rapidly displacing labor. During the next decade, the supply management function is likely to contribute to profits more than any other function in the company.

All of these—changing economic and political environments, emerging technology versus labor, and the changing nature of purchasing as a discipline—must influence the role of purchasing and supply management. To become a competitive strategic weapon, purchasing and supply management must abandon fragmented approaches. The same company that invests in a technology-based manufacturing system (hard technology) at the same time must invest in result-oriented training programs (soft technology). The purchasing function must become an integral part of transforming raw materials and component parts into finished goods by using materials, systems, information, and people. Innovative sourcing requires companywide strategies with strong executive engagement that is internally driven and customer focused.

Purchasing managers An individual buying goods and services for use by their business organization.

Buyers The buying staff negotiates and processes purchase orders, providing assistance to end users. Their mission is to support the departments in obtaining the best products for the best price. Their role in the procurement processes can include troubleshooting vendor, invoice, and payment problems where appropriate.

Purchasing agents An individual who implements the purchasing process by forwarding the orders to suppliers and monitoring the documentation for their business organization.

PURCHASING MANAGERS, BUYERS, AND PURCHASING AGENTS

LO 1.1 Identify the role of the purchasing manager, buyer, and purchasing agent in an organization.

Purchasing managers, buyers, and purchasing agents seek to obtain the highest-quality merchandise at the lowest possible purchase cost for their employers. In general, **purchasing managers** buy goods and services for use by their business organization. On the other hand, **buyers** typically buy items for resale. **Purchasing agents** implement the purchasing process by forwarding the orders to suppliers and monitoring the documentation for their business organization. In general, purchasing managers, purchasing agents, and buyers determine which commodities or services are best for the specific requirement, choose the suppliers of the product or service, negotiate the lowest price, and award contracts that ensure the correct amount of the product or service is received at the appropriate time. To accomplish these tasks successfully, purchasing managers, buyers, and purchasing agents identify foreign and domestic suppliers. Purchasing managers, buyers, and agents must become experts on the services, materials, and products they purchase.

Purchasing managers, buyers, and purchasing agents evaluate suppliers based on price, quality, service support, availability, reliability, and selection. To assist them in their search

for the right suppliers, they review catalogs, industry and company publications, directories, and trade journals. Much of this information is now available on the Internet. They research the reputation and history of the suppliers and may advertise anticipated purchase actions to solicit bids. At meetings, trade shows, conferences, and suppliers' plants and distribution centers, they examine products and services, assess a supplier's production and distribution capabilities, and discuss other technical and business considerations that influence the purchasing decision. Once all of the necessary information on suppliers is gathered, orders are placed and contracts are awarded to those suppliers who meet the purchaser's needs.

THE EVOLUTION OF THE PURCHASING AND SUPPLY MANAGEMENT FUNCTION

LO 1.2 Describe the evolution of the purchasing and supply management function as organizations become more globalized.

To become a competitive organization in today's global economy, the purchasing and supply management function must become world class. The supply management function is the key to unlocking the value within the organization. Organizations must optimize sourcing assets. As can be seen in Figure 1.1, there are three stages in the optimization of an organization's sourcing assets. Stage 1 involves leveraging through volume discounts. It can easily lead to significant reductions in the total purchasing costs. Stage 2 involves focusing on the value proposition throughout the supply chain among customers and suppliers. Finally, Stage 3 is necessary for sustaining the successes in the previous two stages. Practice and high-quality feedback allow the purchasing professional the ability to make adjustments to Stages 1 and 2. The organizations that produce excellence are those that continuously improve. In general the purchasing and supply management function has evolved from a pure cost management function to a competitive advantage (see Figure 1.2).

FIGURE 1.1
Most Business Organizations Can Unlock Significant Value

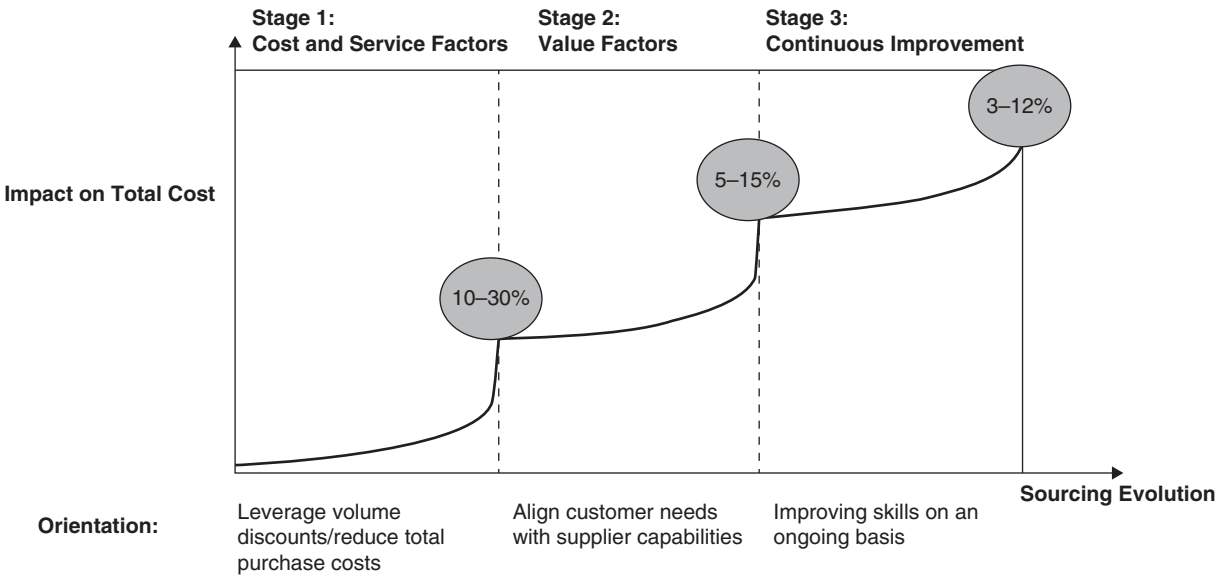


FIGURE 1.2
The Evolution of the Sourcing Function

Traditional Orientation	Current Thinking
1. Focus on prices	1. Focus on value
2. Total cost of ownership	2. Total contribution to ownership
3. Process-driver sourcing approach	3. Strategic intent–driver sourcing approach
4. Compatibility objectives	4. Differentiation objectives
5. Involvement in specification definition phase	5. Involvement in strategic decisions
6. Procurement skills	6. Business skills
7. Sourcing as adversarial zero-sum transaction	7. Sourcing aligned and intrinsically linked with business stakeholder

THE SUPPLY MANAGEMENT PROCESS

LO 1.3 Explain the relationship between the purchasing function and inventory, ordering, and transportation costs.

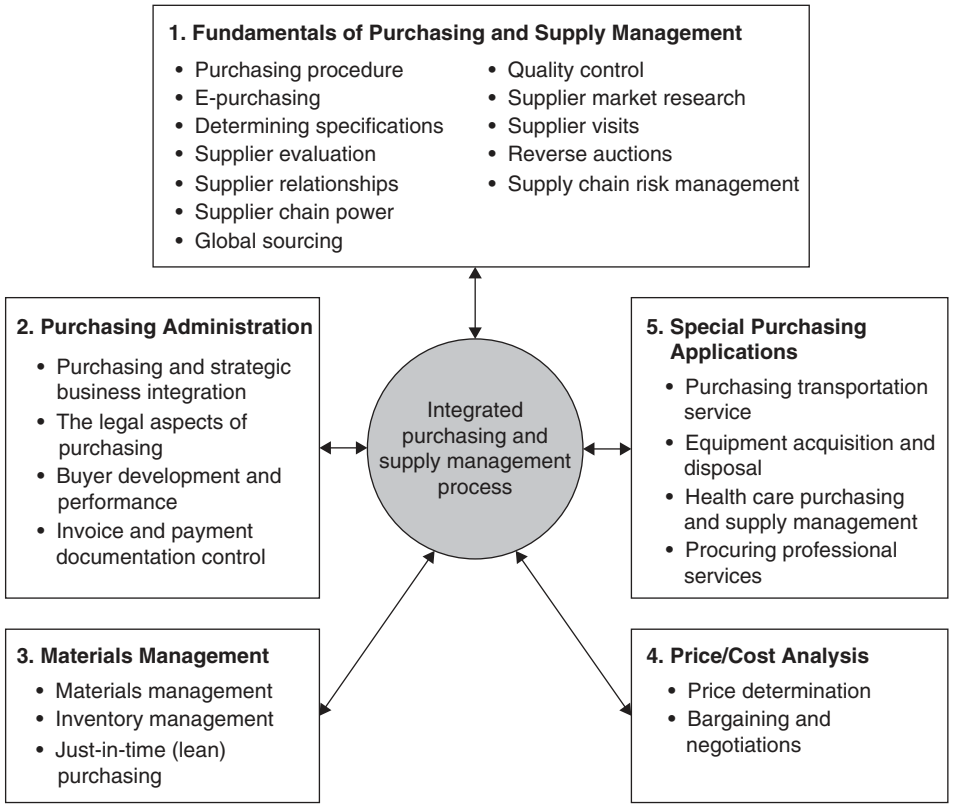
The primary focus of this text is integrated purchasing and supply management. As shown in Figure 1.3, this involves the coordination of fives aspects of the process:

1. Purchasing Administration (see chapters in Part I)
2. Materials Management (see chapters in Part II)
3. Fundamentals of Purchasing and Supply Management (see chapters in Part III)
4. Price/Cost Analysis (see chapters in Part IV)
5. Special Purchasing Applications (see chapters in Part V)

In the past 25 years, the supply management function has grown from a tactical function of purchasing/procurement into a key strategic role within organizations. Supply management now

- contributes to the bottom line.
- serves as an information source.
- increases efficiency and productivity.
- enhances the continuous improvement process.
- improves competitive position and customer satisfaction.
- impacts the organization's image and social policy.
- develops the organization's future leaders.

FIGURE 1.3
Integrated Purchasing and Supply Management Process



Supply management involves a strategic approach to planning and acquiring organizational needs through effective management of suppliers. It exists to explore business opportunities and implement supply strategies that deliver the most value possible to the organization, its suppliers, and its customers. Strategic supply management is the organization's primary source for collecting market intelligence and developing cost-reduction programs. Given the strategic nature of the supply function, the top supply management professional is usually a member of the organization's senior management team. In this leadership role, supply management professionals must be knowledgeable and understand all areas of the business in order to develop strategies consistent with the organization's goals and successful business procedures.

Supply management A strategic approach to planning and acquiring organizational needs through effectively managing suppliers.

With the increasing technology and demand for global operations, supply management is often involved in finding sources for products and/or services from international suppliers. An understanding of global business concepts is increasingly important for those in the profession.

In most firms, functional managers within each area make independent decisions using similar techniques. The approach introduced in this chapter proposes that the supply management decision should be integrated. **Integrative materials management** consists of the planning, acquisition, and conversion of raw materials and component parts into finished

Integrative materials management The planning, acquisition, and conversion of raw materials and component parts into finished goods.

goods. In this scenario, each functional manager reports to the same superior. What's more, the managers should work for the overall purpose of delivering high-quality products to the customer on time. An important objective of this approach is to provide high-quality customer service while minimizing the cost of producing the service.

Integrative supply management is not related to the size of the firm. Realistically, the purchasing subfunctions must first be integrated before the supply function will be synergistic with other business functions.

The purpose of supply management is to support the transformation of raw materials and component parts into shipped or inventory goods. The function of inventory in general is to decouple the entire transformation process. During the transformation process, materials are combined with labor, information, technology, and capital.

The supply planning system is central to the acquisition of part and component needs in an assemble-to-order environment. The material requirements planning (MRP) function is the most important input into a manufacturing planning and control system. Although many productive companies have embraced just-in-time (JIT) philosophies, they continue to use MRP concepts to enhance the effectiveness of the manufacturing mission. Perhaps the most significant change in the past decade has been in the purchasing function. During the time period 1960–1980, most American manufacturing firms fabricated 60% to 80% of the product's value (see Figure 1.4). On the other hand, in the past decade, a large number of manufacturing firms purchased from 60% to 80% of the product's value (see Figure 1.5). Since this impressive shift in percentages, the complexity of the manufacturing system has been greatly reduced. As can be seen in Figure 1.5, the complexity in the fabrication operation has been shifted upstream to the supplier. Under the traditional model, the firm transformed significantly more raw materials and labor into the end product. Today, since industrial firms are purchasing more and more subassemblies (component parts), the manufacturing focus is shifted downstream to the assembly operation. This significant shift has elevated the importance and profile of purchasing professionals.

A vice president of purchasing for a Fortune 500 company suggested that the *discount* acceptance decision cannot be made independently from the open order rescheduling decision. He went on to suggest that inventory record accuracy and open order rescheduling were key inputs into determining whether to accept or reject a specific discount schedule.

The expected economic benefit from the creation and continuous improvement of an integrated purchasing and supply management process is supply chain profit maximization (see Figure 1.5).

FIGURE 1.4
Manufacturing Process (1960s–1980s)

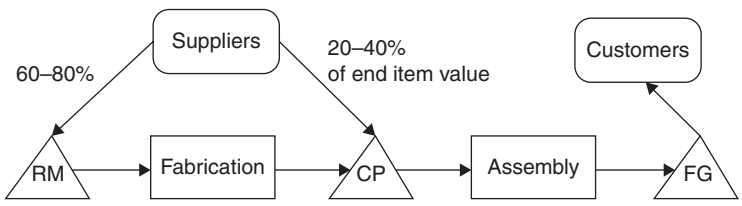
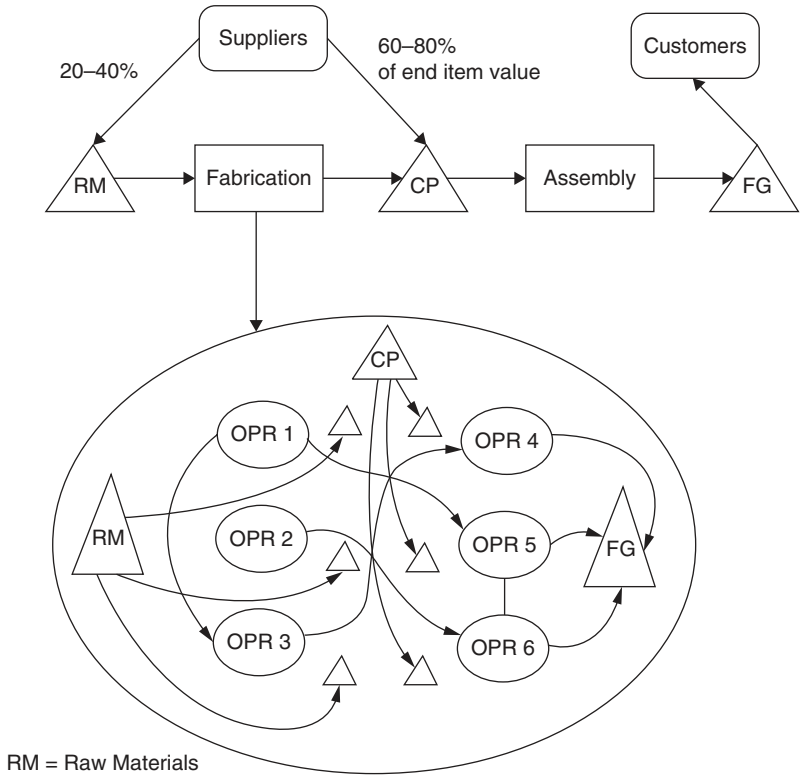


FIGURE 1.5
Manufacturing Process (1980s–Now)



The global economy has evolved from exclusively manufacturing to services. Thus, it is important to show how the lessons learned from manufacturing supply management can be applied to service systems purchasing. The differences between service supply management systems and the traditional supply management systems must be acknowledged. In service supply management systems, human capital forms a significant source of the value proposition. In addition, it is more challenging to measure value in service supply management. Chapter 18 focuses on service supply management.

PURCHASING DOLLAR RESPONSIBILITY

LO 1.4 Explain the purchasing function's contribution to profitability.

The cost of acquiring, storing, and moving materials is an increasingly large fraction of the **cost of goods sold**. To gain a different perspective about the importance of materials-related expenditures, consider the dollar responsibility of one General Motors materials management group:

Cost of goods sold Cost of materials in addition to the cost of labor input to create a product.

1. Parts and materials — 10 times direct labor dollars
2. Supply management expenditures — $100 billion

3. Transportation bill $3 billion
4. Purchasing buys 97% of all component parts

The mission of the General Motors supply management group is to manage purchasing, planning, scheduling, and the transportation of material required for specific products in a manner that will provide a *significant competitive advantage* to the division in the production of quality trucks and cars. Integrative purchasing and supply management make possible the production of vehicles in terms of cost and quality that are competitive in the world.

Thus, we see that the dollar responsibility of supply management is very large in both relative and absolute terms. More importantly, supply management contributes to the competitive stance and long-run survival of the firm.

The following are ratios of materials-related costs that are typically cited in fabrication–assembly industries, for example, consumer durable goods.

Cost of purchase = 80% of sales

Cost of marketing (sales) = 10% of sales

Cost of transportation = 10% of sales

These ratios are increasing for various reasons: material shortages, increased use of synthetic materials, inflation, and thoroughly complex high-value products.

Material Shortages

As natural resources are consumed, costlier methods of exploration, extraction, and processing are necessary. Shortages also result from political events. Former colonies of Western nations, once a low-cost and ready source of supply, have gained their independence. As autonomous nations, these new nations manage their resources to achieve economic, social, and nationalistic objectives.

In the early 1960s, nearly all the chrome in Rhodesia (Zimbabwe) was owned by U.S. firms. Rhodesia was described as a very comfortable, placid little British colony. The United States had almost no domestic sources of chromium, a material essential for manufacturing a wide range of products used in everyday life and military defense. Yet during the struggle for Rhodesian independence, the U.S. government placed an embargo on imports of chromium from Rhodesia. Prior to the second Gulf war and after the first Gulf war, there was a similar embargo on oil from Iraq.

Shortages can occur by depletion and by governments. In 1986, the U.S. government wrestled with the question of economic sanctions against the government of South Africa for its apartheid policy.

Synthetic Materials

In our quest for lighter-weight products with sophisticated capabilities, we have turned more and more to man-made materials. These compounds, fabrics, and crystalline structures are the materials from which the marvels of high-tech products are made. For example, automobiles will soon boast rust-free outer skins made of laminates of ferrous and nonferrous materials. They will be powered by an engine built around a ceramic engine block. The design and production costs of such esoteric materials are reflected in their higher cost structure. There are, of course, offsets to higher purchase prices. The operating costs of the products are expected to be lower and their capabilities greater.

Inflation

The materials buyer continues to experience periodic increases as material prices are adjusted upward in response to the rising costs of energy and labor. Managing materials during inflationary periods, or in developing countries with triple-digit inflation, results in decisions that would make little sense in stable environments.

PHOTO 1.1 Our cars have gotten more complex, requiring more high-quality components and materials to allow increased customization.

Complex, High-Value Products

Management in the auto industry frequently hears the complaint, "They don't make them like they used to." The industry's response is, "If we did, you wouldn't buy them." Consumers demand ever more reliable and capable products. Our cars now have microprocessors to monitor the vehicle's operation and tell us everything we would want to know about the state of the car. There are seat and steering wheel heaters. There's an instrument that tells us how many miles we can travel with the gasoline inventory on board. Another device talks to us telling us to shut doors, buckle up, and so on. Recently, vehicles with a communications link that communicates with an Earth-orbiting satellite tell the driver exactly where they are. Maps are displayed on a computer monitor with a cursor showing instantaneously the location of the car. Not all products are so esoteric, but generally today's products (and those of tomorrow) will use more complex materials and components in more configurations with higher degrees of customization. For all these reasons, you should expect no reversal in the trends of increased dollar responsibility and the strategic importance of supply management. Where else is the potential for cost reduction and competitive advantage so great?

Example 1.1

POTENTIAL FOR PROFIT

All supply management activities have potential for cost reduction and, hence, increased profit. The purchase of raw materials is used to illustrate what is called the "profit leverage" argument. We might just as easily have used the distribution or production activities. Suppose a firm has an income statement such as that illustrated in Figure 1.6.

FIGURE 1.6
Income Statement

Sales (000s)	$1,000
Direct materials	$500
Direct labor	$200
Gross profit	$300
Selling and administrative expenses	$250
Net profit	$50

(*Continued*)

(Continued)

At this level of activity, direct materials are (500/1,000) 100, or 50% of sales. Direct labor is 20%. Suppose the purchasing manager is able to reduce the cost of materials by 2%. Perhaps the manager bargains more skillfully or substitutes standard materials for custom-made materials. Or perhaps a value analysis program resulted in the purchase of functionally equivalent but less costly materials. Many opportunities exist to reduce the cost of purchases. If the firm's sales remained the same, the effect on profit, given the 2% reduction of material cost, would look like that in Figure 1.7. For each $1 reduction of material cost, there is a $1 increase in profit. The ratio is 1:1.

FIGURE 1.7
Income Statement Example 2

Sales (000s)	$1,000
Direct materials	$490 (49% of sales)
Direct labor	$200
Gross profit	$310
Selling and administrative expenses	$250
Net profit	$60

What increase in sales would be necessary to increase profit by $10,000 if material costs were not reduced?

Let χ be the required sales; then 0.5x is the cost of materials and 0.2x is labor cost.

Sales = variable cost + fixed cost +/- profit

x 0.5x + 0.2x + 250 + (10 +50)

x $1,033,333

Sales must be increased by $33,333 to achieve the same $10,000 increase in profit. The ratio is 3.3:1. Depending on the market, and the firm's competitive position, a sales increase of 3.3% may be possible only by exerting considerable effort. This is not to say that cost reductions in purchasing are achieved at no cost, but before trying to increase market share, we need to get our operating cost well in hand. Profit efficiency, not market share, should be our first concern.

INTEGRATED SUPPLY MANAGEMENT (ISM)

LO 1.5 Identify the relationship between the purchasing function and other functional areas.

Whatever the appeal and promise of integrated supply management, achieving integration is a challenge. In firms with conventionally organized subfunctions, supply managers are primarily concerned with satisfying their own subfunctional objective. Purchasing managers minimize purchasing costs; marketing managers minimize distribution costs; and so on. These objectives are local, not systemwide. The decisions of a production-inventory control (PIC) manager may maximize use of production equipment yet poorly serve the requirements of the marketing manager.

The decision of the purchasing manager affects not only the purchasing function but other materials functions. It is the objective of ISM to manage the related considerations. Purchasing should consider the nonpurchasing consequences of its decisions.

Example 1.2

DECISION-MAKING ON PURCHASING

Suppose a purchasing manager must decide the order quantity for a material with an annual requirement of 200,000 units. The material is consumed by manufacturing at a constant rate. The unit cost of the material is $1. For transportation purposes, 50,000 units are considered a truckload (TL). Shipments fewer than 50,000 units are charged at a less-than-truckload (LTL) rate that is higher per unit. Asked to state their objectives, the subfunctional managers might respond by saying the following:

Purchasing manager: "Minimize annual ordering cost."

PIC manager: "Minimize work-in-process inventory."

Traffic manager: "Minimize transportation cost."

If the purchasing manager weighs only the purchasing objective, annual ordering cost is minimized when the annual requirement is ordered once a year. Order cost is the cost to place one order. It is incurred each time an order is placed or part of an order is scheduled for delivery. Placing a single order for 200,000 units minimizes annual order cost but results in an average inventory of $100,000. We assume no safety stock, and receipt of the material is at the beginning of the year.

Average inventory = (beginning inventory + ending inventory)/2

= (200,000)/2

= 100,000 units @ $1 per unit, the average inventory value held is $100,000.

The significance of average inventory is that inventory cost is a function of average inventory. Inventory is an asset. Working capital is tied up in material rather than an alternative asset. Opportunity costs as well as costs of storing, insuring, and handling are incurred when inventory exists.

If the purchasing manager considered PIC's objective (minimize WIP inventory), the order quantities would be 4,000 units, with an order going to the supplier once a week. Assume there are 50 weeks in a year. Because manufacturing requires a uniform flow of material, its weekly requirement is 200,000/50, or 4,000 units per week. The reduction in average inventory when order quantity changes from 200,000 to 4,000 units is offset by the 50-fold increase in annual ordering cost.

To satisfy the traffic manager, the order quantity should be at least 50,000 units. With that quantity, the TL transportation rate applies and transportation costs are minimized. At 50,000 units, the average annual inventory is $25,000, and 200,000/50,000, or 4 orders per year are placed.

Each manager can make a strong case for the order quantity selected. If the purchasing manager ignores the PIC and traffic manager, manufacturing will have to live with a year's supply of material in its stockroom. The purchasing manager should try to quantify the inventory and order costs and ask about other costs that might be relevant.

Suppose the cost of carrying one unit of material in inventory is $1/year, and the order cost is $100/order. Assume the transportation rates are $20/CWT LTL and $10/CWT TL. CWT means "hundred weight," that is, 100 pounds. The weight of the material is 1 pound. In tabular form, the annual costs of the order quantities of 200,000, 4,000, and 50,000 are shown in Figure 1.8.

At least in terms of the costs quantified, and assuming realistic estimates of inventory cost/unit/year, and cost to place an order, the order quantity of 50,000 units minimizes annual costs. A word of caution: There are often

FIGURE 1.8
Integration Tradeoff Example

	Purchasing Cost	Order Quantity	Average Inventory	Orders/Year
Purchasing	$100	200,000	$100,000	1
PIC	$5,000	4,000	$2,000	50
Distribution	$400	50,000	$25,000	4

(*Continued*)

(Continued)

costs that have not been identified. For that reason we should not label the sum of the three costs as "total annual cost." Later we'll learn that the criterion for decision-making in supply management is "total cost of ownership."

Now, what effects if any does the decision in the preceding example have outside the supply management function? Let's sample the reactions of other functional managers to the decision to order 50,000 units of the material in question.

> Manufacturing manager: "Sounds good to me. I always feel good when I've got wall-to-wall inventory, but I don't want to be charged with inventory in the raw material storeroom."

The point illustrates the manufacturing manager's knowledge that while he needs to worry about a stock-out only four times a year, the cost of manufacturing's security blanket (inventory) can be high.

> Controller: "$25,000 worth of inventory on the average is just too much. It ties up working capital, and money doesn't grow on trees, you know."
>
> Plant engineer: "Where do you guys plan to store 50,000 units? We're already renting warehouse space across town. Besides, this stuff gets liberated (stolen) if it gets out of our sight."
>
> Sales manager: "I really don't have anything to say. Just don't let manufacturing stock-out. Keep the stuff coming off the production line. We have backorders by the tons."

So, you see that a rather routine decision about a purchased item's order quantity affects a variety of nonmaterials management people. How can the *best* decision be made—one that provides the desired *customer service* at *minimum cost*? In this example, the customers are manufacturing, sales, distribution, the final consumer, and, of course, purchasing, which is the supplier's customer. The costs of satisfactory customer service are only partly identifiable and quantifiable. Our knowledge of the opportunity costs of poor customer service is also incomplete. Yet decisions must be made while recognizing that systemwide decision criteria are

1. multiple,
2. complex, and
3. conflicting.

Supply management is a developing discipline and an area of management specialization. Measures of customer service are usually expressed in terms of the *availability* of material. Did the plant ship on time? Was the product on the shelf when the customer entered the shop? While important, availability is only one dimension of customer service.

Purchasing, inventory control, and distribution do not have detailed cost classification and accounting procedures. In manufacturing, we have a history of cost accounting going back to the turn of the century. Elaborate techniques are used to relate costs to output levels. Costs are segregated into variable and fixed portions. Budgeting for manufacturing is done with precision using resource standards produced by work measurement methods perfected many decades ago. Tell us what you want to produce and we'll tell you exactly what amounts of resources you'll need—direct materials, manufacturing supplies, tooling, machining time, setup, and so on.

Standard costs of production are the basis for operating budgets, product prices, and control of production costs. Such is not the case in purchasing, marketing, and transportation.

As these areas develop, purchasing and distribution cost accounting will become part of the accounting-information system. Standard costs to create the *time* and *place* utilities will be calculable. Budgeting for materials management activities will have the detail and reliability of budgeting in manufacturing. When supply management costs become more visible, their control becomes more feasible.

ORGANIZING FOR PURCHASING

LO 1.6 Identify the advantages and disadvantages of various purchasing organizational designs.

Supply coordination involves both structure and design of the organization. Purchasing organizational *structure* is the sum total of the ways in which an organization divides its labor into distinct tasks and then coordinates among them. Organizational *design* is concerned with bringing together a group of interrelated tasks for a common goal. However, organization design alone does not ensure effectiveness or efficiency. Most companies' organizational charts do not reflect true lines of authority and responsibility that flow through managers. Too much detail can lead to micromanagement. On the other hand, a loosely designed organizational structure can lead to a greater risk.

In any purchasing organization, two major problems must first be considered. The first issue: Where should the purchasing functions be located in the organization? Second, what level of authority should the purchasing function have? Given the evolution of outsourcing, the purchasing function is expected to gain more authority in the corporate hierarchy.

Centralized Versus Decentralized Purchasing

The first issue deals with centralized purchasing of decentralized functions. **Centralized purchasing** involves coordinating all purchasing activities for the entire plant through one central location. That purchasing department is the only place in the firm where requisitions are processed and suppliers are selected. In **decentralized purchasing**, authority and responsibility for supply-related functions are dispersed throughout the organization.

Centralized purchasing The coordination of all purchasing activities for the entire plant through one central location.

Decentralized purchasing The authority and responsibility for supply-related functions are dispersed throughout the organization.

Advantages of Centralized Purchasing

In most cases, centralized purchasing results in lower costs because of the availability of purchase quantity discounts. If all material uses are coordinated into one major purchase, the supplier will work harder to service the buying firm. Large dollar purchase quantities equal buying power. Most manufacturing firms spend more than 70% of their total revenue on purchasing materials and component parts. Thus, the effectiveness of a centralized organizational design will have a significant impact on profit. As an example, consider a firm that has several departments that use similar components; they could actually compete against each other for scarce material, resulting in higher prices for each department.

Centralized purchasing promotes the effective use of purchasing professionals because it allows the supply manager more authority and credibility. Each buyer can easily become an expert on associated buys (commodities and noncommodities). Expertise will be developed when there is a critical mass. GM, Dell, Walmart, and IBM all use centralized purchasing and have in-house expertise ranging from engine parts to rental cars to office equipment to pharmaceuticals.

Centralized purchasing enables the buying firm to do a better job of monitoring various changes throughout the industry. Centralized purchasing also lends itself to periodic

(1) reviews of purchasing activities, (2) evaluation of suppliers, and (3) development of purchasing training programs. In decentralized purchasing operations, these important strategic activities may not be accomplished.

Centralized purchasing is preferred from the suppliers' point of view. The selling firm can easily determine whom to call on. This will improve efficiency for both parties.

According to a recent Center for Advanced Procurement and Supply (CAPS) study, 59% of the firms used a combination centralized–decentralized structure, and 28% used centralized purchasing. Only 13% of the firms responding used decentralized purchasing.

Disadvantages of Centralized Purchasing

There are several arguments against centralization. Most of the resistance is from companies where there are decentralized profit centers. The following three main arguments are given:

1. *High engineering involvement in procurement decision-making.* At the early stages of product development, engineering needs to be deeply involved with the design, which can be different with remotely located centralized purchasing.
2. *High need to coordinate purchased parts with production schedules.* This is especially applicable when small amounts are ordered frequently. The supplying firm must be within close geographical proximity or guarantee JIT deliveries. It may not be cost-effective to have centralized purchasing operations in some JIT situations.
3. *High need to buy from local community.* Sometimes it makes good political sense for firms to make purchases in the community where the plant is located.

Because of the profit-leveraging effect, profit center managers feel the need to control purchasing if they are to be held accountable for profits.

Advantages of Decentralized Purchasing

Decentralized purchasing provides for a more streamlined procedure since the department manager's purchasing needs and thus decisions can be made immediately. As an example, if a manager needs to purchase 10 laptops for the business unit, the unit manager can easily make the purchase online or from a local computer store.

Disadvantages of Decentralized Purchasing

The disadvantages of decentralized purchasing are duplication of effort in buying, receiving, inspection, and accounts payable. Decentralized purchasing also prevents the buying organization from taking advantage of volume discounts.

Centralized/Decentralized Hybrid Purchasing Systems

Some organizations adopt a hybrid system that combines both centralized and decentralized purchasing. They use centralized purchasing for larger organization-wide contracts, but give individual business units autonomy to make small purchases for their departments or subsidiaries. Table 1.1 summarizes the three approaches.

TABLE 1.1
The Degree of Centralization Impacts on Purchasing Success

	Decentralized Purchasing System	Hybrid Purchasing System	Centralized Purchasing System
Advantages	Business responsiveness	Business responsive, increased leverage, some processes	Increased cost savings, enhanced talent management, consistent processes
Disadvantages	Loss of leverage, lack of consistent sourcing process	Priority given to business requirements, control and coordinate activities	Significant focus on cost savings, less focus on business requirements
Example organization	Heavy highway construction	Universities	Major retailer, automotive manufacturers, and technology

FIGURE 1.9
Example of Geographically Centralized Purchasing

A Fortune 500 appliance company is a good example of a company that has great difficulty in centralizing purchasing on a geographical basis. The company has many plants throughout the country. Although each plant makes electrical products, the product lines are diverse. As a result, the company has relatively few common suppliers, and those are widely separated geographically.

In some cases, national pricing contracts have been negotiated on a centralized basis for common items that can be used by the individual plants as they see fit, particularly where the vendor has several plants nationwide and can provide adequate delivery. Such items are relatively few, however, and are of a supply rather than a production nature. In no case are actual purchase orders placed from the central location in Cincinnati. At one time, machine tools were purchased in this manner. This practice was later abandoned because of objections by manufacturing.

Even when several plants are located in the same local geographical area, their requirements could be so specialized that they would often prefer to do their own purchasing. On the other hand, the Columbus, Ohio, plant operates with a centralized purchasing department handling the buying of all raw materials, fabricated component parts, and maintenance repair and operating (MRO) items for four product lines:

- Refrigerators and freezers
- Room air conditioners
- Specialty product (dishwashers)
- Compressors

Each division has its own manufacturing, engineering, and sales departments, all reporting to a general manager. Production control is reported to the manufacturing manager in each case. Purchasing is reported to the general manager.

The Future Organization Concept

The outlook is that the majority of significant dollar-valued purchases will continue to be centralized. This trend also will be the result of increased computer-based management information systems. As firms become lean, centralized purchasing will become a major focus. Long-term agreements will be more frequently negotiated to stabilize prices. Honda of America is an excellent example of a firm that uses centralized procurement as a competitive weapon. Approximately 75% of the sales dollar for each automobile manufactured in Marysville, Ohio, is purchased from Japanese firms. Moreover, as multinational firms continue to expand and grow, the host government's national interest will increasingly become the focal point of a firm's procurement strategies. An example of geographically centralized purchasing is given in Figure 1.9.

REPORTING STRUCTURE

LO 1.7 Describe the reporting structures common in the purchasing profession.

The status of the purchasing professional in an organization is determined by the capacity structure. In the majority of Fortune 500 firms, the purchasing professional reports directly to the manufacturing vice president. This is also true for medium-sized firms. To be effective, the purchasing function should never report to another major line activity. If this occurs, the purchasing professional does not have the appropriate authority to make a difference. Of course, the reporting structure must be consistent with the capabilities of the specific person in each position. The purchasing organizational structure also should be different for service-based firms. Purchasing services are addressed in Chapter 18.

A recent Center for Strategic Supply Management (CAPS) study found that in 16% of the firms surveyed, purchasing managers report directly to the president. However, in the majority of the firms, the purchasing manager reports directly to the VP of manufacturing/operations. In smaller firms, more than one third of the purchasing professionals report to the VP of manufacturing. What's more, in firms with sales between $5.1 and $10 billion, 61% report to either the president or executive VP.

The Organization Concept of Supply Management

A formal organizational concept of supply management involves the flow of materials through a manufacturing firm. The functional areas involved in this flow include (1) purchasing, (2) inventory control, (3) traffic, (4) production control, and (5) stores, as shown in Figure 1.10. Approximately 70% of the firms surveyed follow this organizational concept. Figure 1.10 also shows some emerging organizational examples trending in supply chain management. The overwhelming acceptance of the supply management concept has created a need for more technical and managerial sophistication from the supply manager. A common feature of all the organizational examples is that people support and adjust the process using technology to increase throughput.

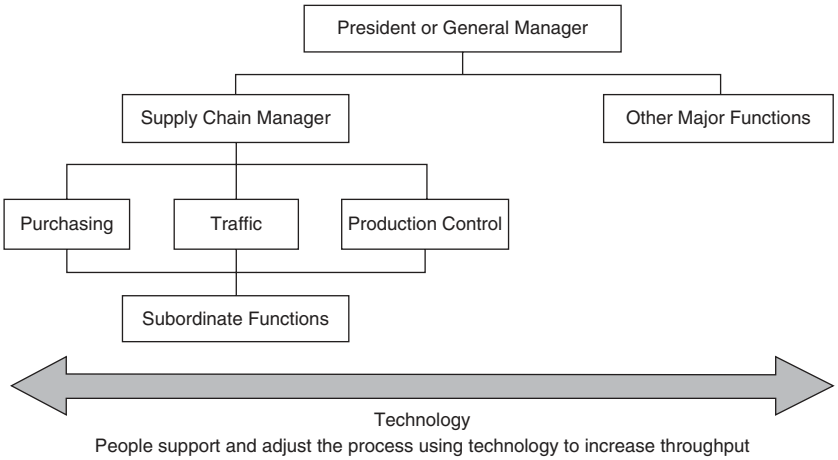
The examples in this section are by no means conclusive. In summary, designing an organizational structure depends on the following:

- The kind and quality of information it gathers from its customers, suppliers, and partners
- How the company gathers the information
- How it interacts with each of these constituents
- How this information flows through the organizational structures
- Who has access to it and who doesn't
- How the information is used in making decisions
- How the information is stored for ease of use and analyzed
- Whether both the organizational processes and systems reflect and mirror information flow

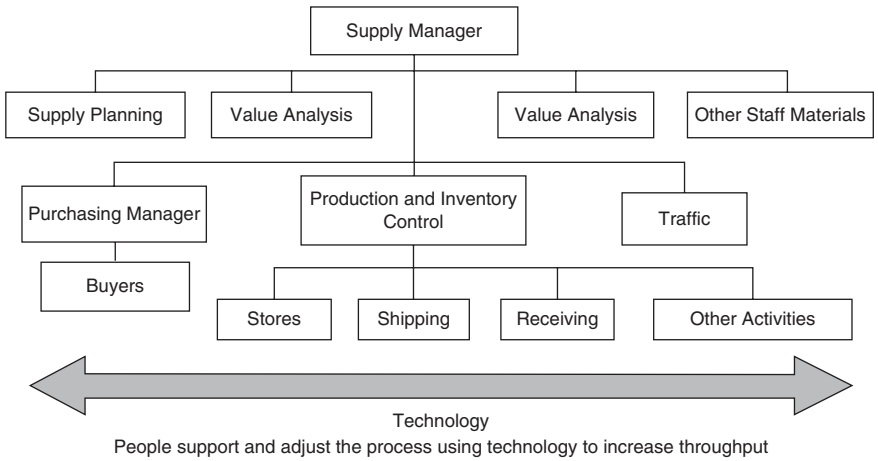
FIGURE 1.10

Organizational Examples

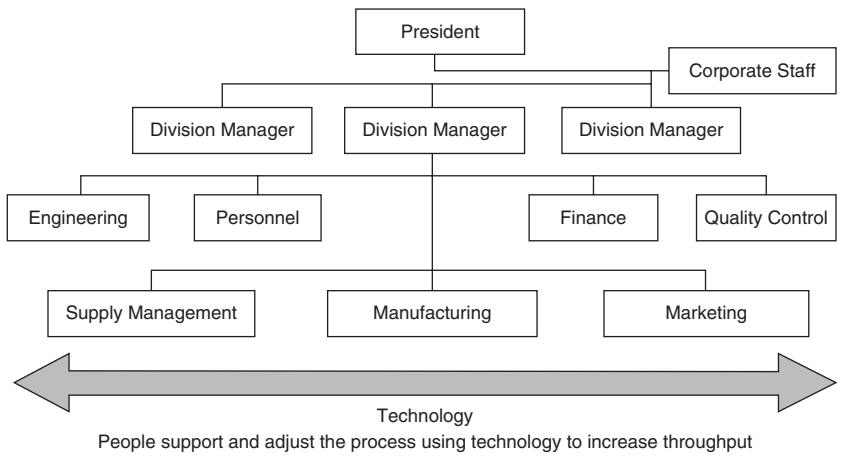
I. Basic Supply Management Organization



II. Supply Management with a Staff Operation



III. Divisional Supply Management



PROFESSIONALISM WITHIN PURCHASING AND SUPPLY MANAGEMENT

LO 1.8 Identify careers in purchasing and supply management.

As supply chains continue to grow globally, and as products become more complex, the supply chain professional must become more sophisticated. Supply management professionals across all industry sectors must become major players in the organization's decision-making process.

Institute for Supply Management
A professional association with a mission to provide national and international leadership in purchasing and material management, particularly in the areas of education, research, and standards of excellence. Membership is individual, not institutional, with local affiliates in Southwest Michigan and Central Michigan. See http://www.ism.ws.

The **Institute for Supply Management** offers two professional certifications. They are the Certified Professional in Supply Management (CPSM) and the Certified Professional in Supplier Diversity (CPSD). The knowledge base for CPSM focuses on effective decision-making in an integrated supply management operating environment. Specifically, the knowledge base includes financial analysis, strategic sourcing, and international regulations. More than 20,000 professionals have been certified as CPSMs. The CPSD was established in 2010. The primary purpose of the CPSD is to show that the organization is committed to diversity throughout the company's supply chain. The 2019 ISM salary survey shows that the average salary for the CPSM credential was $119,551, and the average salary for the CPSD credential was $125,596, compared to $114,348 for those with no certification. A summary of the two professional credentials is given in Table 1.2.

Careers in Purchasing

Now is the best time for the next generation of managers to pursue a career in purchasing and supply management. Supply management professionals must possess a diverse skill set. First, the successful supply manager must have excellent technology, people, and negotiations skills in order to add value to his or her organization. Supply professionals must also be

TABLE 1.2
A Snapshot of Requirements for ISM's Professional Credentials

	CPSM		CPSD	
Education requirement	Bachelor's degree from a regionally accredited institution or international equivalent	No degree	Bachelor's degree from a regionally accredited institution or international equivalent	No degree
Experience requirement	Three years of full-time, professional supply management experience (nonclerical and nonsupport)	Five years of full-time, professional supply management experience (nonclerical and nonsupport)	Three years of full-time, professional supply management experience (nonclerical and nonsupport)	Five years of full-time, professional supply management experience (nonclerical and nonsupport)
Testing requirement	Pass three exams: "Supply Management Core," "Supply Management Integration," and "Leadership and Transformation in Supply Management"		Pass two exams: "Supply Management Core" and "Essentials in Supplier Diversity"	

analytical problem solvers. In today's global business arena, supply management professionals must be able to interact with potential sources of materials and services throughout the world.

The average salary for a supply management professional is $119,271. One of the major factors affecting salary and professional achievement continues to be education. Those with a bachelor's degree earned an average of $108,065, while the average for those with a master's degree was $139,476. Professional certifications from ISM are also associated with higher wages, as is work experience.

An increasing number of supply management professionals are earning salaries that exceed $100,000. More than half of the respondents to a 2019 ISM salary survey reported earning a six-figure salary. The median salary was $102,352, while the top 5% of earners received an average of $340,956. Entry-level (less than 5 years) supply management professionals reported an average of $74,162. The purchasing and supply management salary drivers are job title, experience, education, credentials, annual spend, gender, and size of the organization. A summary of the results of the 2019 ISM salary survey is shown in Table 1.3.

For a more comprehensive discussion of purchasing and supply management career opportunities, see www.ism.ws/CareerCenter.

The Institute for Supply Management: J. Shipman Gold Medal Award

Johnson Shipman was a pioneer member of the New York affiliate of the National Association of Purchasing Agents, now Institute for Supply Management, well-known for giving liberally of his time and counsel. The J. Shipman Gold Medal Award was created in 1931 and is presented to those individuals whose modest, unselfish, sincere, and persistent efforts have aided the advancement of the procurement and supply chain management field. Those chosen for the award have also assisted and guided members of the profession in their endeavor. Each year the ISM recognizes a procurement leader that exhibits achievements within the supply management profession.

On April 19, 2019, the Institute for Supply Management named Thomas K. Linton, chief procurement and supply chain officer at Flex, the 2019 J. Shipman Gold Medal Award winner in recognition of his distinguished service for the cause and advancement of the supply management profession.

Linton was honored during the 2019 Shipman Award ceremony at ISM2019, ISM's annual international supply management conference, taking place April 7–10 in Houston,

TABLE 1.3
Summary of Salary From 2019 ISM Survey

	2019 Salary Survey
Overall average for supply management professionals	$119,271
Average for those with 4 or fewer years of experience	$74,162
Average for those with a bachelor's degree	$108,065
Average for those with CPSM certification	$119,551
Average for those with a master's degree	$139,476

Source: Institute for Supply Management.

Texas. "Tom Linton is an inspiring leader at the pinnacle of his career," said ISM CEO Tom Derry. "He has made a lasting impact in giving back to the profession and in driving transformational change through his leadership that spans the globe."

In Linton's 37-year career in procurement and supply chain, four times as chief procurement officer (CPO) over the last 16 years, he has earned the reputation as a visionary leader. Since joining Flex in 2011 after CPO roles at LG Electronics in Seoul, South Korea, as well as previous CPO roles at Freescale Semiconductor, and Agere Systems, he is now responsible for serving automotive, industrial, consumer, networking, energy, medical, and telco industries with more than US$1B spend in each.

In a US$25B global supply chain solutions company, he oversees execution of supply chain management, sourcing (direct and indirect), materials operations, logistics, and systems transformation. He assists in managing 9,000 employees in 30 countries and more than 100 factories and is a force for innovation and technological advancement. For example, he established an industry-leading real-time information platform called Flex Pulse, which drives asset velocity with supply chain visibility.

In his current and prior roles at Flex and LG, respectively, he implemented corporate-wide procurement policies that fundamentally improved their way of doing business while enhancing and driving all sourcing decisions into and through the procurement organization.

Tom leads with the objective to "drive the business, before the business drives you." This philosophy has led to a career of innovations that drive cost savings, business process innovations, and the enhancement of the business reputation of the places he has worked. This has included a rigorous adherence to a code of ethics.

"It is an honor to be named as this year's winner of the J. Shipman Gold Medal," said Tom Linton, chief procurement and supply chain officer at Flex. "Over its 87-year history, the J. Shipman award has recognized many of the leaders and innovators in the supply chain and purchasing field, and I'm humbled to be included in their ranks."

Beyond his full-time professional endeavors, Linton's passion for procurement leads to extensive volunteering to help develop the industry. His ISM contributions include terms on the ISM global board of directors, including as chairman of the board (2013–2015), in addition to serving on multiple ISM committees, undertaking speaking engagements, serving as an R. Gene Richter Scholarship executive mentor, and volunteering as a member and leader in numerous other professional organizations.

SUMMARY

LO 1.1 Identify the role of the purchasing manager, buyer, and purchasing agent in an organization.

Purchasing managers, buyers, and purchasing agents seek to obtain the highest-quality merchandise at the lowest possible purchase cost for their organization. In general, purchasing managers, purchasing agents, and buyers determine which commodities or services are best for the specific requirement, choose the suppliers of the product or service, negotiate the lowest price, and award contracts that ensure the correct amount of the product or service is received at the appropriate time. To accomplish these tasks successfully, purchasing managers, buyers, and purchasing agents identify foreign and domestic suppliers. Purchasing managers, buyers, and agents must become experts on the services, materials, and products they purchase.

LO 1.2 Describe the evolution of the purchasing and supply management function as organizations

To become a competitive organization in today's global economy, the purchasing and supply management function must become world class. The supply management function is the key to unlocking the value within the organization. Organizations must optimize sourcing assets. The purchasing process involves leveraging through volume discounts. It can easily lead to significant reductions in the total purchasing costs. The organizations that produce excellence are those that continuously improve. In general, the purchasing and supply management function has evolved from a pure cost management function to a competitive advantage.

LO 1.3 Explain the relationship between the purchasing function and inventory, ordering, and transportation costs.

Supply management exists to explore business opportunities and implement supply strategies that deliver the most value possible to the organization, its suppliers, and its customers. Strategic supply management is the organization's primary source for collecting market intelligence and developing cost-reduction programs.

The mission of a successful organization's supply management process is to manage purchasing, planning, scheduling, and the transportation of material required for specific products in a manner that will provide a *significant competitive advantage* to the organization in the production of quality products or services. Integrative purchasing and supply management make possible production of goods and services in terms of cost and quality that are competitive in the world.

LO 1.4 Explain the purchasing function's contribution to profitability.

There are many opportunities to reduce the cost of purchases. If the firm's sales remained the same but materials costs decreased, the effect would be an increase on profit. For each $1 reduction of material cost, there would be a $1 increase in profit. The ratio is 1:1.

LO 1.5 Identify the relationship between the purchasing function and other functional areas.

Achieving an integrative purchasing model (IPM) is a challenge. In firms with conventionally organized subfunctions, supply managers are primarily concerned with satisfying their own subfunctional objective. Purchasing managers minimize purchasing costs; marketing managers minimize distribution costs; and so on. These objectives are local, not systemwide. The decision of the purchasing manager affects not only the purchasing function but other materials functions. It is the objective of IPM to manage the related considerations. Purchasing should consider the nonpurchasing consequences of its decisions.

LO 1.6 Identify the advantages and disadvantages of various purchasing organizational designs.

Supply coordination involves both structure and design of the organization. Purchasing organizational *structure* is the sum total of the ways in which an organization divides its labor into distinct tasks and then coordinates among them. Organizational *design* is concerned with bringing together a group of interrelated tasks for a common goal. However, organization design alone does not ensure effectiveness or efficiency. Most companies' organizational charts do not reflect true lines of authority and responsibility that flow through managers. Too much detail can lead to micromanagement. On the other hand, a loosely designed organizational structure can lead to a greater risk.

The outlook is that the majority of significant dollar-valued purchases will continue to be centralized. This trend also will be the result of increased computer-based management information systems. As firms become lean, centralized purchasing will become a major focus. Long-term agreements will be more frequently negotiated to stabilize prices. Honda of America is an excellent example of a firm that uses centralized procurement as a competitive weapon.

LO 1.7 Describe the reporting structures common in the purchasing profession.

Given the strategic nature of the supply function, the top supply management professional is usually a member of the organization's senior management team. In this leadership role, supply management professionals must be knowledgeable and understand all areas of the business in order to develop strategies consistent with the organization's goals and successful business procedures.

LO 1.8 Identify careers in purchasing and supply management.

As supply chains continue to grow globally, and as products become more complex, the supply chain professional must become more sophisticated. Supply management professionals across all industry sectors must become major players in the organization's decision-making process.

The Institute for Supply Management offers two professional certifications. They are the Certified Professional in Supply Management (CPSM) and the Certified Professional in Supplier Diversity (CPSD). The knowledge base for CPSM focuses on effective decision-making in an integrated supply management operating environment.

KEY TERMS

Buyers 4
Centralized purchasing 15
Cost of goods sold 9
Decentralized purchasing 15
Institute for Supply Management 20
Integrative materials management 7
Purchasing agents 4
Purchasing managers 4
Supply management 7

DISCUSSION QUESTIONS

1. Compare the two unique types of purchasing categories in the business world.
2. The purchasing function can easily make a contribution to profitability. Please discuss this statement. What is the profit leverage effect of purchasing?
3. What is meant by "integrative materials management"?
4. What is meant by "supply management"?
5. Describe how purchasing interacts with other functional areas of the firm.
6. Discuss the issue of centralization versus decentralization as it applies to the purchasing function. What are the advantages of centralized purchasing organizations? What are the disadvantages of centralized purchasing?
7. Discuss the specific objectives of purchasing and supply management. Relate these to (1) the automobile industry, (2) a hospital, and (3) a pizza shop.
8. What are some careers in purchasing?
9. What are the most well-known professional purchasing associations?

SUGGESTED CASES

Case 5: BSD at 777-Holdings
Case 13: GRC Systems, Inc.
Case 28: Tom & Jerry (T&J) Construction, Inc.

Purchasing Decisions and Business Strategy

2

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National Medico has been a manufacturer of quality, low-cost blood pressure monitors since 2010. The company has based its business strategy on automation, fast delivery, and reliable service. National is one of the first low-cost monitor manufacturers still producing and selling blood pressure monitors in the United States. Competition, especially from China, has made this an increasingly difficult business. The manufacturing process is highly dependent on timely delivery, low cost, and high-quality materials as a means of staying competitive. In the third quarter of 2019 there was a drop in sales due largely to the cost of plastic components increasing. What decisions might the management at National Medico be facing as they strategically plan for the upcoming year? How should Medico plan for their 5 year strategic plan?

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

2.1 Explain the relationship between purchasing and competitive strategy.

2.2 Describe the impact of competitive strategy and purchasing strategy on the supply chain and supplier relationships.

2.3 Discuss the competitive ranking system used to control quality relationships between suppliers and buyers.

2.4 State the decision-making factors that impact a buying decision.

2.5 Demonstrate how to develop a strategic sourcing plan.

2.6 Identify the continuing trends of purchasing and supply chain management.

INTRODUCTION

Purchasing can play a significant role in making a firm competitive. Purchased inputs constitute a large portion of the company's resources. In most industrial firms, materials constitute 60% to 80% of total revenue. Purchased inputs offer a potential source for helping a company develop leverage against its competitors. Purchasing actions designed to reinforce the firm's competitive priorities can give the firm advantages over its competitors. In essence, firms must design their purchasing actions to emphasize the competitive strategy.

In this chapter, a framework for linking purchasing decisions with the firm's competitive strategy is presented. Alternate purchasing strategies can be formulated by selecting a unique combination of purchasing actions. The framework in Table 2.1 offers a systematic approach for designing purchasing strategies consistent with a firm's competitive strategy. As can be seen in Table 2.1, an effective purchasing framework includes four important decision areas: (1) supply management, (2) buying, (3) supplier development, and (4) the scope of manufacturing.

TABLE 2.1
Purchasing Strategy Framework

Decision Areas	Decisions	Alternatives
Supply management	Number Location	Single or multiple source
	Size	Close or geographically dispersed
	Managerial expertise	Small versus large
	Financial health	High or low
	Amount of purchase	Restrict to a certain percentage of supplier's output or no constraint
	Engineering	Developmental versus experienced supplier
	Length of contract	Long term (annual or larger) or short term
	Relationship	Strategic versus commodity focused
	Extent of computerization	Manual versus information systems
	Extent of communication	Share production plan versus nonsharing (integration)
	Value engineering	Active program versus no program
Buying	Criteria	Cost, quality, delivery or lead time, perceived reliability or reputation
	Purchasing scale	Economies of scale (cost/volume) or economies of scope (joint replenishment)
	Ordering policy	Integrated with supplier information system or nonintegration
Supplier development	New product or development	Develop supplier or look for new substitute product sources
Scope of manufacturing activity	Degree of integration	Make versus buy, outsourcing

Some of the tactical tools used for implementation of the strategic framework include total cost ownership (TCO) and SWOT analysis. This chapter also shows how decision-makers can operationalize the linkages between competitive strategy and purchasing decisions.

THE RELATIONSHIP BETWEEN PURCHASING AND COMPETITIVE STRATEGY

LO 2.1 Explain the relationship between purchasing and competitive strategy.

In today's turbulent supply markets, purchasing professionals are expected to develop options that can help business units remain competitive. In doing so, purchasing managers need to devise purchasing actions such that they are consistent with each other and with the firm's **competitive strategy**. The framework for purchasing strategy given in Table 2.1 proposes a way of linking the competitive strategy with the purchasing policy. The components and linkages for purchasing strategy are given in Figure 2.1.

Competitive strategy The plan created to implement a company's unique advantages over competitors in a specific industry.

The purchasing decisions or actions that constitute purchasing strategy are determined by the firm's competitive priorities, its resource capabilities, and the environment. In the formulation of purchasing strategy, the organization's competitive priorities, the organization's strengths and weaknesses, and the competitive environment must be considered.

Competitive Strategy

A firm can compete in two broad alternate ways. It can either seek competitive advantages on cost or choose to differentiate itself from its competitors on some attributes of the product

FIGURE 2.1
Components of Purchasing Strategy

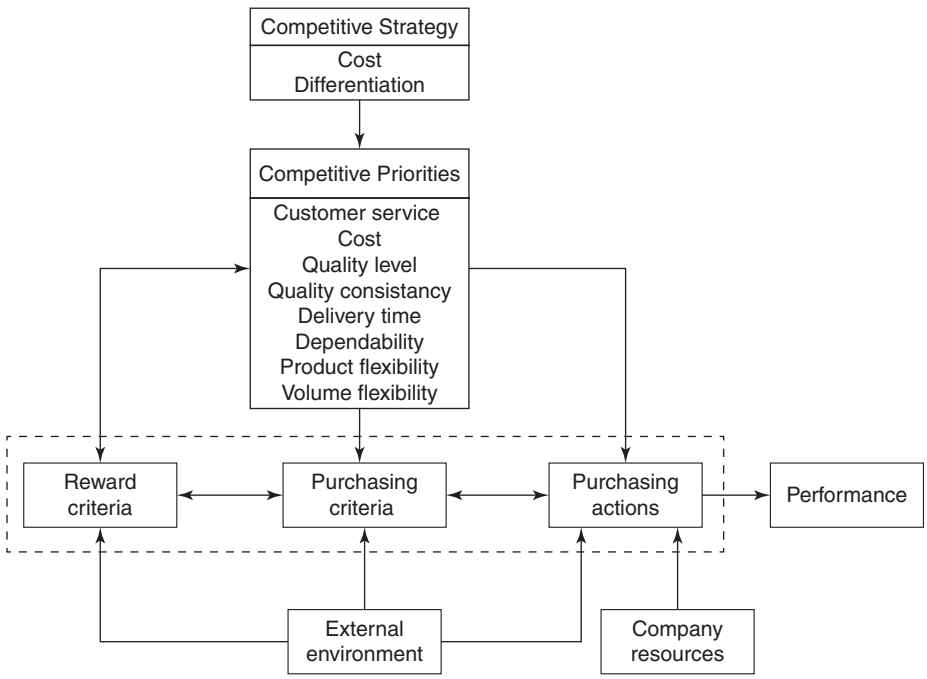


TABLE 2.2
Cost and Differentiation Strategies

	Cost	Differentiation
Purchasing criteria	Low cost/unit Consistent quality Short lead time Dependable delivery	High quality Short lead time Dependable delivery Unit cost based on freight rates
Bargaining basis supplier	Economies of scale	Economies of scope
Number of suppliers	Multiple suppliers	One or few suppliers
Supplier size	Suppliers with moderate/ large capacities	Suppliers with moderate/ small capacities

or in the way it markets its product (see Table 2.2). The notion of two generic competitive advantages—cost and differentiation—is important but too broad to be useful for management faced with day-to-day decision-making. The competitive strategy is articulated in terms of competitive priorities. Key environmental factors also must be considered.

As an example, low-cost strategies generally imply more product standardization, less flexibility in responding to customer demands, fewer options, acceptable quality, and continuous process technology. A low-cost strategy is mostly concerned with market penetration with a high-volume, low-cost product. On the other hand, a product differentiation strategy is concerned with providing the customer with more selection, which implies higher costs and prices. The higher costs are a result of higher material costs and skilled labor costs. The higher service levels expected also lead to increased finished goods inventories.

Competitive Priorities

Competitive priority A key determinant of the importance given to different criteria in purchasing material.

Purchasing criteria Price, quality, and delivery speed.

Reward criteria Determine how closely the objectives are met.

Competitive priorities are one means of articulating a firm's competitive strategy. The **competitive priority** is a key determinant of the importance given to different criteria in purchasing material. However, the **purchasing criteria** also are influenced by individual buyer performance and reward criteria. The competitive priorities define the intended or desired purchase criteria, and the **reward criteria** determine how closely the objectives are met.

The competitive priorities operationalize the firm's competitive strategy. The two generic competitive advantages—delivery speed and reliability—are operationalized in terms of cost, quality level, quality consistency, delivery time, dependability, product flexibility, volume flexibility, and customer service. By assigning priorities to these dimensions, the firm operationalizes its strategy. The priorities can then be used to generate alternatives consistent with the firm's competitive strategy. A company competing on cost should drive the overall costs down. On the other hand, a firm competing on differentiation must devise its actions to enhance its uniqueness on quality, flexibility, customer service, or any combination of the three. Expertise and understanding of the buying organization to cost differentiation and environmental factors usually lead to a competitive advantage.

Purchasing Criteria and Purchasing Actions

The criteria in buying material must reflect the firm's competitive priorities. A firm competing on cost must give high priority to purchasing costs. A firm competing on flexibility must give high priority to lead time in buying material. With short lead times, the company can be more flexible; it can develop the ability to respond to changing situations quickly. Lead times are also important in achieving superior customer service. Suppliers with short lead times and who are reliable in meeting their due dates minimize the problem of material shortages for the manufacturer; as a result, the company's production can be more dependable in meeting the customers' due dates. A company emphasizing customer service will need to carry more inventory to buffer against uncertainties, if the supplier is unreliable. Inventory is an expensive alternative. Purchasing decision-makers must consider the firm's competitive priorities in choosing the criteria on which the material is purchased. The impact of purchasing/manufacturing on inventory is given in Table 2.3.

The criteria on which the buyer's performance is evaluated can influence the effectiveness of purchasing actions and effectiveness in making the firm competitive. Cost variance seems to be the dominant criterion in evaluating performance of purchasing decision-makers. This emphasis on cost can drive purchasing decision-makers to take actions that keep material costs low, but other criteria may be neglected, and the purchasing actions may end up being inconsistent with the competitive strategy.

Reward Criteria

The reward criteria determine the firm's actual priorities. The closer the reward criteria reflect the performance on the competitive priorities, the narrower the gap will be between intended and realized objectives. If reward criteria emphasize cost, purchasing decision-makers will emphasize cost in making decisions, irrespective of the competitive priority.

TABLE 2.3
Purchasing Strategy and Inventory Investment

Inventory Classification	Raw Materials and Parts	Work in Process	Finished Goods	Spare Parts
STRATEGY				
Low cost make-to-stock	Low	Low	Medium	Low
Narrow product line make-to-stock	Low	Low	Medium	Medium
Wide product line make-to-stock	Medium/High	Medium	Medium	High
Rapid customer response with customized product	High	Low	None	Low
Level production for seasonal demand	Low	Low	High/Low	High/Low
Quick spare parts response	Low	Low	__	High

FIGURE 2.2
Environmental Factors

Environmental Factors
1. Inflation rate
2. Monetary policy
3. Fiscal policies
4. Technological development
5. Industry capacity
6. Market growth
7. Global stability
8. Cultural differences
9. Recently implemented trade policies

External Environment

For suppliers in emerging economies, recent environmental factors are altering the competitive landscape (see Figure 2.2). First, many manufacturers in advanced economies are reevaluating their global outsourcing relationships due to the hidden costs of outsourcing, such as intellectual property (IP) theft and quality problems. Second, as the ability to innovate within a supply chain is becoming increasingly more important, many firms in emerging economies are attempting to shift from a cost focus to an innovation focus.

SUPPLY CHAIN STRATEGY

LO 2.2 Describe the impact of competitive strategy and purchasing strategy on the supply chain and supplier relationships.

As competitive forces increase, customers demand better products, faster delivery, increased service, and decreased costs. As firms become more competitive, a rippling effect is experienced by the suppliers. As a result of increased competition, deregulation, and relaxed antitrust requirements, the supplier partnership concept has emerged as a competitive weapon. Other secondary reasons for partnerships are the increased use of electronic data interchange (EDI) and just-in-time (JIT) manufacturing. In theory, the newly developed "partnership concept" is adequate; however, in practice, partnerships may result in one-way power moves. One partner usually gains the flexibility and efficiency of quickly responding to the changing marketplace; the weaker partner is left with higher inventories and unstable schedules. As inventory levels are reduced throughout the supply chain, each member becomes less insulated from demand variation. As defined by Maloni and Benton (2000),

> Power may be defined as the ability of one firm (the *source*) to influence the intentions and actions of another firm (the *target*). The power of a supply chain member [is] the ability to control the decision variables in the supply strategy of another

member in a given chain at a different level of the supply chain. It should be different from the influenced member's original level of control over their own supply strategy. (p. 53)

Thus, supplier partnerships are not always beneficial for both buyer and seller. These new supplier–customer relationships require trust and commitment by both parties, which is in direct contrast to their historical relationships that have been far from cooperative. Traditional purchasing attitudes have always encouraged arm's-length relationships with price as the dominant buying factor. Today, supplier partnerships look for a more cooperative attitude between parties. Companies participate in a variety of supplier relationships and take on a variety of roles. Each company can be a supplier, customer, or end user of products. As presented in Table 2.4, supplier partnerships can be categorized using four factors: (1) degree of risk/reward, (2) information, (3) planning, and (4) asset ownership.

The characteristics of buyer–seller relationships exist on a continuum beginning with the traditional approach of *open market*, with a single short-term contract that presents minimal risk to both parties. The opposite extreme is *vertical integration*, where the parties are fully integrated as one unit. *Partnerships* are a hybrid of these extremes with each party retaining an individual identity. A long-term relationship provides the ability to share assets and information and integrate planning, technology, and processes. In theory, partnership members equally share risks and rewards.

Since supplier–customer relationships have historically been categorized by open-market characteristics, this often-adversarial relationship may be difficult to circumvent when developing a partnership. The movement from one extreme to another requires great trust and cooperation of the parties. This comfort level can be more easily obtained by understanding the dynamics of the relationship, being aware of the inherent risks and benefits to each party, and safeguarding the individual partners from undue burdens or compensation. Example 2.1 provides a real-world example.

TABLE 2.4
Major Characteristics of Industrial Buyer–Seller Relationships

Factor	Open Market	Partnership	Vertical Integration
Degree of risk/reward relationship	Minimize risk, maximize rewards, Single contract between firms	Manage/share Risk and reward Multiple contracts/levels	Absorb or manage risk and reward internally Multiple contract levels
Information	Limited only as needed for transaction	As required for planned output, processes, and technology	Fully integrated
Planning	Short-term transaction	Long-term, ongoing	Long-term, ongoing
Asset ownership	Completely separate	May be shared, with some financial commitment	Fully owned

Source: Ellram, Lisa M. "Life Cycle Patterns in Industrial Buyer Seller Partnerships."International Journal of Physical Distribution and Logistics Management 21, no. 9 (1991), pp. 12–21.

Example 2.1

A PARTNERSHIP

PPG Industries established what came to be known as "Supply City" in Lake Charles, Louisiana, next to its chemical plant. This complex consists of nine noncompeting suppliers who supply the plant on a just-in-time (JIT) basis with high-use maintenance, repair, and operating (MRO) inventory items.

Before Supply City, the Lake Charles facility operated a warehouse for spare parts and MRO items. This warehouse was linked throughout the plant by computers with item users. Users would order supplies needed through the computer. Orders were printed out in the warehouse and stock pickers would pick the material, load it onto a truck, and deliver it on a prescheduled basis throughout the plant. This system operated effectively; however, operating cost and inventory levels were high. To reduce costs and lower inventory levels, the Supply City idea was executed. This new system would set up a supplier stocking program and establish a supplier complex in one location next to the Lake Charles plant.

Supply City is an industrial park created by PPG next to the Lake Charles chemical plant. The suppliers in the facility signed 5-year agreements ensuring continuity of supply and minimum levels of performance. PPG's side of the contract outlines commodity groups for each supplier, stock levels, pricing, and delivery schedules. These contracts ensure a full scope of commitment from both sides while guaranteeing sales volumes for each supplier.

The Supply City stocking program operates within the existing plant stock-picking warehousing systems. Each supplier is connected to the plant computer system. When plant personnel place an order for an item supplied from Supply City, the order is printed out in the supplier's office instead of the plant warehouse. The supplying firm then retrieves the item and places it on the dock to be delivered to the plant with the next scheduled shipment. The item is then delivered to the plant receiving dock and is immediately transferred to the end user. This system eliminates duplicate stock storage and handling from middleman stock pickers. Each supplier is paid electronically every two weeks, eliminating invoicing.

In the first two years of operation, Supply City allowed the Lake Charles plant to eliminate 45% to 50% of its plant inventory, resulting in a savings of $3 million. Stockouts were reduced to 3%. In addition, administrative costs were reduced through elimination of POs and invoices, procurement time was reduced, quality was improved through the reduction of suppliers, and the proximity of technical personnel improved supplier technical and material application support. These savings and improvements can be transferred directly to PPG customers in the form of improved product quality, reduced cycle time to market allowing for quick adjustment to customer demands, and reduced costs for the final products.

SUPPLIER RELATIONSHIP QUALITY (SRQ)

LO 2.3 Discuss the competitive ranking system used to control quality relationships between suppliers and buyers.

Supplier relationship quality indexing (SRQ) A methodology that may provide the manufacturer with the information needed to make the hard decisions about balancing the needs of the buying organization and the needs of the supply chain itself.

Supplier relationship quality indexing (SRQ) is a methodology that may provide the manufacturer with the information needed to make the hard decisions about balancing the needs of the buying organization and the needs of the supply chain itself. The ultimate customer's expectations of performance may not be consistent with the manufacturer's or supplier's expectations. The customer is interested in cost, quality, satisfaction, service, and delivery performance. The customer will engage competing manufacturers and supply chains if their expectations are not met. On the other hand, supplying firms may be just as critical for the manufacturer's survival as the ultimate customer. There is a trend toward outsourcing a larger share of the sales dollars to suppliers. Thus, it is not easy to replace a strategic supplier. In a

supply chain environment, changing suppliers can have an adverse effect on the value creation process. More importantly, the supplier may choose to service manufacturer B and sever the relationship with manufacturer A (see Figure 2.3). The change in suppliers could easily have a negative impact on the desires and expectations of the ultimate customer. As shown in Figure 2.3, in a supply chain environment, the manufacturer is the suppliers' customer.

Because of the increasing importance of supplier relationship management, many buying firms are implementing supplier relationship management strategies in their business plans to ensure they maintain their competitive edge. This is especially true in an oligopolistic environment where supplying firms are members of competing supply chain networks. This supply chain relationship disparity is the motivation for the current supplier relationship quality (SRQ) indexing. SRQ indexing seeks to assess the supplier–buyer relationship from the supplier's point of view. Specifically, SRQ indexing is concerned with the extent to which cooperation, trust, commitment, satisfaction, and performance expectations influence the relationship between supplying and buying firms competing in the same industry. Critical issues addressed by SRQ indexing will provide the purchasing manager with answers to the following questions:

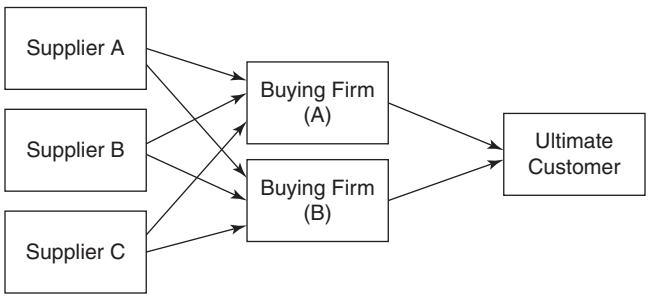
- How does commitment influence the SRQ index of the supplier–buyer relationship?
- How does trust influence the SRQ index of the supplier–buyer relationship?
- How does cooperation influence the SRQ index of the supplier–buyer relationship?
- How does satisfaction influence the SRQ index of the supplier–buyer relationship?
- How does performance influence the SRQ index of the supplier–buyer relationship?

The supplier relationship quality (SRQ) concept focuses on strategically planning for and managing the perceived quality of the buyer–seller relationship to maximize value and minimize the risk of those interactions.

The Evolution of Supplier Relationships in the Automobile Industry

In the early 1900s, automobile manufacturers transformed the entire manufacturing industry from a craft orientation to mass manufacturing. Half a century later, the same industry revolutionized manufacturing again, steering manufacturing from mass production to lean production. Now these same producers offer the next revolution, e-manufacturing.

FIGURE 2.3
Typical Supply Chain Network



These automotive giants were not the first to embrace the information economy. However, over the past several years, they have contributed to its development. This development has experienced difficulties and roadblocks at every stage. Nevertheless, the automobile industry can be a leading indicator of what lies ahead for the application of networking and information technology to manufacturing and supply chain management.

In 1999, General Motors, Ford, and Chrysler joined together in a venture that attempted to take advantage of the promises of e-manufacturing. The venture was given the name Covisint (COmmunication VISion INTegration). This online marketplace was expected to connect more than 35,000 suppliers, partners, and manufacturers worldwide in a virtual market that would process over $300 billion worth of transactions annually. Covisint, as it was originally envisioned, did not work for at least two reasons:

1. A majority of the suppliers were skeptical and did not sign up.
2. The manufacturers themselves did not appear to trust sharing information among themselves.

A result of the major automakers sharing the same supply chain is the creation of a "free-rider" situation in which the automakers lack the incentives to invest adequately in their supply bases. That is, if an automaker helps its suppliers develop a new technology (such as Covisint), the supplier's other customers will enjoy the same improvements without having contributed.

However, with the increase in globalization, driven in part by IT, competition has increased at accelerated rates. Increased competition has led to firms focusing more on their core competencies and less and less on vertical integration. This focus has led to increased specialization within the firm, which drives the need for firms to outsource more of their noncore functions. The result is that a firm must build more collaborative business relationships with constituencies beyond its formal boundaries. Moreover, tightly integrated sharing of information facilitates these relationships. As competition increases, the range of integration expands and the need to manage information becomes increasingly critical. The rise of MRP, MRP2, CRM, SRM, and ERP is evidence of the need for information sharing and the fact that e-manufacturing is becoming a reality.

Five automobile manufacturers (Chrysler, Ford, General Motors, Honda, and Toyota) participated in a research project. Telephone interviews were conducted with Ford and Toyota. Field visits were conducted with General Motors, Chrysler, and Honda at their facilities. The manufacturer meetings, as well as other industry research, showed that the manufacturers had achieved different levels of success in implementing supply chain management. Some manufacturers, such as Chrysler and Honda, were already capitalizing on integrated supply relationships in order to gain competitive advantage in the industry. Others, like General Motors, still struggle, however, to implement effective supply chain integration strategies. Given this disparity, the SRQ indexing methodology was implemented (see appendix).

The automobile industry is used to set the stage for the SRQ indexing methodology. The import of high-quality, fuel-efficient, and competitively priced automobiles from Japan in the 1970s and 1980s forced American automobile manufacturers to become more competitive or go out of business. Subsequently, one critical success factor in the industry has proved to be effective supplier partnering. Furthermore, the industry retains a fertile climate for technological integration.

Table 2.5 shows the relative state of competition in the U.S. automobile industry. One impression is that relatively few manufacturers account for most of the automobile production for the U.S. market. The Big Three, along with the three Japanese transplant manufacturers (Toyota, Honda, and Nissan) sell more than 75% of new automobiles in the U.S. market. Given the high price of automobiles and the fact that over 17.2 million vehicles were sold in the United States in 2018, a tremendous amount of revenue is associated with just six manufacturers. This indicates a significant supply chain power advantage in favor of the automobile manufacturers because they are an oligopoly.

Given the market share of the larger automobile manufacturers, there are many critical industry-wide issues that affect supply chain processes in the United States. This has implications for manufacturer–supplier integration. First, both the U.S. and Japanese transplant firms are attempting to use supply chain management as a source of competitive advantage within the industry. Effective supply chain management involves the coordination of suppliers and manufacturers to decrease costs, increase quality, and accept more product design responsibilities.

In the management of an effective and coordinated supply chain relationship between suppliers and manufacturers, there must be a way to assess what constitutes success from the suppliers' and buyers' vantage points. The suppliers' perception is important despite the

TABLE 2.5
Cumulative Market Share of Automobile Manufacturers in 2018

Manufacturer	Vehicles Sold in the U.S. Market	Percentage of Total	Cumulative Percentage
GM	2,954,037	17.1%	17.1%
Ford	2,485,222	14.4%	31.5%
Toyota	2,426,672	14.0%	45.5%
Fiat Chrysler	2,235,204	12.9%	58.5%
Honda	1,604,828	9.3%	67.8%
Nissan	1,493,877	8.6%	76.4%
Subaru	680,135	3.9%	80.4%
Hyundai	677,946	3.9%	84.3%
Kia	589,673	3.4%	87.7%
Mercedes	354,144	2.1%	89.7%
VW	354,064	2.0%	91.8%
BMW	311,014	1.8%	93.6%
Mazda	300,325	1.7%	95.3%
Audi	223,323	1.3%	96.6%
Tesla	191,627	1.1%	97.7%
Mitsubishi	118,074	0.7%	98.4%
Other	274,085	1.6%	100.0%
Total	17,274,250	100.0%	100.0%

Sources: Mark lines, the *Wall Street Journal*, Tesla; January 4, 2019.

relative difference in power between supply chain partners. One way to assess how suppliers view success is to peg the supply chain relationship on the appropriate criteria.

A Practical Example of the Use of SRQ Indexing

On March 31, 2012, there was a fatal explosion at a chemical plant in Germany. That plant was responsible for producing roughly half of the world's supply of a chemical used to produce a specific plastic resin—Nylon-12—critical in fuel lines and other auto parts. The chemical plant was expected to take more than 6 months to repair the damage and resume full production. This meant the world's automakers were suddenly facing a crisis that threatened to slow vehicle production around the world.

When it became clear that the whole industry was affected, more than 200 auto executives met in Detroit to deal with the looming parts shortage. Each was assigned a task, such as finding a replacement material or identifying new firms to produce it. Chemical manufacturers assembled teams to work with the automakers on increasing production of replacement materials. Ultimately, the industry's teamwork paid off, and they managed to get other companies to make the chemical. This is an excellent example of the importance of the concept of supplier relationship quality (SRQ).

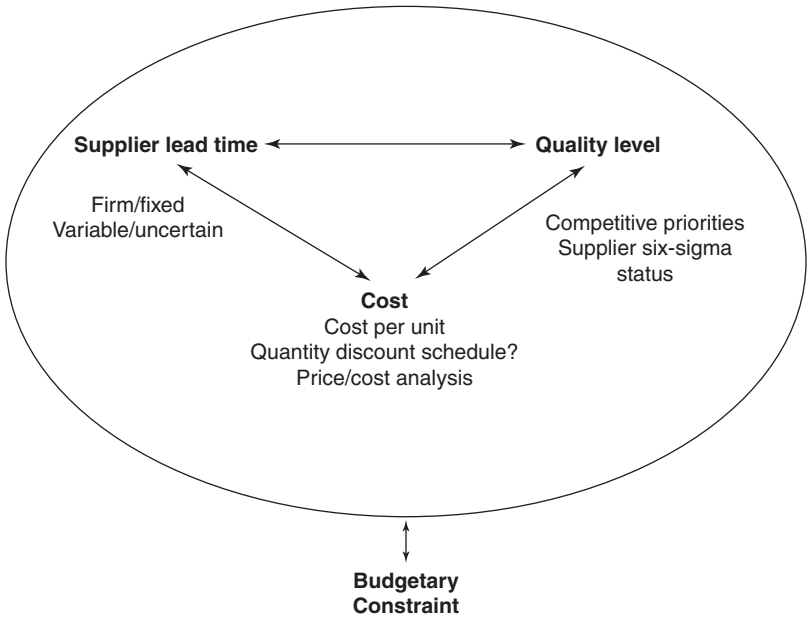
THE INTEGRATED BUYING MODEL

LO 2.4 State the decision-making factors that impact a buying decision.

Integrated buying model A model used by the buyer organization in making purchasing decisions; buying the right material at an acceptable cost and quality level within a reasonable lead time.

The **integrated buying model** is shown in Figure 2.4. The decision-maker faces multiple goals in making the buying decision. The cost per unit, quality, and lead time are some of the issues a decision-maker faces in making the buying decision.

FIGURE 2.4
Integrated Buying Model



In most cases, the purchasing decision calls for buying the right material as specified at an acceptable cost and quality level within a reasonable lead time. The acceptable levels will vary depending on the firm's competitive position. The decision-maker has to contend not only with multiple goals but also with several constraints. Firms often have limited resources. Inventory budgets may be limited, or storage space may constrain the quantity that may be purchased at any instant. The multiple goals must be satisfied within the constraints.

Cost

The cost per unit of material depends on the volume or amount purchased, the quality level desired, and the desired lead time. Material procured in larger volume enables the firm to buy at discounts. The discounts drive down the material cost. Higher quality level expressed in terms of lower defect rate usually pushes the purchase price higher. Since the supplier ensures higher quality by absorbing or preventing more defects, it usually charges a premium. To procure material at less-than-normal lead times, a premium price may have to be paid by the buyer. Thus, cost per unit is composed of material volume, quality level, and response time.

Quality Level

The quality level of material purchased must meet the desired objective as defined by the firm's competitive priorities. The lower the acceptable defect rate, the higher the quality level of the material purchased. A firm emphasizing quality may give more importance to achieving quality goals than cost objectives. Six sigma is a way to measure supplier quality (see Chapter 12 for a more detailed discussion). Supplying firms that follow the core philosophy of six sigma will make excellent strategic partners. Six-sigma suppliers focus on (1) defects per million units as a standard metric, (2) provision of extensive employee training, and (3) the reduction of non-value-added activities.

Supplier Lead Time

Supplier lead time affects a firm's flexibility and service to its own customers. Firms that compete in volatile markets and face rapidly changing product or technology require greater flexibility than firms competing in stable markets. With short lead times, the company can be responsive to external changes. In these circumstances, firms may desire to pay a premium for quick delivery to maintain their competitive edge. The more uncertainty there is in a supplier's lead times, the more difficult it is to manage the production process.

Budgetary Constraints

A buyer must not only satisfy cost, quality, and lead-time goals but also stay within quantity and budgetary constraints. The buyer must ensure that the right quantity of material is purchased to satisfy the demand; otherwise, shortages may occur, resulting in poor customer service. The budget limitations may constrain the amount of material that can be purchased at any instant. The buyer may have to give up quantity discounts if the storage or budget resource is not available.

THE STRATEGIC SOURCING PLAN

LO 2.5 Demonstrate how to develop a strategic sourcing plan.

A number of important challenges face supply managers and executives in the future. Perhaps the most significant changes will occur in the purchasing area. More and more firms will be competing for limited supplies of materials. At the same time, stockholders will demand more profitability. In addition, the internationalization of supply markets, manufacturing, and market segments will bring the purchasing function into clear focus. The opportunities, if pursued, will be unlimited; if not pursued, it could be devastating to the firm's survival. To take full advantage of the challenges, the purchasing function must be integrated into the firm's overall strategic plan.

Developing a Strategic Sourcing Plan

The development of a strategic sourcing plan requires the following:

1. A complete understanding of corporate strategies and marketing plans in order to provide well-integrated purchasing systems
2. An extensive evaluation/study of current suppliers, how performance is measured, and the expectation of suppliers relative to the industry
3. Study of the degree of global purchasing opportunities
4. Identification of total costs associated with current purchasing department function, budgets, staffing, and so forth

Management must devise a data collection instrument to respond to these four issues. The strategic purchasing plan must answer questions related to specific sources of supply, technological changes, and the extrapolated costing structure. The four phases of the strategic sourcing plan are outlined here.

Phase 1. Sourcing Audit

The sourcing audit is used as a diagnostic process that identifies opportunities for increased profitability. The audit should be broad and systematic and will serve to reaffirm company objectives, determine how well the current sourcing strategy is performing, and identify the areas that need immediate managerial attention. Some of the issues relating to the organization, policies, and procedures that should be addressed are listed here:

1. Evaluation by senior management of the increased profits and benefits from an effective sourcing system
2. Interdepartmental communication on the benefits from the joint sourcing requirement
3. Effective participation in long-range planning by the supply management/purchasing department
4. Evaluation of the efficiency and cost-effectiveness of existing sourcing policies

5. Exploration of the cost-effectiveness of the present purchasing organization
6. Examination of the advantages and disadvantages of a centralized versus decentralized organization
7. Review of the strategic plans of the purchasing department to determine if they have been carefully developed and documented
8. Senior management support of the purchasing manager
9. Assessment as to whether procedures for small purchases are cost-effective
10. Review of the current purchasing manual to determine whether it is understood and followed in current purchasing decisions
11. The role of senior management in promoting compliance with the purchasing manual throughout the company

In addition, questions relating to the requirements process, the selection of the right sources, getting the right price, subcontract administration, and other important issues will be thoroughly investigated.

Phase 2. Organizational Development

This phase involves developing sourcing strategies, setting clearly outlined areas to cut costs and improve profitability, establishing a sourcing control system based on frequent analysis and systematic approach, formulating incentive programs, and making provisions for training by taking advantage of local ISM seminars and in-house sessions on how to establish the purchase of monitoring systems.

Phase 3. Implementation and Evaluation

In this phase, a thorough indoctrination of the company with sourcing strategy, implementation of new procedures, monitoring of sourcing activities, feedback mechanism for evaluation, and refinement of sourcing processes is conducted. The implementation and evaluation plan includes the following:

1. Thorough indoctrination of the company with the sourcing strategies
2. Implementation of new procedures
3. Monitoring of sourcing activities
4. Development of a feedback mechanism
5. Refinement of sourcing processes

Phase 4. In-House Training Sessions

Classes should be conducted in groups of approximately 15 individuals. Appropriate purchasing and other management personnel from the company will attend these sessions to learn state-of-the-art purchasing techniques, negotiation strategies, and cost-containment methods.

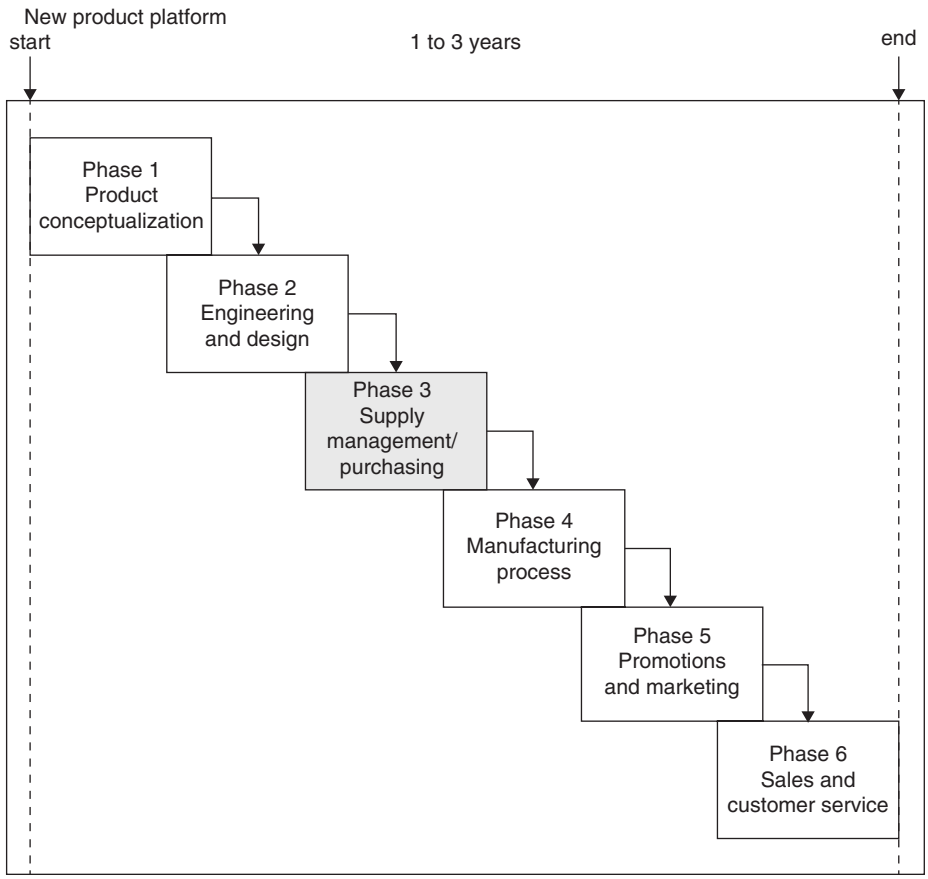
Program Objectives by Phase

From work done during Phase 1 of the project, the company can expect to gain valuable insight into the present sourcing system and discover paths that can lead to new opportunities as the company enters the next decade. Information on the relationship with suppliers during the current period compared with the next decade will help chart the course for the future. In addition, the present systems for the control of the sourcing process should be evaluated, as should the compliance with the purchasing manual.

In addition, sourcing objectives should be refined to take advantage of insights gained from Phase 1 of the project. Buyers should be exposed to a reinforcement of the basic skills of their profession, refinement of the technical knowledge required, and a system of effective time management that are necessary to take advantage of sourcing opportunities. Finally, control devices for monitoring and reassuring sourcing activity will be created for ensuring consistency and effectiveness.

During and following Phase 2, "management by objective" systems should be implemented that enable the purchasing department to clearly set cost-savings goals. These savings will go straight to the bottom line.

FIGURE 2.5
Purchasing's Role in the New Product Development Process



After Phase 3 has been completed, the company can expect to be operating with a more developed organization capable of producing more cost-effective purchases with more profit from the savings. In short, more efficiency from planning and controlling the sourcing operation can be expected. The necessary tools also will be in place for effectively monitoring and refining the sourcing processes and conducting in-house sourcing audits in the future.

Purchasing and supply management has evolved into a strategic business activity and thus also is a potential contributor to the successful development of new products. However, the involvement of purchasing in new product development (NPD) is for the most part informal in most firms. Firms differ in the extent to which they involve purchasing in NPD. Purchasing specialists can be especially useful at the design and engineering phase of the NPD process (see Figure 2.5).

PURCHASING STRATEGY TRENDS

LO 2.6 Identify the continuing trends of purchasing and supply chain management.

An article titled "Research Opportunities in Purchasing and Supply Management" was published in the August 2012 issue of the *International Journal of Production Research*. Panels of eight leading scholars in the purchasing and supply management (PSM) field were the contributors for the study. Among them were several journal editors of highly respected peer-reviewed academic journals publishing PSM research, as well as authors of some of the most successful PSM textbooks. These distinguished individuals provide an opportunity to tap the knowledge of a group of experts with extensive experience in the academic and practical aspects of PSM.

The purchasing and supply management function is crucial for effective business strategy and operations excellence. The PSM function has evolved from being a routine transactional function to a dominant function that delivers true competitive advantage to the business organization. The environment of increased globalization and outsourcing has led to an increased reliance on supplying organizations. This change in status has significantly enhanced the importance of PSM's role in the business strategy process. It is therefore crucial to highlight continuing trends in industry practice. The findings are given here.

1. *Increases in global purchasing with China and India.* Outsourcing from India and China will continue to be important to businesses throughout the world. The products and services that are outsourced will become more sophisticated. Examples include health care, tax consulting services, engineering and design, and high-tech manufacturing.
2. *The strong relationship management between buying and selling organizations.* While the development (creation) of buyer–supplier relationships is well understood (e.g., influence of trust, dependence, communication), the ending or termination of these relationships warrants additional understanding. Specifically, when do buyers end a relationship, and when do they switch to an alternative supplier? Why do buyers resist switching to an alternative supplier even when there is a "better" alternate supplier? Given the costs involved in forming and maintaining supplier relationships, it is critical to understand factors that influence the termination of a buyer–supplier relationship.

3. *Buyer–supplier relationship life cycles.* It is critical that buyer–supplier relationships consider the life cycle of the relationship to assess new productive relationship insights. For example, supplier development in early versus late relationship phases needs to be understood. The goals and results of supplier development efforts might be quite different depending on the stage of the relationship.

4. *Purchasing function as a key driver of business strategy.* Supply chain management must be seen as a strategic element, instead of merely a means to managing the flow of products. A fundamental rethinking must occur to leverage the supply base to its fullest potential. Supply chain leverages organizational transformation and strategic change, focusing on the issues of strategic procurement, supply chain competence, and supply chain integration.

5. *Supply chain culture as a key resource and component of corporate strategy.* A firm's supply chain culture and its influence on corporate strategy and performance will increase in the coming years. Aspects of supply chain culture include service to customers, attitudes toward suppliers, adherence to established processes, readiness for and adaption to change, communication styles, and level of respect for members of the extended supply chain team.

6. *Monitoring buyer or supplier ethical conduct in the supply chain.* The relationship between ethics and the law can be described as complex. Many violators of ethical conduct maintain that their actions are perfectly legal under the law.

7. *Developments in electronic purchasing.* As the market for electronic PSM offerings expands, the selection of the most appropriate solution is becoming increasingly challenging. Buying organizations can choose between dedicated software residing on their servers to hosted software-as-a-service (SaaS) solutions. Costs and benefits of these two extreme options may depend on firm and industry characteristics, and need to be carefully considered in choosing an electronic PSM execution strategy.

8. *Determining the appropriate electronic purchasing structures.* The notion that electronic procurement is only suited for indirect or maintenance, repair, and operating (MRO) supplies needs reevaluation. Recent developments in electronic procurement solution offerings enable procurement professionals to address management of quality and delivery beyond price-related aspects. These developments are changing the role of electronic procurement systems from a purely cost-based, transactional processing tool to a decision support system. To harness this potential, maintaining an alignment between the system capabilities and the practices it supports is critical. For example, a distinction between MRO I and MRO II items depending on their criticality, and subsequent choice of the structure for electronic reverse auctions, is necessary for the successful use of this tool, enabling increased value appropriation from the electronic procurement system. Critical MRO items and suppliers may not be suitable candidates for reverse auctions.

9. *The supplier's perspective of reverse auctions.* The use of reverse auctions represents one of the major components of an electronic procurement strategy. From a supplier's perspective, two pressing questions pertain to the relational implications and the supplier's response to, for example, a reverse auction invitation, which

is often perceived by suppliers as an antagonistic way of doing business. Within this context, a supplier's perspective of a buying firm's intentions and efforts can significantly influence its level of satisfaction, which in turn has implications for the buying firm's performance. The supplier's potential retaliation after having been "pressured" to participate in an auction should be expected.

10. *Long-term relationship risk of continuous reverse auction purchasing.* Reverse auctions are a great tool to obtain market price visibility and to obtain the most competitive bids. However, the mechanism has also been criticized for promoting sharp business practices and hurting the relationship. As such, reverse auctions should be used to gain market information but should probably not be used as a routine sourcing method. To maintain trust and cooperation between buying and supplying firms, reverse auctions should be used carefully. While certain mechanisms can help in preventing the buyer–supplier relationship from deteriorating, negative effects are not unavoidable in all instances. For instance, while suppliers may be willing to bid competitive prices, they may have to achieve these by cutting back on quality, service, or delivery reliability. While this seems likely, no research has been found that empirically or quantitatively investigates this issue.
11. *The role of decision support systems in purchasing and supply management.* While most companies have transitioned to an integrated enterprise resource planning (ERP) system, or are in the process of doing so, the true potential for PSM to leverage the wealth of data available for better decision-making is likely untapped to a large extent. The presence of a strategy is therefore not sufficient; it also requires effective execution, implementation, and adoption of practices. The value of decision support systems (DSS) and enterprise resource planning (ERP) systems for PSM is, however, well accepted.

Purchasing and supply management will continue to become more relational focused, rather than transactional with key suppliers. Of course, for commodities, automation will remain the primary focus.

SUMMARY

LO 2.1 Explain the relationship between purchasing and competitive strategy.

Purchasing managers need to devise purchasing actions such that they are consistent with each other and with the firm's competitive strategy. The purchasing decisions or actions that constitute purchasing strategy are determined by the firm's competitive priorities, its resource capabilities, and the environment. A firm can seek competitive advantages on cost or choose to differentiate itself from its competitors on some attributes of the product or in the way it markets its product.

LO 2.2 Describe the impact of competitive strategy and purchasing strategy on the supply chain and supplier relationships.

As competitive forces increase, customers demand better products, faster delivery, increased service, and decreased costs. As firms become more competitive, a rippling effect is experienced by the suppliers. As a result of increased competition, deregulation, and relaxed antitrust requirements, the supplier partnerships concept has emerged as a competitive weapon. Today, supplier partnerships look for a more cooperative attitude between

parties. Companies participate in a variety of supplier relationships and take on a variety of roles. Each company can be a supplier, customer, or end user of products.

LO 2.3 Discuss the competitive ranking system used to control quality relationships between suppliers and buyers.

The advent of supply chain management has led to a more complicated operating environment. Not only does the individual firm have to maintain its competitive edge; the entire supply chain must be competitive. Supply chain relationship quality indexing can be used to drive continuous improvement in competitive supply chains. The individual members of the supply chain cannot function without the economic, quality, and service performance of the other supply chain members. The quality of the relationships between each supply chain member will determine which firms survive in a competitive environment. Many manufacturing firms consider the relationship between themselves and their ultimate customers more important than the relationship between themselves and their suppliers.

LO 2.4 State the decision-making factors that impact a buying decision.

The decision-maker faces multiple goals in making the buying decision. The integrated buying model is used by the buyer organization in making purchasing decisions. Purchasing decisions require buying the right material at an acceptable cost and quality level within a reasonable lead time. The decision-maker has to contend not only with multiple goals but also with several constraints. Firms often have limited resources. Inventory budgets may be limited, or storage space may constrain the quantity that may be purchased at any instant.

LO 2.5 Demonstrate how to develop a strategic sourcing plan.

A number of important challenges face supply managers and executives in the future. Perhaps the most significant changes will occur in the purchasing area. More and more firms will be competing for limited supplies of materials. At the same time, stockholders will demand more profitability. In addition, the internationalization of supply markets, manufacturing, and market segments will bring the purchasing function into clear focus. The opportunities, if pursued, will be unlimited; if not pursued, it could be devastating to the firm's survival. To take full advantage of the challenges, the purchasing function must be integrated into the firm's overall strategic plan. The four phases of the strategic sourcing plan are these:

- Phase 1. Sourcing audit
- Phase 2. Organizational development
- Phase 3. Implementation and evaluation
- Phase 4. In-house training sessions

LO 2.6 Identify the continuing trends of purchasing and supply chain management.

The purchasing and supply management function is crucial for effective business strategy and operations excellence. The PSM function has evolved from being a routine transactional function to a dominant function that delivers true competitive advantage to the business organization. The environment of increased globalization and outsourcing has led to an increased reliance on supplying organizations. This change in status has significantly enhanced the importance of PSM's role in the business strategy process. Some of the trends continuing to impact purchasing and supply chain management are the following:

1. Increased global purchasing with China and India
2. The strong relationship management between buying and selling organizations
3. Buyer–supplier relationship life cycles
4. Purchasing function as a key driver of business strategy
5. Supply chain culture as a key resource and component of corporate strategy
6. Monitoring buyer or supplier ethical conduct in the supply chain
7. Developments in electronic purchasing
8. Determining the appropriate electronic purchasing structures
9. The supplier's perspective on reverse auctions
10. Long-term relationship risk of continuous reverse auction purchasing
11. The role of decision support systems in purchasing and supply management

KEY TERMS

Competitive priority 28
Competitive strategy 27
Integrated buying model 36
Purchasing criteria 28
Reward criteria 28
Supplier relationship quality indexing (SRQ) 32

DISCUSSION QUESTIONS

1. Why should the purchasing professional be concerned with strategic planning?
2. How does purchasing fit into a firm's overall strategic plans? Give a specific framework for the linkage between purchasing and competitive strategy.
3. What are the components of purchasing strategy?
4. What decision areas are associated with purchasing strategy?
5. What is the impact of purchasing strategy on manufacturing inventory?
6. What is meant by "partnership"? Please categorize the four factors of partnerships.
7. Discuss the elements of the proposed buying model mentioned in this chapter.
8. Describe the elements of a strategic purchasing plan.
9. Describe the supply chain relationship quality indexing process.

SUGGESTED CASES

Case 2: The Art and Science of Bidding Not to Get a Job

Case 14: Industrial Heating Systems

Case 17: McGruder Pavers, Inc.

Case 29: Worldwide Auto Manufacturers, Inc.

APPENDIX: SUPPLY CHAIN RELATIONSHIP QUALITY STUDY

An example of the SRQ indexing process for the automobile industry offers insight into the development processes of effective SRQ supplier–buyer relationships.

Phase I. Assessment

The assessment phase is represented by the observations during the plant visits.

Phase II. Data Collection and Questionnaire Development

A mailing list for 548 of the most critical tier 1 suppliers in the automobile industry was used as the sample for the study. This list consisted of individuals with high-level, strategically oriented positions, having titles such as president, CEO, and chairman. The data were entered into spreadsheet format and verified twice for entry accuracy. The data were then filtered for problems. Some companies also were removed from the Honda list because they were Honda subsidiaries. Given a total of 548 contact names supplied, 130 were considered usable for the quality analysis study after data cleansing. The response rate for the supply chain quality study was 23.7%. This sample allowed for suitable testing of the research question.

Demographics of Respondents

Several standard demographic measures including products/services supplied, percentage and value of sales to the manufacturer, quality certification, and number of employees were taken to obtain a general

understanding of respondent attitudes. The ranked frequencies of the products and/or services provided by the suppliers are displayed in Table 2.6. Bearing in mind that a respondent may select more than one category, chassis and power train components were found to be the most frequently marked categories. Most of the remaining categories were relatively evenly distributed in frequency, indicating that each of the categories was well represented in the data.

Next, the suppliers were asked to estimate the average percentage of their total sales as well as the total dollar amount of sales purchased by the manufacturer of interest (see Table 2.7). The average percentage was 23.52%, indicating that manufacturers accounted for a relatively large proportion of the suppliers' sales. The average dollar amount of sales was found to lie between $5 million and $50 million. The number of employees per firm averaged approximately 7,000.

Finally, information about quality certification with specific regard to ISO9000 and QS9000 was collected. *ISO9000* (International Organization for Standardization) seeks to offer standardization of quality management issues. Firms attempting to register for certification must meticulously map and refine the control of processes such as inspection, purchasing, distribution, and training. One hundred twelve of the respondents reported that they currently have or will soon qualify for ISO9000 certification. The steep cost of certification may prevent small suppliers from achieving such certification. Related to ISO9000, *QS9000* was developed by the Big Three U.S. manufacturers (General Motors, Ford, and Chrysler) specifically for the automotive industry.

TABLE 2.6
Categories of Products/Services of Respondents

Category	Count	Percentage
Chassis components	54	23.6
Power train components	54	23.6
Interior components	33	14.4
Exterior components	32	14.0
Stamping components	28	12.2
Electrical components	27	11.8
Other	24	10.5
Transportation/logistics	24	10.5
Tooling/equipment/construction	12	5.2
Nonproduction services	6	2.6

TABLE 2.7
Demographics of Respondents

Category	Percentage of sales	Value	QS9000 Certified	ISO9000 Certified	Number of Employees
Mean	23.52	3.39	125 yes	112 yes	6,949.11
Standard deviation	26.28	1.50			

Supplier Relations Data Collection

This section serves to establish an assessment of supplier relations in the U.S. automotive industry. This understanding of industry best practice will help the reader to focus on the importance and relevance of the summary statistics to be presented later. Specifically, a segment of the survey given below sought to establish a comparison of supplier opinions about the different major manufacturers in the automobile industry. The statement read, "In considering your relationships with the following firms, please allocate a total of 100 points among them based on their quality as a customer"; Chrysler, Ford, General Motors, Honda, and Toyota were among the e-manufacturers listed. These five manufacturers accounted for over 85% of U.S new vehicle sales in 1999.

An assessment of the relative quality of the manufacturers through the eyes of the suppliers was measured with the point allocation. If all the manufacturers supplied by the particular respondent have perceived quality as a customer, the score for each should be equal to 100 divided by the number of firms supplied. Scores differing from this average score would indicate above- or below-average perceived quality. This allowed suppliers to rate their customers, thus offering an *industry relationship standard* of the results of supplier relationship efforts. To gain insight into the factors affecting supplier relations pegging responses, respondents also were asked to select important factors influencing their rating of customer quality. They selected one or more among *commitment*, *cooperation*, *trust*, *satisfaction*, *performance*, and other.

Phase III. The Classification and Analysis

The scores for each response were examined. Any score sets that failed to total to 100 were removed from consideration, as were responses that indicated the respondent supplied only one of the five listed manufacturers. This left 130 usable supplier responses. The score sets for response were taken as a percentage of the expected response given the supplier considered all its manufacturer customers as equals. For instance, if a respondent supplied four manufacturers, the expected score for each would be 25. If a manufacturer achieved its expected score of 25, its resulting indices would be 25 divided by 25, equaling one. Thus, the quality indices would assume a value of one if the supplier considered the manufacturer to retain average quality as a customer. Subsequently, indices greater than one would indicate an above-average rating for customer quality while a below-average score would be below one. Table 2.8 shows summary statistics for these customer quality indices. With an average overall rating of 1.42, Chrysler retained the strongest reputation among the suppliers, while Honda ranked second with a mean score of 1.10. The ranks of the remaining three manufacturers were found to be Toyota (mean of 0.96), Ford (0.91), and General Motors (0.72). Ninety-five percent confidence intervals were constructed for each score and are displayed in Figure 2.6 to offer a visual representation of the scores. The scores also were tested for significance in difference from the average value of one. Both Chrysler and Honda showed evidence of significant above-average ratings while Ford and General Motors demonstrated significant below-average ratings. Toyota demonstrated no significant difference from one.

TABLE 2.8
Index Scores for Usable (n=130) Responses

	Chrysler	Ford	General Motors	Honda	Toyota
Mean	1.42	0.91	0.72	1.10	0.96
Std Dev	0.467	0.428	0.405	0.545	0.398
t-stat	8.84	−2.14	−7.25	1.76	−0.86
p-value	<0.1	0.03	<0.1	0.08	>0.10
Count	97	108	113	98	69

FIGURE 2.6
95% Confidence Intervals for Index Scores (*n*=130)

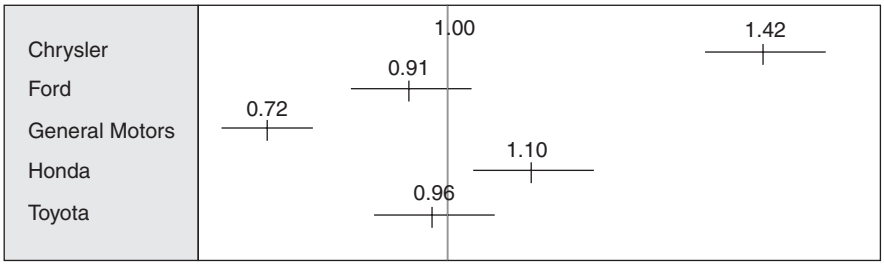
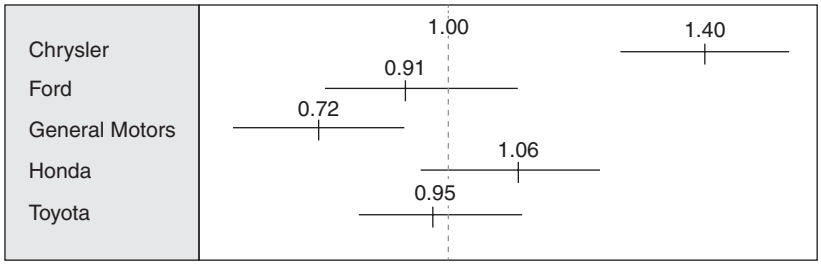


TABLE 2.9
Index Scores for Suppliers of All Five Manufacturers (*n*=41)

	Chrysler	Ford	General Motors	Honda	Toyota
Mean	1.40	0.87	0.72	1.06	0.95
Std Dev	0.561	0.427	0.445	0.565	0.392
t-stat	4.51	−2.01	−3.98	0.72	−0.78
p-value	<0.01	0.04	<0.01	>0.10	>0.10
Count	41	41	41	41	41

FIGURE 2.7
95% Confidence Intervals for Index Scores for Suppliers of All Five Manufacturers



To gain further insight regarding suppliers' opinions of their customers, this same analysis was conducted for the 41 respondents who indicated they supplied all five manufacturers. These results (see Table 2.9) were similar to the previous ones, finding Chrysler with the highest average rating at 1.40. Honda followed with 1.06, then Toyota with 0.95, Ford with 0.87, and General Motors with 0.72. Figure 2.7 displays 95% confidence intervals for the mean score for each firm. Also, t-tests run for significance in difference from the average value of one revealed that Chrysler retained a significant above-average rating while Ford and General Motors demonstrated significant below-average ratings. Both Honda and Toyota demonstrated no significant difference from one. The above relationship assessment verifies this best practice, indicating that these two firms set the industry best practice for fostering relationships with their suppliers.

TABLE 2.10
Basis for Allocation of Points in Pegging Assessment (n=130)

	Commitment	Cooperation	Trust	Satisfaction	Performance
Count	98	107	93	33	56
Frequency	0.754	0.823	0.715	0.254	0.431
z-stat	5.79	7.37	4.91	−5.61	−1.58
p-value	<0.01	<0.01	<0.01	<0.01	>0.10

Important Factors in Customer Assessment

The customer assessment results were tallied for the 130 suppliers providing responses to the relationship assessment (see Table 2.9). Of these factors, commitment (98 out of 130 responses, 75.4%), cooperation (107, 82.3%), and trust (93, 71.5%) were checked most frequently. Both satisfaction (33, 25.4%) and performance (56, 43.1%) were chosen less, by fewer than half of the respondents, and no consensus replies were provided for the "other" category. These proportions were examined for significance in difference from 0.50 (50% of respondents). Commitment, trust, and cooperation were significantly greater than 0.50. Furthermore, satisfaction was found to be significantly less than 0.50, while performance demonstrated no significant difference.

The respondents also were asked to indicate the relationship factors that were most important in evaluating the quality of the automotive manufacturers as customers. The most important relationship factors—cooperation (107, 0.823%), commitment (98, 0.754%), and trust (93, 0.715%)—were selected more frequently. Both performance (56, 0.431%) and satisfaction (33, 0.254%) were chosen by less than half of the respondents. There were no consensus replies chosen for the "other" category. These proportions were examined for significance in difference from 0.5 (50% of the respondents), and *cooperation*, *commitment*, and *trust* retained significance greater than 0.50. There is less than 0.50 significance for *performance* and *satisfaction*. An explanation for this finding is the comfort level the respondents had with defining some of the concepts. Cooperation, commitment, and trust can be perceived to be more easily defined. On the other hand, the performance and satisfaction definitions are less clear. Performance and satisfaction may be confounded with financial and relational elements. Perhaps in future studies, performance and satisfaction can be more clearly defined.

Another explanation for the lack of significance of performance and satisfaction as indicators of customer assessment may be derived from supplier expectations. Because the primary performance measures in the industry are associated with the manufacturer, the suppliers may accept their own performance measures through the manufacturer. Thus, these suppliers seek to maintain their relationships with the best-practice manufacturers as they figure their own success will be inevitable because of their alignment with these manufacturers. This would be especially true over the last few years, as the manufacturers have enjoyed great profitability.

These results show that in judging the quality of the manufacturers as customers, the suppliers are more focused on relational elements such as commitment, cooperation, and trust. Satisfaction and performance seem to carry less weight in such an assessment. This is not to say that the suppliers are not concerned about performance and satisfaction. It merely indicates that the suppliers seem to be more relationally oriented and value those customers that seek to foster sincere and mutual business partnerships.

Overall, the assessment reveals the importance of *manufacturer strategy* toward supplier management. The suppliers value those manufacturers that foster relational exchanges. This indicates that those manufacturers focused on building strong supplier partnerships should emphasize enhancing the relationship itself. This yields direct implications for supply chain strategy in practice.

Phase IV Conclusions

The purpose of this study was to develop an objective supply chain relationship quality indexing system. The

U.S. automobile industry was used as the test industry for a supply chain relationship quality indexing system. In general, the respondents believed that Chrysler and Honda are higher-quality customers than the other three manufacturers. The respondents ranked the automotive manufacturers from the highest quality to the lowest as Chrysler, Honda, Toyota, Ford, and General Motors.

These results clearly show that in judging the quality of the manufacturers as customers, the suppliers are more focused on relational elements such as commitment, cooperation, and trust. Satisfaction and performance seem to carry less weight in such an assessment. This is not to say that the suppliers are not concerned about performance and satisfaction. It merely indicates that the suppliers seem to be more relationally oriented and value those customers that seek to foster sincere and mutual business partnerships.

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The Legal Aspects of Purchasing[i]

3

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Every day parents send their sons and daughters to college. After a difficult examination, Meagan text-messaged her parents and announced that she needed a new computer and needed their permission to make the purchase at the university bookstore. Her mother called the bookstore to inform them that Meagan had her permission to charge the purchase to her account. Her mother informed Meagan that she could proceed with the purchase as long as it was within an *appropriate* price range. After evaluating more than five laptop computers, she decided on one and signed the charge slip. The 16" MacBook with Touch bar and Touch ID was purchased on the same day. At the end of the month, her father received a statement for $2,956. A day later, while still in shock, Meagan's father sent the bookstore a check, and the transaction was completed.

At first glance this appears to be a normal transaction between families and retailers. The impressive coincidence of this scenario

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

3.1 Define the extent of the purchasing professional's legal authority.

3.2 Identify the requirements and terms necessary for a purchase contract to be legally enforceable.

3.3 Define what makes an offer legally valid and the terms that may be aligned with the offer.

3.4 Explain the role of the purchasing manager in the execution of contracts and purchase orders.

3.5 Express the legal impact of the information age.

3.6 Discuss the importance of ethics in purchasing.

3.7 State factors needed to be in compliance with women business enterprise (WBE), minority business enterprise (MBE), and disadvantaged business enterprise (DBE) programs.

[i] The author expresses appreciation to Linda F. McHenry, Esq., W. C. Benton and Associates, Inc., for contributing this chapter.

is that Meagan accomplished her mission in the same way the purchasing process is accomplished in a business. A need is requested by a specific department and the purchasing person satisfies the need. The potential source is evaluated in terms of quality, price, and delivery performance. The purchasing manager makes the purchase and the treasurer of the company sends the check after an invoice is received.

As can be seen, both Meagan and the purchasing agent are able to buy goods and services and have someone else pay the bill. However, the seller must know that the decision-maker has given the purchasing manager the authority to make the purchase. This transaction is legally binding through the **agency** concept. An agency relationship requires two parties.

Agency Implies a relationship between two parties in which one is empowered to perform certain functions or business transactions for the other.

INTRODUCTION

In corporations, the purchasing manager is an agent for the firm. The terms *purchasing manager*, *buyer*, and *purchasing agent* will be used interchangeably. The purchasing manager administers the purchasing function. The purchasing function consists of many tasks within the business entity, including supporting the company with the required (1) materials, (2) supplies, and (3) services.

One of the most important tasks the purchasing manager is involved in is representing the principal in the development and negotiation of contracts with third parties. The title *purchasing agent* is a generic legal term. Recently, the term has been superseded by vice president of purchasing, vice president of materials management, and vice president of supply management. From a legal standpoint, the term *purchasing agent* accurately defines the individual who deals with a third party for a principal.

The selection of the senior purchasing manager is an important recruitment effort since the person will "inherit" the principal–agent relationship for all the expenditures and commitments of the company made by the purchasing agents. From a legal point of view, the following factors are associated with the appointment:

1. The purchasing manager must be granted the authority to make purchase contracts.
2. The purchasing manager accepts the contracting authority.
3. The employer accepts the commitments that were made to the purchasing manager.

AUTHORITY OF THE PURCHASING MANAGER

LO 3.1 Define the extent of the purchasing professional's legal authority.

The three types of purchasing authority are express authority, implied authority, and emergency authority.

Express authority The authority the principal has explicitly given to the agent whether orally or in writing.

1. *Express authority.* **Express authority** is conferred to the purchasing manager by the principal. This authority usually occurs automatically when the purchasing

manager is appointed. The detail associated with the appointment should reside in the company bylaws. The statement may be a job description for the top procurement officer. It is recommended that the purchasing manager's authority be in writing. If the authority is put in writing, there should be no misunderstanding of what the purchasing manager's express authority is. This will be especially helpful if there are disagreements between any parties in the relationship.

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PHOTO 3.1 A real estate contract must be in writing.

2. *Implied authority.* **Implied authority** is suggested by the law at the time the principal grants express authority to the incidental purchasing agent. It gives the purchasing agent the legal authority to carry out the duties for which he or she was appointed. As an example, if the purchasing agent is given the express authority to make a contract, he has the implied authority to negotiate the terms of the contract. This includes:

    - The quantity
    - The quality and other specifications
    - The delivery conditions
    - The price
    - The payment date

Implied authority Under contract law, the ability to make a legally binding contract on behalf of another person or company.

Implied authority is clearly needed to complete a transaction. However, the purchasing agent does not have the *implied* authority to sign a promissory note for the principal unless granted the express authority to do so.

3. *Emergency authority.* In cases where the purchasing agent does not have express or implied authority, the purchasing agent may still take action. This is called **emergency authority** and is rarely implemented. Emergency authority is used only when the purchasing manager must protect the principal's rights or property when a consultation with the principal is impossible at the time.

Emergency authority The ability to act in the event of an emergency answering point that has not been officially designated.

In general, most of the purchasing authority is not given in writing, or the scope is vague. When purchasing managers are appointed as agents for the company, they are vaguely given the purchasing responsibility. However, written formalities are important when a legal issue occurs.

It is strongly recommended that the authority of the purchasing manager be clearly written and communicated. This is also true for buyers and other purchasing personnel under the purchasing manager. In addition, most buyers are given dollar limitation authorization. Any contract that exceeds the dollar level must be signed by a superior purchasing officer.

CONTRACTS AND PURCHASE ORDERS

LO 3.2 Identify the requirements and terms necessary for a purchase contract to be legally enforceable.

Purchase order Authorizing document for provision of goods or services from a supplier; becomes a legally binding contract on acceptance by the supplier.

A **purchase order** is a document generated by the buyer to purchase products or property. This document allows a transaction to occur and when accepted by the seller becomes a legal binding contract of sale. A **contract** is an agreement between at least two parties creating mutual obligations enforceable by law. Purchase orders do not become legally bound until accepted by the seller, whereas a contract is a legal document from the start. Purchase orders are commercial documents while contracts are legally bound documents.

Contract An agreement between two or more parties that is written and enforceable by law.

Essentials of a Purchase Contract

A purchase consists of passing *title* of a product or service to a buyer from a seller. The title represents the ownership right to the product or service. A *buyer* is a person who contracts to buy goods or services. A *seller* is a person who sells or contracts to sell goods or services. The two parties must agree to the transaction before a sale can take place. This agreement is a *contract*. The title of the good or service cannot be passed until an agreement or contract is reached between the buyer and seller.

The Requirements for a Contract

The four components of an enforceable (contract) agreement are the following:

1. *The parties must be capable.* Both parties must know what they are doing. This standard clearly eliminates parties who are impaired in any way. Impairment includes a mentally unstable person, a confirmed alcoholic, and a confirmed drug addict. It is important to acknowledge that these conditions must be confirmed through adjudication. Of course, if a party entered the company into an undesirable agreement after too many drinks, he or she cannot use impairment as a legal defense. Finally, a corporation itself cannot enter into a contract without a corporate official as an agent.
2. *The subject of the matter must be legal and valid.* The definition of a valid contract is that the product or service contracted must be legal and not against public policy. The court cannot enforce a contract that is illegal. This is usually not a problem for most purchasing officials since most of the products and services are covered.
3. *There must be mutual consideration.* **Consideration** is a legal term that is easily understood until there is a challenge. The definition of consideration is that something of value passes from one party to a second party in exchange for a promise of the second party. The value must be consistent with the second party's promise. If an auto mechanic is given $1,000 in return for a promise to repair a fender that is mutual consideration. Mutual consideration makes a contract legally binding and enforceable. In most cases, if there is no consideration, the contract is not enforceable.

Consideration A term used to describe the value that shall be reimbursed to one party to a contract by another party in return for services or articles rendered.

Mutual consideration is important to purchasing managers. One objective of the purchasing manager is to receive the best value for the company. As an example, some of the important purchasing considerations are price, quality, quantity, and delivery.

4. *The parties must reach an agreement by offer and acceptance.* In a purchasing situation, the seller usually makes an offer and the buyer accepts, negotiates, or rejects the offer. Only when the offer is accepted is there an agreement.

In summary, under the U.S. Uniform Commercial Code, an agreement is a legal transaction that requires all four components just given. The absence of any of the components results in an unenforceable agreement in a court of law.

Oral Contracts

Oral contracts occur every day. Ordering a pizza is an oral contract. However, oral contracts have no place in the professional purchasing arena. If a supplier refuses to perform, there is no recourse for the buyer. The courts are silent on enforcing oral contracts that exceed $500.

OFFERS

LO 3.3 Define what makes an offer legally valid and the terms that may be aligned with the offer.

A valid contract hinges upon the mechanics of reaching an agreement. In order to have an agreement, there must be an offer and an acceptance of the offer. An **offer** is a proposal made to someone to enter into a contract. It is an invitation to do business. An offer is also a legal commitment to the other party. In the business purchasing environment, an offer can be initiated by either the buying or selling party. If the buying firm initiates an offer, it is called an *offer to buy*. When a selling firm initiates an offer, it is referred to as an *offer to sell*. Of course, throughout an extended negotiations process, there will be numerous offers and counteroffers.

Offer A proposal or bid made by an individual or organization to another individual to perform a service or action; the acceptance of such an offer results in a contract. The individual or organization that makes the offer is called an offeror, and the individual or organization that receives the offer is called an offeree. A bid or proposal is an example of an offer.

An offer clearly has legal implications. If a person makes an offer, he or she must be prepared to perform if the offer is accepted. The acceptance of an offer poses legal obligations. The written contract should immediately follow the acceptance of the offer.

Purchasing agents receive numerous offers daily and must be able to identify complete legitimate offers. The three necessary components of an offer are the following:

1. *Intent to make an offer.* The intent to make an offer must be clearly stated. The purchasing official should require the supplier to submit a written quotation form that states precisely what the supplier offers to sell or (in the case of the buying firm) the purchaser offers to buy.
2. *Communication of the offer intent.* The offer must be communicated to the offeree. The purchasing agent can easily communicate the offer with a purchase order. The seller communicates through a proposal or quotation.
3. *Identification of the specific subject matter.* The product or service must be accurately described. Specifications are especially important when the competitive bidding method of pricing is used. Brand names, quality standards, and specific performance expectations also should be used. The quantity and price are also important when referring to the subject matter.

The Terms of an Offer

The specific subject matter is generally described and referred to as the terms of an offer. The terms define what will be enforced in a contract.

Quantity

An offer must express a fixed quantity of a sale. A contract that does not specifically express quantity is unenforceable. The unit of measure of quantity is unique to the industry. As examples:

1. Concrete is quoted in cubic yards.
2. Lumber in board feet.
3. Number of bales of hay.
4. Barrels of oil.
5. Number of gallons of fuel.

Please see Chapter 5 for an economic discussion of quantity determination and inventory control.

Quality

The purchasing professional must pay close attention to the quality term of the contract. Quality should not be overspecified or underspecified. There is a wide range of quality factors. The quality factors must be included in the final contract. See Chapter 12 for a comprehensive discussion of the quality dimension.

Price and Credit Terms

The pricing terms of a contract are directly related to value. The purchasing professional must obtain the best value for the firm. Thus, price is the third major term that must be included in an enforceable contract. The price is determined when the offer is accepted. In some cases, price escalation clauses are used in a contract. A price escalation clause is an adjustment that the seller uses to compensate for variances at delivery. Purchasing professionals should agree to an escalator only as a last resort. See Chapter 13 for a comprehensive discussion on the pricing term. Finally, the purchasing professional should negotiate the credit terms with the supplier. See Chapter 14 for a comprehensive discussion on bargaining and negotiations.

Delivery Terms

Delivery terms are closely related to price terms. The transportation between the buying and selling firm is usually considered as part of the price. The delivery terms formalize the responsibilities of the buying and selling firm for delivery of the goods. As an example, "FOB shipment" means free on board (FOB) at a named place. Please see Chapter 15 for a comprehensive discussion of transportation analysis.

Leasing

Leasing is becoming more attractive for both consumers and businesses. Consumers are leasing automobiles in record numbers. One reason for the increase in consumer leasing is the tax effect of the leased automobile for small businesses. If the automobile is partially used for the business, a portion of the monthly lease payment is tax deductible.

For a business, the lease payment is fully deductible and there is no need to keep track of depreciation of equipment on the balance sheet. Since the business does not own the plant equipment at the end of the lease, the business has no equity. However, productivity is increased as a result of the continuous modernization of equipment. There is clearly a trade-off. Currently, there are no laws that specifically address the rights and obligations of the lessee and lessor. See Chapter 16 for a comprehensive discussion on leasing.

The Time Limits of an Offer

There are four outcomes of an offer:

1. *The offer may lapse.* The terms of an offer can be specified to lapse after a stated period. Suppose you are a purchasing agent who receives a quote for 5 tons of rebar and on the face of the quotation you are given 7 days to decide whether to accept the offer; if you fail to take action during the 7 days, the offer no longer exists. The 7-day period is counted from the date typed on the request for quotation (RFQ). The 7 days commence when the offer is received and only if the RFQ is undated. If the supplier is attempting to avoid a price increase or offer a quantity discount, the offer may be subject to *immediate acceptance*. The purchasing agent must be careful about acting too often on immediate acceptances. It is understood that the experienced purchasing agent is close to being an expert on the items he or she purchases and should be able to distinguish between buying *opportunities* and buying *risks*. In the case of a quantity discount purchase, the buyer not only must consider the cost per item; he or she also must consider the total costs (cost of capital, inventory carrying cost, insurance cost, and the cost of obsolescence) of the purchase. The purchasing agent must be able to analyze the conceptual as well as the economic criteria associated with alternative buying decisions. In any case, the supplying firm's representative should be questioned about the reason for requirement of immediate acceptance of the offer.

In many cases, an offer has no time limits, and in these cases, the law states the offer should lapse after a reasonable period of time, although it usually does not indicate what that is. Thus, the time span may vary. The following factors can serve as guidelines for what is a reasonable period of time:

- The nature of the product or service
- The variability of the market price
- The historical dealings between the two parties
- The industry norms

As an example, if the supplier is selling a perishable commodity, then it is easy to see that an immediate response is needed. On the other hand, if the seller is offering a 5 Series BMW to you, there is a wide range of discretion. This is also a serious problem in the construction industry. As an example, in March, Apex Trucking firm agreed to haul 100 tons of dirt based on a total cost (costs that included fuel, labor, maintenance, tire replacement). The prime contractor later informed Apex that the project had been delayed until December. In the

meantime, the cost to Apex of diesel fuel increased from $2.90 per gallon to $4.45 per gallon. This is significant since dump trucks get an average of 5 miles to a gallon.

1. *The offer may be rejected.* The rejection of an offer kills it completely. The offer ceases to exist. The rejection of an offer must be communicated to the supplier. The communication can be either verbal or written. If the offer is amended, it becomes a counteroffer.
2. *The offer may be revoked.* In some instances, the offer is revoked. The law permits an offer to be revoked any time before it is accepted. According to the law, if a company has the free will to make an offer, the company also has the equally free will to revoke the offer before it is accepted. Remember, consideration has not occurred. Revoking an offer is legal, but it should be avoided if possible. It usually causes a hardship on the buying firm. It is the responsibility of the purchasing professional to protect the buying firm. The following approaches can be used to protect against revocation:
   - Obtain a firm offer.
   - Write an option contract.
   - Secure a bid bond.
3. *The offer may be accepted.* The offer is accepted and a contract is made.

EXECUTION OF CONTRACTS AND PURCHASE ORDERS BY THE PURCHASING MANAGER

LO 3.4 Explain the role of the purchasing manager in the execution of contracts and purchase orders.

Purchasing personnel routinely sign purchase orders and contracts committing the company to the specific terms and conditions as specified in these documents. The purchasing official has no personal liability providing that the following requirements are met:

1. The name of the principal or company is shown on the document.
2. All parties involved know the purchasing agent is acting on behalf of the company or principal.
3. The agency relation is shown on the document.
4. The purchasing agent is acting within the scope of his or her authority for the transaction.

A legal signature is any type of signature as long as the person who is signing the document intends it to represent his or her authority. Typewritten, faxed, and e-mail signatures are also acceptable for execution.

In some cases, the purchasing agent can become personally liable for signing if a note is signed without an official title. This is true even if the intent was to sign for the company.

Invitation to Do Business

In most instances, the purchasing official initiates an invitation to do business. The purchasing official issues a **request for quotation (RFQ)**. The RFQ is an excellent way for the buying firm to test the market without making a legal commitment to purchase. The RFQ lacks the *intent* component. When the intent component is missing, the document is merely an invitation to bid.

Request for quotation (RFQ) Specific pricing and delivery information on listed products or services. Quotations are requested for exact quantities and products may be specified by make/model number, batch number, industry specification, and so forth.

Suppliers use catalogs as an invitation to do business. The catalog usually illustrates colorful pictures and detailed descriptions. Catalogs fail to meet the intent and identification requirements necessary for a legal offer. Suppliers usually place a caveat in the catalog that qualifies the stock level and prices of the listed item. As more and more business is conducted via the Internet, promotional materials are becoming close to a bona fide offer. A bona fide offer is a written offer by a qualified purchaser to buy the entire membership interest of a member accompanied by a cash deposit of a sum not less than 5% of the total proposed purchase. There is also an increased opportunity for fraud and illegal selling activity. There has been a rise in consumer protection laws to prevent illegal selling. However, there is little protection for the professional purchasing environment.

Making an Offer

The negotiations process between the buyer and the seller usually leads to many offers and counteroffers. A counteroffer is legally binding if it contains the components that institute an offer. A more comprehensive treatment of the counteroffer process is given in Chapter 11.

Firm Offers

The **firm offer** is an offer that will remain open for a certain period or until a certain time or occurrence of a certain event, during which it is incapable of being revoked. The firm offer question should be raised when quotations are requested. This approach gives the supplier equal opportunity to consider the risks before quoting. As an example, consider the following condition for Apex Trucking:

Firm offer An offer that will remain open for a certain period or until a certain time or occurrence of a certain event, during which it is incapable of being revoked.

> *Prices quoted in your offer must be guaranteed for 90 days. This assurance must be included in the quotation you submit. Quotations received without such assurances will be returned.*

Quotations as a result of this RFQ are enforceable. It must be made clear to the supplier that any supplier that submits an offer without this guarantee will not be considered. The purchasing manager must enforce this condition for each of the suppliers. If the purchasing manager does not enforce this condition, he or she loses credibility. Other suppliers will quickly find out that the purchasing person (the company) is unethical.

Option Contracts

In case the supplier is unwilling to give the buying firm a firm offer, the purchasing professional should attempt to offer the seller an **option contract**. The seller will make an agreement to allow the buyer a specific time limit to make the purchase. Consideration will pass from the offeree to the offeror in return for a firm commitment. As an example:

Option contract An agreement between a buyer and seller that gives the purchaser of the option the right to buy or sell a particular asset at a later date at an agreed-upon price.

> *For the consideration of $50,000, for the next 90 days we will sell you our 2.4GHz quad-core computer chip for $55.20 per chip delivered, in units of 1,000 chips, up to a total of 5,000 chips.*

This option contract is enforceable because of the payment of the $1,000 consideration. The buyer is actually paying for the protection of a firm offer. In the case that the buyer fails to make a purchase during the 90-day period, the seller retains the $1,000. An option contract can be executed for any length of time.

Bid Bonds

Bid bond A form of bid security purchased by a bidder; provided, subject to forfeit, to guarantee that the bidder will enter into a contract with the owner for construction of the facility within a specified time period.

A **bid bond** enlists a third party into the transaction. The supplier secures a bonding company to guarantee that the supplier will enter into a contract if it is awarded the contract. The bid bond approach is used extensively by governmental agencies. A bid bond condition is usually motivated by a federal or state regulation. Bonding is used to protect governmental agencies from unqualified bidders. Therefore, it should come as no surprise that bonding companies are selective in the issuing of bid bonds. The supplying firm must be able to prove that it possesses the managerial, engineering, and financial capability required to perform the contract. Bonding is used when risks are expected. Thus, bonding is widely used in the construction industry.

Promissory Estoppels

The construction industry is unique in that the general/prime contractor accepts offers from subcontractors in expectation of being awarded a project from a third party. As an example, a bridge contractor solicits offers from a structural steel firm for the purpose of preparing an estimate for the department of transportation. It is understood between the prime contractor and the subcontractors that an acceptance cannot be made until the project has been awarded. However, the prime contractor is depending on the promise of the subcontractor to provide steel contracting if the prime is awarded the project. The doctrine of **promissory estoppels** is enforceable by the prime contractor. In a landmark case, a prime contractor solicited a telephone bid from a paving contractor. The paving subcontractor failed to perform after the prime contractor was awarded the project. The court ruled in favor of the prime contractor.

Promissory estoppels The legal principle that a promise is enforceable by law, even if made without formal consideration when a promisor has made a promise to a promisee who then relies on that promise to his subsequent detriment.

THE LEGAL IMPACT OF THE INFORMATION AGE

LO 3.5 Express the legal impact of the information age.

The Internet has infiltrated every aspect of the world. E-mail and text messaging have outpaced the postal system as the primary communication mode in the developed world. Nine-year-old children are buying and selling through online store builders. In some instances, purchasing professionals are requiring the supplier to meet minimum levels of connectivity, which is not easily done. The investment in business-based information systems and their upkeep is expensive. Walmart and General Motors have mandated their suppliers to become electronically connected. Most governmental agencies also are moving toward connectivity. Electronic contracting is worldwide.

As an example, a major challenge facing the automobile manufacturing industry is the integration of supply management with information and technology management. As technology continues to develop, automobile manufacturers and their suppliers will have to share more information to help maintain market share. It is important to integrate supply chain management with information technology.

Federal and State Electronic Transactions Laws

In 2000, the Electronic Signatures in Global and National Commerce Act (ESIGN) made most e-contracts and e-signatures legal and enforceable just as paper contracts and signatures.

The 50 states have adopted the Uniform Electronic Transactions Act (UETA) that provides legal validity for contracts in a similar manner as the federal law (ESIGN). The integration of federal and state laws ensures that with a few exceptions, e-contracts and e-signatures are valid no matter where the parties live or execute the contract.

PHOTO 3.2 The automotive industry needs to adapt and learn to integrate technology and sharing of information to remain viable in the market.

An e-contract is an agreement created and "signed" in electronic form. An e-contract can also be in the form of a "click to agree" contract. ESIGN and UETA allow individuals and businesses to make e-contracts and signatures valid and enforceable if the following requirements are met:

- Obtain consent from signers using an e-contract or e-signing. Signers can acknowledge their consent by agreeing in an e-mail or simply e-signing an e-mailed contract.
- Inform signers about what their signature agrees to.
- Provide signers with a paper contract option.
- Inform signers that they can withdraw consent at any time.
- E-mail final copies of the signed contracts to all parties.

Electronic contracts and electronic signatures are legal and enforceable. The law benefits B2Bs (business-to-business websites) that need enforceable agreements for ordering supplies and services. The law helps them conduct business entirely on the Internet. This results in substantial cost savings to businesses.

Contracts That Must Be on Paper

The following contracts cannot be executed electronically:

- Wills and testamentary trusts
- Documents relating to adoption and divorce
- Court orders, notices, and other court documents like pleadings and motions
- Notices of cancellation or termination of utility services
- Notices of default, repossession, foreclosure, or eviction

- Notices of cancellation or termination of health or life insurance benefits
- Product recall notices affecting health or safety
- Documents required by law to accompany the transportation of hazardous materials

PURCHASING AND ETHICS

LO 3.6 Discuss the importance of ethics in purchasing.

Ethics can be defined as the standards of right conduct. However, depending on many factors, what constitutes ethical conduct varies. On the other hand, there are many clear examples of unethical conduct. But many business practices are less discernible among business professionals. Some examples in this gray area are as follows:

1. Using a high-pressure sales technique to persuade naive customers to buy
2. Misleading a buyer or seller into thinking he or she is getting a deal
3. Giving a potential client or customer an expensive gift

How do you decide whether these controversial business approaches are acceptable? Some of the most egregious examples of unethical conduct are also illegal. Examples include bribery, giving and receiving kickbacks, falsifying costs on private and public contracts, deceptive behavior, and outright dishonesty about attributes of products.

Ethics and the Law

The relationship between ethics and the law can be described as complex. Many violators of ethical conduct maintain that their actions are perfectly legal under the law. The societal norms must also be considered. In a free democracy, the law can only codify and enforce the most egregious violations as defined by society. In a democracy, governments must not stand between buying and selling organizations. However, fraud should be prevented by law, and ethical conduct must be practiced to prevent greed and opportunism. The elimination of fraud and exploitation does not regulate aggressive negotiations and other business practices. Aggressive but honest and effective negotiations may lead to an advantage for the negotiator. The legal system cannot determine the rules of engagement for fairness in negotiations. Ethics does not require an opponent to seek less than the optimum outcome. There are no fast rules on knowing when a negotiation evolves from skillful aggression to exploitation. At what point does bluffing become lying? If a car buyer tells a car seller that she "cannot afford" to pay more than $15,000 for the car even if the buyer has been approved for $20,000, this can be considered a bluff and not a lie. The term *cannot afford* is sufficiently vague enough to prevent the buyer from lying. It should be clear that good business and ethical conduct are equivalent. Successful business conduct requires that both parties are sensitive to differences in culture and situational context. Bluffing in the negotiations process is usually counterproductive and could lead to damaged relationships.

Ethics and the Negotiations Process

Purchasing professionals must strive to conduct honest negotiations. However, there are some situations when honesty is out of the control of the negotiator. Sometimes veracity can

be overruled by company culture. This could cause a serious conflict. Consider a situation where you are speaking for your boss. If it is understood that you are taking your boss's point of view and relying on information supplied by your boss, you may not be lying in saying something false. As a purchasing professional, it must be made clear to the opponent that you are speaking on behalf of your company and not yourself. This could cause serious conflict.

Negotiations must not be fraudulent (full of lies and misrepresentations) or exploitive (taking unfair advantage of the opponent). Finally, just because an action is legal does not make it ethical. Chapter 14 discusses in greater detail the aspects of the negotiations process.

Purchasing agents are governed by the company's ethical policies, the **Uniform Commercial Code (UCC)**, the Securities and Exchange Commission, and many state and local laws. Purchasing agents who violate ethical codes could easily go to jail. Various actual company and government ethical policies are provided in Figures 3.1, 3.2, and 3.3.

Uniform Commercial Code (UCC)
A codification of law that clarifies and regulates the rights and obligations of buyers and sellers engaging in commercial transactions. It has been adopted by all states except Louisiana.

FIGURE 3.1
An Example of a Corporate Code of Ethics

Big D Purchasing subscribes to the principles of the Institute of Supply Management (ISM). Suppliers should read and understand the guidelines below:

- Avoid the intent and appearance of unethical or compromising practices in relationships, actions, and communications.
- Demonstrate loyalty to the employer by diligently following the lawful instructions of the employer, using reasonable care and only authority granted.
- Refrain from any private business or professional activity that would create a conflict between personal interest and the interest of the employer.
- Refrain from soliciting or accepting money, loans, credits, or prejudicial discounts, and the acceptance of gifts, entertainment, favors, or services from present or potential suppliers that might influence, or appear to influence, purchasing decisions.
- Handle confidential or proprietary information belonging to employers or suppliers with due care and proper consideration of ethical and legal ramifications and governmental regulations.
- Promote positive supplier relationships through courtesy and impartiality in all phases of the purchasing cycle.
- Refrain from reciprocal agreements that restrain competition.
- Know and obey the letter and spirit of laws governing the purchasing function and remain alert to the legal ramifications of purchasing decisions.
- Encourage all segments of society to participate by demonstrating support for small, disadvantaged, and minority-owned businesses.
- Discourage Big D Purchasing's involvement in employer-sponsored programs of personal purchases that are not business related.
- Enhance the proficiency and stature of the purchasing profession by acquiring and maintaining current technical knowledge and the highest standards of ethical behavior.
- Conduct international purchasing in accordance with the laws, customs, and practices of foreign countries, consistent with U.S. laws, your organization policies, and these Ethical Standards and Guidelines.

Big D Purchasing does allow promotional items to be exchanged if (1) the item displays the company logo and (2) the item is of a value less than $25. Payment of meal expenses is an acceptable and common practice in today's business environment. The purchase of meals should alternate between companies.

FIGURE 3.2
University Code of Ethics

1. Give first consideration to the objectives and policies of my institution.
2. Strive to obtain the maximum value for each dollar of expenditure.
3. Decline personal gifts or gratuities.
4. Grant all competitive suppliers equal consideration insofar as state or federal statute and institutional policy permit.
5. Conduct business with potential and current suppliers in an atmosphere of good faith, devoid of intentional misrepresentation.
6. Demand honesty in sales representation whether offered through the medium of a verbal or written statement, an advertisement, or a sample of the product.
7. Receive consent of originator of proprietary ideas and designs before using them for competitive purchasing purposes.
8. Make every reasonable effort to negotiate an equitable and mutually agreeable settlement of any controversy with a supplier, and/or be willing to submit any major controversies to arbitration or other third-party review, insofar as the established policies of my institution permit.
9. Accord a prompt and courteous reception insofar as conditions permit to all who call on legitimate business missions.
10. Cooperate with trade, industrial, and professional associations, and with governmental and private agencies for the purposes of promoting and developing sound business methods.
11. Foster fair, ethical, and legal trade practices.
12. Counsel and cooperate with NAEP members and promote a spirit of unity and a keen interest in professional growth among them.

Source: Reprinted with permission of the National Association of Educational Procurement, www.naepnet.org.

FIGURE 3.3
National Institute of Governmental Purchasing (NIGP) Code of Ethics (Short Version)

1. Seeks or accepts a position as head or employee only when fully in accord with the professional principles applicable thereto and when confident of possessing the qualifications to serve under those principles to the advantage of the employing organization.
2. Believes in the dignity and worth of the services rendered by the organization and the social responsibilities assumed as a trusted public servant . . .
3. Is governed by the highest ideals of honor and integrity in all public and personal . . . relationships in order to merit the respect and inspire the confidence of the organization and the public being served.
4. Believes that personal aggrandizement or personal profit obtained through misuse of public or personal relationship is dishonest and not tolerable . . .
5. Identifies and eliminates participation of any individual in operational situations where a conflict of interest may be involved.

Source: NIGP: The Institute for Public Procurement

As can be seen, all three of the plans are specific and easily understood. However, in order for any ethical code of conduct to be effective, there must be enforcement. In most cases, unless the purchasing agent commits egregious violations, it is business as usual.

WOMEN AND MINORITY COMPLIANCE

LO 3.7 State factors needed to be in compliance with women business enterprise (WBE), minority business enterprise (MBE), and disadvantaged business enterprise (DBE) programs.

Government contractors, under certain conditions, must award subcontracts to minority or disadvantaged bidders. Several Fortune 500 companies have implemented measures to encourage purchasing managers to purchase from a variety of diverse suppliers. To be eligible to participate in some federal or state programs, a company must be certified as at least one of the following:

- *Women business enterprise (WBE).* To classify as a women-owned business, a company must be at least 51% owned by one or more women or, in the case of a publicly owned business, at least 51% of the stock of which is owned by one or more women, and whose management and daily business operations are controlled by one or more women.
- *Minority business enterprise (MBE).* To classify as a minority-owned business, a company must be at least 51% owned, managed, and controlled by one or more minority persons. Minority means being African American, Hispanic American, Native American, or Asian American.
- *Small Business Administration (SBA) hub zone.*
- *SBA disabled veteran.*
- A Disadvantaged Business Enterprise is a small business as defined by the Small Business Administration that is at least 51 percent owned by socially and economically disadvantaged individuals who:
- Are US citizens or permanent residents
- Possess expertise in the field
- Control the daily business operations
- Have a personal net worth less than $1,320,000 (excluding the value of their primary residence and assets of the firm applying for DBE certification)

The following groups are presumed by law to be socially and economically disadvantaged: Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Subcontinent Asian Americans, and Women.

SUMMARY

LO 3.1 Define the extent of the purchasing professional's legal authority.

The three types of purchasing authority are express authority, implied authority, and emergency authority.

1. Express authority is the authority the principal has expressly given to the agent whether orally or in writing. Express authority is conferred to the purchasing manager by the principal. The detail associated with the appointment should reside in the company bylaws.

2. Implied authority is suggested by the law at the time the principal grants express authority to the purchasing agent. It gives the purchasing agent the legal authority to carry out the duties for which he or she was appointed.
3. Emergency authority applies in cases where the purchasing agent does not have express or implied authority but may take action when an emergent situation requires so; it is rarely used.

LO 3.2 Identify the requirements and terms necessary for a purchase contract to be legally enforceable.

The four components of an enforceable (contract) agreement are the following:

1. *The parties must be capable.* Both parties must know what they are doing. This standard clearly eliminates parties who are impaired in any way. Impairment includes a mentally unstable person, a confirmed alcoholic, and a confirmed drug addict.
2. *The subject of the matter must be legal and valid.* The definition of a valid contract is that the product or service contracted must be legal and not against public policy. The court cannot enforce a contract that is illegal.
3. *There must be mutual consideration.* The definition of consideration is that something of value passes from one party to a second party in exchange for a promise of the second party.
4. *The parties must reach an agreement by offer and acceptance.* In a purchasing situation, the seller usually makes an offer and the buyer accepts, negotiates, or rejects the offer. Only when the offer is accepted is there an agreement.

LO 3.3 Define what makes an offer legally valid and the terms that may be aligned with the offer.

A valid contract hinges upon the mechanics of reaching an agreement. To have an agreement, there must be an offer and an acceptance of the offer. There are three necessary components to a legitimate offer: intent to make an offer, communication of the offer intent, and identification of the specific subject matter. Specific subject matter identifies the terms of the contract and usually is a statement of the following: quantity, quality, price, credit terms, delivery terms, and leasing.

LO 3.4 Explain the role of the purchasing manager in the execution of contracts and purchase orders.

Purchasing personnel routinely sign purchase orders and contracts committing the company to the specific terms and conditions as specified in these documents. In most instances, the purchasing official initiates an invitation to do business. The RFQ is an excellent way for the buying firm to test the market without making a legal commitment to purchase. The RFQ lacks the *intent* component. When the intent component is missing, the document is merely an invitation to bid. Purchasing personnel also have a role in making offers and should be familiar with the specifications of a firm offer, an options contract, bid bonds, and promissory estoppels.

LO 3.5 Express the legal impact of the information age.

The Internet has infiltrated every aspect of the world. E-mail and text messaging have outpaced the postal system as the primary communication mode in the developed world. The Electronic Signatures in Global and National Commerce Act (ESIGN) made most e-contracts and e-signatures legal and enforceable just as paper contracts and signatures. The 50 states have adopted the Uniform Electronic Transactions Act (UETA) that provides legal validity for contracts in a similar manner as the federal law (ESIGN).

LO 3.6 Discuss the importance of ethics in purchasing.

Ethics can be defined as the standards of right conduct. However, depending on many factors, what constitutes ethical conduct varies. On the other hand, there are many clear examples of unethical conduct. But many business practices are less discernible among business professionals. How do you decide whether these controversial business approaches are acceptable? Some of the most egregious examples of unethical conduct are also illegal. Examples include bribery, giving and receiving kickbacks, falsifying costs on private and public contracts, deceptive behavior, and outright dishonesty about attributes of products.

LO 3.7 State factors needed to be in compliance with women business enterprise (WBE), minority business enterprise (MBE), and disadvantaged business enterprise (DBE) programs.

Government contractors, under certain conditions, must award subcontracts to minority or disadvantaged bidders such as WBE, MBE, and DBE. Several Fortune 500 companies have implemented measures to encourage purchasing managers to purchase from a variety of diverse suppliers.

KEY TERMS

Agency 52
Bid bond 60
Consideration 54
Contract 54
Emergency authority 53
Express authority 52
Firm offer 59
Implied authority 53
Offer 55
Option contract 59
Promissory estoppels 60
Purchase order 54
Request for quotation (RFQ) 59
Uniform Commercial Code (UCC) 63

DISCUSSION QUESTIONS

1. What tasks are allocated to the purchasing function? What are the legal issues associated with the purchasing function?
2. What is meant by *purchasing authority*? Give examples of each type of purchasing authority.
3. How does *implied authority* relate to *express authority*? Give specific examples.
4. Discuss the liability issues associated with purchasing agents' actions.
5. What are the requirements of an enforceable contract? Provide specific examples. How is an offer related to a contract?
6. Compare an invitation to bid with an offer.
7. What are the four outcomes of an offer?
8. Explain how the purchasing agent can protect the company against a revoked offer.
9. Discuss the legal impact of the information age on the purchasing function.
10. What is an electronic signature?

SUGGESTED CASES

Case 23: Pendleton Construction, Inc.

Case 27: Simpson Hospital Systems

Case 28: Tom & Jerry (T&J) Construction, Inc.

PART II

Materials Management

4 Materials Management

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

4.1 Explain the relationship between materials requirements, capacity planning, and inventory.

4.2 State the relationship of throughput time to inventory.

4.3 Compare the order cycle as a link and as a set of activities.

4.4 Identify the components that impact customer satisfaction.

4.5 Compare objective and subjective measures of quality.

4.6 Discuss the concepts of conformance and specifications as they relate to the quality of materials.

4.7 Define maintenance, repair, and operating supplies by how they factor into materials management.

4.8 Define standard and nonstandard tooling related to specifications.

Tim Brown, the purchasing manager at Thomas & Company, pointed out that since they are a job-shop organization, they cannot afford to buy in large enough quantities. Ninety percent of the steel is purchased through a broker. According to Tim, it makes more sense for small firms to order through a broker. Thomas & Company maintains an excellent relationship with their brokers. Tim has negotiated with the steel broker to get the price based on the annual usage of steel rather than on an individual order. The lead times are also remarkable, being only, on average, 1 to 3 days.

He later explained, "Our main competitive advantage is high service, as we can serve our customers a lot faster. A good relationship with our suppliers also allows us to operate an inventory-less job shop."

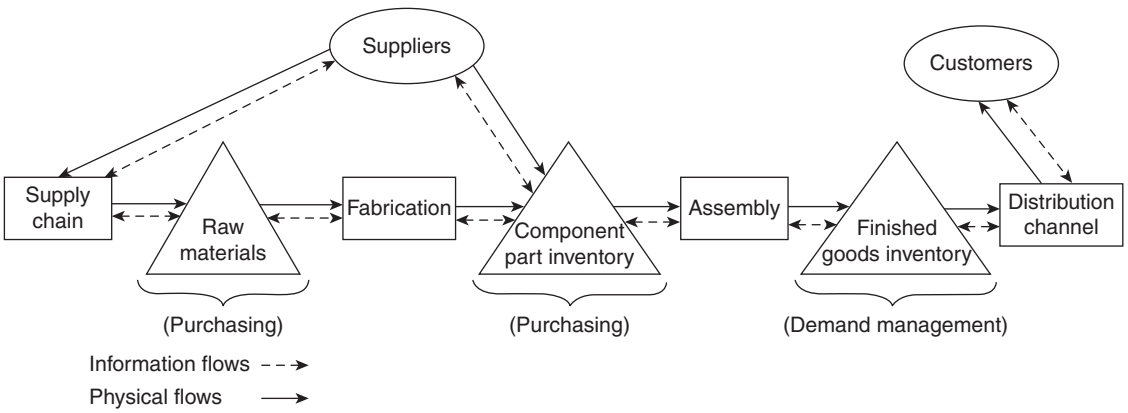
INTRODUCTION

The purpose of materials management is to support the transformation of raw materials and component parts into shipped or finished goods. The function of inventory, in general, is to decouple the entire transformation process. During the transformation process, materials are combined with labor, information, technology, and capital. The five functions of inventory are these:

1. *Pipeline inventory.* The supply pipelines of the entire system require a considerable investment in inventory. If the system's volume is 1,000 units per week and it takes one day to transport from the supplier to the plant, there are 1/7 x 1,000, or about 143, units in transit on the average.
2. *Cycle stocks*. Assume the average unit sales volume is 5 units per week or 15 units in the 3-week ordering period. Thus, the firm must have no fewer than 15 units of cycle stock on hand when the order is placed for an average on-hand cycle stock of 15/2, or 7.5 units. During the 3-week replenishment period, cycle stock is required. The concept of average inventory is addressed in the next section.
3. *Seasonal inventories.* If demand follows a seasonal pattern, inventories can be accumulated during low-sales periods and depleted during high-usage periods to avoid problems associated with adjusting capacity.
4. *Safety stocks*. Safety stocks are designed to absorb random demand uncertainties.
5. *Decoupling stocks.* Stocks of inventories at major stocking points throughout the system make it possible to carry on each activity independently. That is, the presence of inventories allows for each work center to begin at the same starting time.

These five basic functions of inventory are fundamental to achieving smooth flow, reasonable equipment use and materials handling costs, and maintenance of good customer service. Periodically, an inventory audit of the five functions must be performed to compare the "should have" and the actual investment (units) for each function. Inventory is treated as a current asset for accounting purposes. Figure 4.1 illustrates a flow diagram of inventory usage in a materials management system.

FIGURE 4.1
Production Inventory System



The supplier is the source of raw materials and component part inventories. Customer service is a concept that applies to all suppliers whether they are external to the company or internal. In the system shown in Figure 4.1, there are both external and internal pairs of suppliers and customers, for example, suppliers–purchasing, purchasing–assembly. Each supply point must meet peak demand or suffer the loss of sales when demand exceeds capacity.

MATERIALS REQUIREMENTS PLANNING AND CAPACITY REQUIREMENTS

LO 4.1 Explain the relationship between materials requirements, capacity planning, and inventory.

When planning to acquire materials, whether raw materials, component parts, or finished goods, the capacity must be considered for both the buyer and seller. Each materials acquisition must be translated into a capacity requirement by the supplier.

Capacity Management

Capacity management
A systematic process of matching planned system outputs with the necessary capacity requirements.

Capacity management is defined as a systematic process of matching planned system outputs with the necessary capacity requirements. For example, suppose capacity is the potential to produce 50 assemblies an hour. Although the short-term capacity may be higher, effective capacity is a range of substantial output under normal conditions, that is, a rate. A manufacturing plant is designed to produce 1,000 units of product a day. Is it possible for the plant to operate at a rate of 10, 50, or 120 units a day? There is a lower limit beyond which it is not economical to run. At some point, management will decide to shut down rather than produce indefinitely at a rate that does not generate revenues to cover fixed and variable costs. At low rates of production, fixed costs are borne by small volumes of output resulting in higher unit costs.

The upper level of production is limited by the process technology and/or the disposition of the workforce. Can a plant manager exhort workers to produce, in the short run, at very high levels of production to satisfy a very important customer? Probably yes, but not very often. Pushing the plant (equipment, people, and suppliers) to produce at very high levels of output accelerates wear and tear on machines and people. Machine maintenance, quality, and morale suffer.

Combinations of factors determine lower and upper bounds of capacity. Plant managers are concerned that productive facilities be well utilized. For the economy as a whole, we monitor the use of industrial capacity as an indicator of the general level of economic activity.

Capacity and Inventory

In general, inventory is stored capacity. If capacity is insufficient to satisfy peak demand for a product with seasonal sales, finished goods inventory can be accumulated during periods of low demand. In other words, if this inventory did not exist, management would have to invest in additional production equipment and systems to satisfy the demand of customers during peak demand periods. In the age of computer-integrated manufacturing (CIM), computer-aided design and manufacturing (CAD/CAM), flexible manufacturing systems (FMS), and group technology (GT), the burden of specification is changing from the buying organization to the supplying organization. The implications are serious. Buying

organizations must be knowledgeable about the new manufacturing technologies so they can make good decisions about their purchase, implementation, and use.

THROUGHPUT TIME—VELOCITY

LO 4.2 State the relationship of throughput time to inventory.

The delay between receipt of raw materials and the availability of the finished goods produced from them is **throughput time (TPT)** or velocity. The concept applies also to single components of the supply chain; for example, we speak of the TPT for the plant or distribution center.

Throughput time (TPT) The delay between receipt of raw materials and the availability of the finished goods produced; also known as velocity.

For the whole system, TPT should be as short as possible. Consumers prefer to obtain goods or services in the shortest possible time. If TPTs are long, it is more likely that the customer's requirements will change:

> *"I know we ordered 100 units, but now we only need 75." "Yes, we ordered 50 blues and 50 greens; now we really need 75 blues, 15 greens, and 10 reds!" "As long as you haven't finished the order, we'd like to change the product specifications." "The due date we originally agreed to was the first of the month, but now we don't need the stuff until the 15th."*

The longer an order for material stays in the plant, the larger the work-in-process inventory will be, the larger the storage area required, and the more likely the material will be damaged, lost, or stolen. Work-in-process inventory has little market value except to the salvage yard. The firm is not in the business of making and inventorying work in process. The adage is, "Move it out; ship it; bill the customer."

ORDER CYCLE

LO 4.3 Compare the order cycle as a link and as a set of activities.

The **order cycle** is both a link and a set of activities.

Order cycle (1) The flow of information and materials. (2) A set of activities.

The Order Cycle as a Link

As a link, the order cycle facilitates the flow of information and materials. Customers communicate orders and inquiries about the status of orders. Suppliers respond and initiate the movement of product to the customer. The link that is the order cycle is sometimes visualized as a conduit or pipeline. The **pipeline** is the means by which various resources flow (see Figure 4.2):

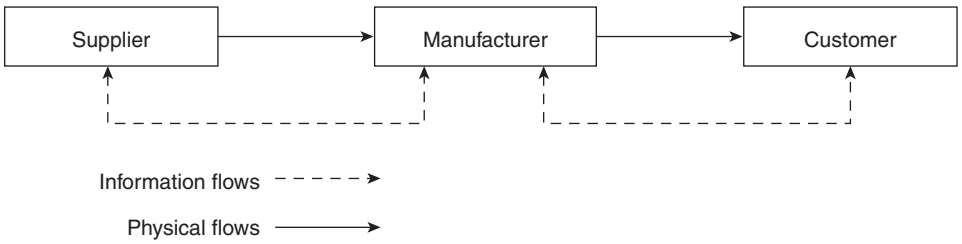
Pipeline The means by which various resources flow.

- Information (orders, billings, inquiries)
- Material
- Money (credit)
- Title

Distribution managers speak of a **distribution channel** when they mean the network of system components from the manufacturer to the final consumer, and the pipeline or linkages that tie the components together. From these notions, the concepts in the following sections can be developed.

Distribution channel The network of system components from the manufacturer to the final consumer, and the pipeline or linkages that tie the components together.

FIGURE 4.2
The pipeline is the flow of resources



Integrated Materials System

Channel separation
A process where the company develops various marketing techniques and strategies in order to service a large customer base.

It is not necessary that all resource flows between components occur at the same time or in the same manner. This idea is called **channel separation** and is useful when designing supply-distribution systems. It really isn't accurate to say that components are joined by a single link. The pipeline actually has several channels because the transfer of materials, information, money, and title requires separate and specialized channels. Only in the simplest of exchanges would resource flows occur simultaneously.

The order cycle has some important characteristics. First, an order cycle has "length." The distance between supplier and customer determines, in part, how long it takes to transmit data and transport materials. However, the *modes* by which information is sent and material moved also determine the length of the order cycle. A customer may elect to have an order moved by various transportation technologies (modes):

1. Air
2. Rail
3. Truck
4. Water
5. Pipeline

Trade-off involves speed, reliability, inventory, and cost. For lightweight, high-valued items, overnight parcel express might be justified, but this would not be the case for a heavy, low-margin, noncritical item.

Customer orders also may be transmitted by alternative technologies:

1. Telephone
2. Postal service
3. Internet
4. Fax
5. Electronic data interchange (EDI)

The prices of these modes vary; although more rapid service usually implies a higher price, technologies such as the Internet have somewhat changed that paradigm. Once the infrastructure investment (e.g., fax machine, Internet, software) is made, the incremental cost is very low despite very high rates of communication. The more rapid, the higher the price. The trade-off considerations are similar to those for transportation.

The shorter the order cycle, the quicker the customer is served and the less inventory the manufacturer needs. If you have a reliable supplier who can supply you every day, you would order just enough to satisfy your daily requirement. At the end of the day, your stockroom would be empty. You can manage with a minimum of inventory, and your customer in turn will benefit. All of the activities that comprise the order cycle can be modified (redesigned) to change the time required, but always there are trade-offs to be evaluated—price, inventory, and customer service. See Chapter 3 for a discussion on how electronic signatures have increased the speed of the order cycle.

The Order Cycle as a Set of Activities

The order cycle is not only a link but a set of activities:

- Order preparation
- Order transmission
- Order processing
- Order transportation
- Order receipt

The principal activities and the locus of responsibility are identified in Table 4.1.

Each activity is in turn a bundle of tasks. For example, the receipt of materials by the customer involves the following:

1. Physical receipt
2. Unloading
3. Inspection

TABLE 4.1
Principle Activities in the Order Cycle and Their Locus of Responsibility

Activity	Responsibility
Order preparation	Customer
Order transmission	Customer
Order processing	Supplier
Order transportation	Supplier
Order receipt	Customer

4. Storage location decision
5. Move to storage
6. Documentation

Each of these, in turn, initiates further activity. For example, inspection verifies that the materials were in fact ordered, the condition of the order, and whether the order is complete. If everything is okay, accounts payable is notified so that payment to the supplier is made.

Lead time The period of time required to perform a specific activity of work.

Lead time is the time between the initiation and delivery of an order or process. If we represent the order cycle as a set of activities, we can identify an important property of the order cycle—lead time. Some may argue that lead time begins when the order is transmitted. We'll go a step earlier and include order preparation, which begins when the need for material is recognized (see Benton & Krajewski, 1990).

CUSTOMER SATISFACTION

LO 4.4 Identify the components that impact customer satisfaction.

Customer service The fraction of customers' demand that is satisfied without delay, or received as promised; also known as service level or fill rate.

Earlier we spoke about **customer service**. Whether the term *service level* or *fill rate* is used, the idea is the same: the fraction of customers' demand that is satisfied without delay or received as promised. Customer service is only one dimension of customer satisfaction. The latter includes material availability and a whole lot more. Customer satisfaction is whatever it takes to make the customer happy. In this sense, it is defined by the customer, may be subject to change, and is subjective. Suppliers cannot say what customer satisfaction is unless they have talked with their customers.

Quality, as we'll see shortly, is another concept that's explained in various ways. Good quality is a consumer expectation and a vital part of customer satisfaction. General Motors has adopted what it describes as a "customer-oriented vehicle evaluation" quality audit. Previously, finished vehicles were randomly taken from the assembly line daily and inspected for completeness, fit, and finish. This process is called a *static audit* because the vehicles are not road-tested.

Corporate officials learned from talking with customers that half of their complaints were not detected by the static audit. An enhanced audit was developed that included a road test so that engine and transmission performance, as well as squeaks, rattles, wind noise, and water leaks, could be discovered. The number of discrepancies found during the road test was added to discrepancies noted during static auditing. Discrepancies by vehicle and plant are reported throughout specific General Motors divisions.

The objective of the program is "zero discrepancies." Management describes the enhanced audit as an aid to achieve world leadership in product value and customer satisfaction. General Motors believes this audit process allows a vehicle to be rated through the eyes of the customer. "Our customers decide whether we pass the final audit."

Subjectively, customer satisfaction is what the customer says it is. The following are elements of satisfaction.

Material Availability

Two cases must be distinguished. If a firm makes products *to order*, customer service is measured by the degree to which products are completed and shipped *as promised*.

Conceivably, an order may be rescheduled at the request of the customer, in which case the revised date is used to determine whether the order was shipped on time, early, or late.

Make-to-order (MTO) is a manufacturing process in which manufacturing starts only after a customer's order is received. Many make-to-order (MTO) firms faithfully calculate the ratio of on-time to total shipments. When customer service is measured this way, we speak of a firm's *delivery performance*. It's not uncommon to have delivery performances in the 90% and higher range. Rather than strive for a particular number, management needs to know what its competitors are doing. High delivery performance may only indicate scheduling inflexibility on the part of the supplier. "You asked for shipment on the 15th, and, by God, that's when we're shipping."

Make-to-order (MTO) A manufacturing process in which manufacturing starts only after a customer's order is received.

The second case is the firm that produces standard products in anticipation of demand for them—a **make-to-stock (MTS)** firm. The consumer expects to find the product on the shelf, that is, available for immediate shipment. In this case, order processing time does not include purchasing and production delays, unless a stock-out is experienced.

Make-to-stock (MTS) A traditional production strategy that is used by businesses to match the inventory with anticipated consumer demand.

If all customer orders are processed without delay, the level of service is 100%. Service level (SL) for an MTS firm is the ratio

$$SL = (\text{orders shipped}/\text{orders received}) \times 100$$

Unfilled orders are processed in one of three ways:

1. Backorder
2. Substitution
3. Cancellation

A customer who goes on backorder chooses to wait until material again becomes available. It is estimated that processing a backorder (or any special order) is 3 times more costly than handling routine orders. Backorders are filled; customers are inconvenienced.

There are other ways to express relative availability. Some companies offer "same day service," which means in most cases that orders received today are shipped today. Transportation time then becomes the determinant of delivery delay. Sometimes the service level objectives may be expressed in terms of 90% of an order received will be shipped within 4 days of receipt.

On-Time Shipment

This element of customer service is a variation on the notion of availability. On-time shipment has to do with the delivery promises made, and the ratio of orders shipped as promised to total orders. If an order is shipped on time, it is presumed that the customer is well served. Realistically, customers are more concerned about when the materials are *received*. In today's high-velocity environment, Amazon offers some customers same-day deliveries.

On-Time Receipt

Customers place orders based on *need dates*. The more imminent the calendar date, the more urgently material is needed. To say an item is needed on the 10th of the month means that if the item is not actually in hand on that date, dire consequences ensue. Sometimes the need date is called the "drop dead date." "If I don't receive the order by the 15th of the month, I'm dead."

The customer thinks of material delivery in terms of the date of receipt, not the date of shipment. However, the supplier often has little control and not much information once an order is turned over to a transportation firm. Calls to the supplier are answered with the explanation, "It's on the truck, or plane, or in the mail." Suppliers rarely ask customers about the receipt of an order, using the logic "no news is good news." However, the absence of complaints doesn't mean that customer service is satisfactory. Suppliers need to follow up to determine whether orders were received on time, in good condition, and so on (see Benton & Shin, 1998).

Complete Shipment

Orders commonly call for numerous items, sometimes in matched sets. A manufacturer of office furniture receives orders for matched desks, chairs, tables, and file cabinets. An order probably contains the requirements to furnish one particular office. The customer expects to receive all items at the same time. If a complete order cannot be shipped, the customer should be given the choice of a split shipment or rescheduling the order. If a customer accepts partial receipt of an order, we say that the partial shipment was planned. The customer knows where and when the balance will be shipped. Unplanned partial shipments (actually receipts) result when materials are misrouted, lost, or stolen. The order left the supplier complete but arrived short.

Quality of shipment

The quality of material can deteriorate between the time it leaves the production floor and the time it arrives at the customer's storeroom. Packaging, loading, transport, and unloading can all take a toll. Although damages can be claimed, materials received in poor condition are unsuitable for processing or distribution. The effect is the same as if a partial shipment were received. One purpose of receiving inspection is to determine damages and begin the procedure to replace, repair, or claim compensation. While the supplier may point an accusing finger at the carrier, the customer service obligation does not end at the supplier's loading dock.

Flexibility

Flexibility is the extent to which a supplier can accommodate a customer's requests. Perhaps the request is for special processing, packaging, or shipment. Even make-to-stock manufacturers receive such requests. The need to be flexible blurs the distinction between *make-to-stock* and *make-to-order*.

The name of the game, whatever the firm's classification, is *customer satisfaction*. Note that the costs of these extras are borne by the customer. The question is not who pays but the willingness and ability of suppliers to cost-effectively perform nonstandard tasks for the customer.

Some requests for flexibility require that a supplier change its basic mode of operation. A wholesaler may perform processing and packaging—activities we normally associate with production. If such activities are offered to all customers, and become the basis by which the firm competes, the wholesaler has integrated vertically. The steel service center is a good example. What began as occasional requests to perform basic operations (cut to length, form, and grind) now constitutes a major part of the product-service offering of the steel service center. Don't call it a steel warehouse because it's much more than a place to store

steel. A more comprehensive discussion about shifting activities forward or backward in the production-distribution network or channel is given in Chapter 6.

Responsiveness to Inquiry

Customers want assurances that their orders are on schedule, especially as the shipping date nears. This element of customer service is the timeliness and accuracy of the information a supplier provides a customer. Suppliers who can't locate an order on the shop floor, or in the warehouse, or who answer all inquiries with, "It just went out on the truck," inspire little confidence.

Customers don't call to simply chat but for information on which they can rely. You'll be reminded often in this text not to lie to the customer. Even if the truth is disappointing, or puts the supplier in a bad light, the sooner the customer has the facts, the sooner the necessary adjustments can be made. If, as a customer, you are told by a supplier that its workers have begun a work stoppage, you can begin to plan alternatives immediately. If, however, you learn about the walkout 2 weeks later when your order's shipping date has come and gone, the consequences for you are more severe—your options are fewer and probably more costly.

Customers want and should get as much notice as possible. Don't tell customers what you think they want to hear, unless it is the truth. Putting an unrealistic shipping date on the order ensures only disappointment.

Customer Satisfaction—The Balance

To summarize, customers want the following:

- Material availability—the right material is available when needed
- On-time delivery—the most important efficiency metric of supply chain processes in an organization
- On-time receipt—the interval between when an order is received from a customer and when action is taken to complete the order
- Completeness of shipment—a shipment that is undamaged and complete and satisfies the customer's requirements
- Good quality
- Flexibility or customizability

The cost of satisfying a customer's delivery time needs may not be entirely known, but we can argue that none of these elements of customer satisfaction are realized without cost. When customers are dissatisfied, other hidden costs are incurred—the costs of customer dissatisfaction. For example, the cost of good-quality materials is the sum of the cost to *prevent* poor quality and the costs to *detect* and respond to poor quality if it occurs. Presumably, if prevention, detection, and response are practiced, a supplier will ship good-quality products.

If poor quality is produced, goes undetected, and is shipped, the costs to both supplier and customer are substantial. The longer the defective material goes undetected in the consumer's plant, the greater the cost. If defects are found during receiving inspection, the costs of inspection and raw material are involved. If the defective materials go undetected to the shop floor when they are processed, the cost of scrapping the semifinished product is much

greater. If the substandard materials are shipped as finished goods to customers, the final cost of poor quality can be many, many times the cost of the original substandard materials.

There are direct and measurable costs associated with poor quality. Yet the more important and difficult-to-measure costs are those associated with the damage to a supplier's reputation, the loss of a customer's capacity, and the dissatisfaction if the customer in the field vows never again to buy the product. We could describe the costs of providing the other elements of customer dissatisfaction similarly. The balance that management seeks is between the

- cost of customer satisfaction and
- cost of a dissatisfied customer.

QUALITY

LO 4.5 Compare objective and subjective measures of quality.

We hear so much about quality that it may come as a surprise that even experts don't agree about how to achieve it. *Fortune* asked the gurus of industrial quality to define it and to assign responsibility for quality, and varying viewpoints were brought forth. To some, quality is a technical matter. It has to do with engineering—both the process technology and product design. To others, quality is a statistical measure that uses sampling to achieve process control and make certain that inferior-quality material isn't shipped from the plant. There is a third view—that quality depends on motivation. This means making a slogan or a rallying cry—"Zero Defects" or "Quality Is Free." The most revered of the quality gurus, W. Edwards Deming, hammers away at management as being the culprit when quality is poor. If management doesn't properly equip workers, how can they be expected to turn out high-quality products?

Is quality technical, statistical, motivational, or managerial? The answer is all of these. What the opposing points of view forget is that different situations call for different treatments. Not all quality problems respond to the same remedies. A firm might have the very best process technology, but its people may be poorly motivated. On the other hand, motivated and experienced workers can do little to improve quality if their materials, process technology, and supervision are second-rate.

Perhaps what the gurus need is a unifying focus. Quality, we have said, is an element of *customer satisfaction*. When all is said and done, quality is what the consumer says it is. As the baseball umpire retorted when the batter asked if the pitch was a ball or a strike, "It ain't a ball or a strike until I say what it is."

Quality is neither good nor bad until consumers cast their ballots in the marketplace. Even though the technology of quality is steeped in statistics and manufacturing engineering, materials managers first need to consider quality as part of the expectations of customers, whether intermediate or final. The quality of materials is uppermost in the minds of end users. Not only should products meet the customer's expectations, they should arrive in good condition. Intermediate customers (e.g., internal) have the same expectations. Buyers of materials evaluate suppliers based on quality, reliability, and price. Note that quality ranks first. Consequently, materials managers, as suppliers, are increasingly concerned about the quality of raw materials, work in process, and finished goods.

Quality is a strategic decision. What should the quality of a product or material be? How do we compete with offshore manufacturers that enjoy reputations for leadership in quality?

What's the quality level of domestic producers in our industry? Top management must decide the *quality level* of materials—high, low, or in between.

All sorts of factors contribute to a customer's perception of quality. Perhaps the reputation of the supplier is important. Advertising may influence one's perception: "We are the Rolls-Royce of our industry." Sometimes advertising underscores historical quality: "Made in the centuries-old tradition." The claim that products are handcrafted is meant to suggest high quality. Customers often believe that high-priced materials are also high in quality, "It's *worth* what you paid for it."

PHOTO 4.1 Levi's is a well-known brand with a history of quality and authenticity.

Quality, in large part, is what people perceive it to be. Once formed, perceptions about the quality of a supplier's materials are slow to change. Despite the subjective nature of quality, expectations about quality are conditioned by public and private organizations that test materials and publish their findings. Consumers Union, a nonprofit organization, is probably the best known. To *qualitatively* evaluate consumer products and services, Consumers Union first identifies the relevant characteristics of a product. It then tests comparable products of various manufacturers and classifies products as

- Best buy
- Acceptable
- Not acceptable

"Best buy" implies a product with high *value*. **Value**, in turn, is the ratio of quality and price:

Value = Quality/Price

Value The real worth of an article; marketable price; the intrinsic worth of an item. The value of an article is determined by the lowest cost at which a satisfactory supply of materials and equipment or services can be obtained.

Suppose we have comparable products of three manufacturers. The quality ratings and prices of the three products are shown in Table 4.2.

Quality is a value in the range of 1–10 with 10 being the highest possible rating. Product A is not the least expensive at $110, but with a quality rating of 9, its value is

[Quality/Price] x 100 = [9/110] x 100 = 8.2

Product A is regarded as a *best buy*. Assuredly, the quality ratings of the respective manufacturers would differ from those shown in Table 4.2. To each manufacturer, the quality would be high, but the manufacturers are defining quality from an engineering specifications point of view.

Quality in the previous example is the degree to which a product meets customer expectations. In an issue of *Consumer Reports*, low-price lawn mowers were evaluated. The quality-defining product characteristics were these:

- Evenness of cut
- Dispersal of clippings
- Freedom from clumping
- Handling

TABLE 4.2
Quality Ratings and Prices

Product	Quality Rating	Price	Value
A	9	$110	8.2*
B	7	$137	5.1
C	7	$105	6.7

**Best buy.*

Judgments were made during field trials by experienced operators who tested a total of 30 side- and 11 rear-bagging mowers. Two of the lowest-priced mowers at $120 were judged *best buys*. The top-quality mower was priced at $250. Its performance was not sufficiently better than the $120 models to qualify as a best buy. The purchaser of a *best buy* product is able to say, "I really got my money's worth."

The quality-defining characteristics of products are those important to the end user of the product. Owners of lawn mowers are not primarily concerned with detailed mechanical or electrical specifications. They want a product that leaves a good-looking lawn and provides relatively trouble-free operation. Owners look first at the way a product serves the purpose for which it was acquired. I am not suggesting that design specifications and manufacturing conformance to specifications are irrelevant where product performance is concerned. I am suggesting that the perceptions of quality held by the consumer and the producer are both important.

A product designer's job is to capture (in the product's design) the expectations of the customer. It's not a matter of designing a product and then foisting it off on the customer. "But customers don't know what they want until we tell them." Arrogance of that kind is fatal in this age of upwardly spiraling expectations of better-informed buyers.

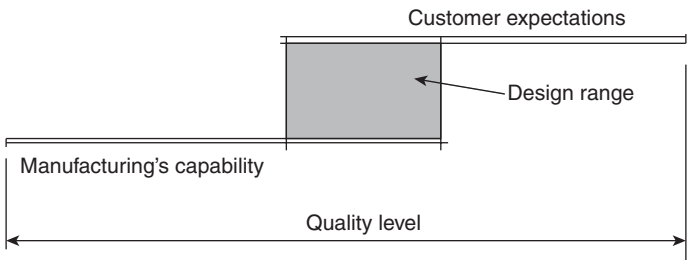
Design means setting the *specifications* for a material or product. Specifications result in the *functional* and *aesthetic* characteristics of the product. The job of the materials manager is to ensure that products are made in the least costly way so that the item qualifies as a best buy.

The Quality Level

The process technology and experience of a supplier limit the range of quality possible. We wouldn't expect a general machine shop to produce high-quality integrated circuit chips. The design of a product must "be producible" given the process capability of the supplier. Within that range, top management sets the quality level—the degree to which the product *functionally* satisfies customers. If it should turn out that the design fails to meet customer expectations (regardless of price), the firm needs to invest in better technology or forfeit the market. This intersection of process capability and expectations is shown in Figure 4.3.

Within the area of intersection, management calls for the quality level it believes to be strategically best. But what does it mean to say that a product's quality is high or low? We have repeatedly said that quality is subjective. It's what a customer says it is. On the other

FIGURE 4.3
Expectations Capability Intersection



hand, on what basis could the mower manufacturers claim that their products are high quality? There is an *objective* definition of quality.

Objective Quality

This is the degree to which material *conforms* to specifications. If conformance is high, the company can claim that product quality is high. Lawn mower specifications are complex. Hundreds of parts are produced and assembled. Each part has numerous dimensions and properties. Surfaces of mating parts are finished to extremely small tolerances to ensure proper assembly. Overall product specifications are fixed—engine size, weight, blade length, and so forth.

It's quite possible to make a mower exactly to specifications, and yet that mower may function poorly—cut uneasily, leave clumps of grass, and be difficult to manipulate. When management decides the quality level, it has in mind the functional or operating characteristics of the mower—how well it cuts grass. Management identifies the market segment in which to compete—low-priced power lawn mowers. The quality–price decisions impose limits on the costs of production and distribution.

Is it possible that *objectively* a product is high quality but *subjectively* low quality? Too often the answer is yes. High-quality products must both

1. conform closely to specifications and
2. satisfy consumer expectations.

Can a product's quality be too high? Again, the answer is yes, but in this case we mean that *objective* quality can be too high. Tolerances are closer than need be, finishes are smoother than necessary—"the bottoms of the drawers are painted." Customers have little difficulty accepting the product, but it's much better than it needs to be, and very few customers would be willing to buy an item of such high quality. It does in fact cost more to produce a Rolex watch than to produce a Timex. If accuracy, durability, and appearance are the quality-defining properties of wristwatches, the Rolex should meet the customer's expectations better. Note, however, that, objectively, *both* watches are high quality if both conform closely to their respective specifications.

We should now be able to understand that *conformance* isn't a sufficient test of quality. The design of the product must be satisfactory. We also can understand why two customers appraising the quality of the same item can have very different opinions about its quality. In Table 4.3, only one of four outcomes results in a high-quality product. See Chapter 12 for a comprehensive discussion on quality.

TABLE 4.3
Objective–Subjective Quality

Quadrant	Design	Execution	Quality
1	Good	Good	High
2	Good	Poor	Low
3	Poor	Poor	Low
4	Poor	Good	Low

SPECIFYING MATERIALS

LO 4.6 Discuss the concepts of conformance and specifications as they relate to the quality of materials.

Disagreements between supplier and customer about quality often stem from misunderstandings about material specifications. Suppliers frequently interpret specifications in ways customers never intended. Qualified suppliers, given identical specifications, may come to quite different conclusions about what a customer wants. If one definition of quality is conformance to specs, the specifications must be *unambiguous*. The manner of specifying materials depends on the kinds of material ordered.

Raw Materials

Raw materials are semiprocessed materials intended for further processing—raw stock, crude oil, bituminous coal, paperboard, paper, lumber, copper, wheat, and cotton, for example. The materials listed are called **commodities**. Their specifications result from agreements on standards, as, for example, the U.S. Department of Agriculture's specifications for meat and grains.

Commodity
A standard article of trade or commerce. Similar goods or services purchased within the company. Excellent candidates for reverse auctions.

By definition, commodities are homogeneous. The output of one producer is indistinguishable from that of another. Commodity markets are organized to facilitate the exchange (buying/selling) of commodities. The quantities available at a particular market and the prices of commodities are reported daily. Spot (current) prices, as well as future prices for commodities, are quoted by specification, for example, "#2 winter wheat/bushel" or "'choice' beef/hundred weight."

Even though specifications are known, judgment is still a factor. For example, the beef buyer for a fast-food restaurant chain may specify "USDA prime beef." The grade, *a priori*, implies age, appearance, weight, and so on. Strictly speaking, there are no physical measurements for appearance, such as for "marbling," or the distribution of fat throughout the meat. Whether a side of beef is prime, choice, or good depends on one person's interpretation of the specifications (written description). Recall the umpire calling balls and strikes. The strike zone is defined for each player. It can be measured. But once play begins, umpires rely on judgment to decide the location of a ball traveling 90 miles an hour as it passes in front of a batter.

Materials such as steel are specified by *process* (e.g., "hot rolled"), physical properties (hardness, strength), and dimension. A steel buyer who orders by industry specification or *standard* incurs little risk that suppliers will misunderstand what material is required. "One-inch diameter, 1020 cold rolled steel bars, 16 feet long" means the same to everyone who makes steel. Note that while specs are unambiguous, the quality of the material produced may fail to conform to the specifications. It's the same problem we discussed earlier—poor execution of a good design.

Purchased Parts

Purchased parts include semifinished items that will be further processed and finished materials that will become components of finished end items. The usual way of specifying purchased parts in a *made-to-order environment* is with a graphic description, that is, engineering drawings. Drawings use standard conventions for showing

dimensions, finishes, hardness, and other properties. The drawing completely and unambiguously describes the part. Exactly what processes are used to make it is decided by the supplier.

When only one or a small number of parts are made to order, the buyer may not provide the supplier with finished drawings. Instead, a prototype of the part is given to the supplier with the request to "make the part as per sample." This opens the door to misinterpretation of the exact part specification.

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PHOTO 4.2 It is necessary that the customer and supplier understand blueprints.

Many parts can be purchased off the shelf. They are like commodities in the sense that they are standardized. In effect, they are *made to stock* according to specifications established by an industry, professional association, or independent testing organization. Many small mechanical parts, for example, fasteners, are manufactured to standards established by the Society of Automotive Engineers, SAE. The specifications for parts such as fixtures and wire are concerned with the satisfaction of safety standards. The buyer is assured that the part is safe to use in a particular application and that its correct installation complies with standards, for example, building construction.

MAINTENANCE, REPAIR, AND OPERATING (MRO) SUPPLIES

LO 4.7 Define maintenance, repair, and operating supplies by how they factor into materials management.

Maintenance, repair, and operating (MRO) materials are quite diverse; they are specified in various ways. The keys are quality and uniqueness.

Maintenance

Maintenance items are those we expect to periodically replace in a piece of equipment. Over time, machine parts are subject to wear and are replaced. The original equipment manufacturer expects to resupply these parts during the life of the equipment. Not infrequently, a contract to purchase equipment includes a specified number of replacement parts. Airlines purchase aircraft and spare engines. Periodically engines are removed for overhaul. Replacement parts are specified by manufactured part number and the model number of the unit in which it is installed. Problems arise when manufacturers discontinue making equipment. Replacements will be available as long as sufficient machines are in operation in the field. After that, procurement and specifications become a problem. Some equipment owners may elect to supply themselves, in which case they must provide complete documentation (specification) of the parts required. The same is true if the parts are purchased externally. Sometimes an equipment manufacturer will produce replacement parts if a sufficient number are ordered to make their manufacture profitable. The older the model being maintained, the less current experience the supplier has, and the more difficult the task of specifying. For example, try to obtain a repair part for a 20-year-old plumbing fixture in your home.

Maintenance also means the application or renewal of materials such as lubricants and coolants. Periodic maintenance (labor and materials) ensures longevity and satisfactory machine operation. In most cases, these maintenance materials are commodity-like in nature and are specified by industry or association standards. These materials are carried in stock and managed as part of raw materials inventory by purchasing management.

Repair

The distinction between maintenance and repair materials is not always clear. In theory, if good maintenance is practiced, events requiring repair will occur infrequently. Repair suggests the unexpected, which means the need to patch up or replace equipment components that we don't expect to fail. Usually the parts are not carried as inventory by the equipment manufacturer. The repair material may have to be described in very specific ways, that is, drawings and photographs. Perhaps field engineers from the machine supplier will need to be called. The more common event is repair of equipment failure in which the services of skilled craftsmen are more important than specific materials.

Operating Supplies

Operating supplies, also called "indirect materials," become part of the end item and are essential for its production, but their unit value or size is too small to plan or control usage unit by unit. A good example is rivets used in airframe construction. Rivets are "counted" by weighing them. Bins of rivets are located throughout the plant and are available to anyone on a "help yourself" basis. Rivets are set, drilled out, replaced, dropped on the floor, and so on, without regard for usage. No one would suggest counting rivets or holding assembly workers accountable for them. Adhesives are another common example. These materials are supplied as needed to assemble components or provide seals between components.

Generally speaking, operating supplies are standard items and are specified by manufacturer or industry codes. Nonstandard items should be questioned by the purchasing manager. Is the special item really necessary? Can a standard material be substituted?

TOOLING

LO 4.8 Define standard and nonstandard tooling related to specifications.

There are two kinds of tooling with respect to their specifications. The first kind is standard tooling. Various holding devices, partitioners, material cutting, and forming tools are standard with respect to their size and capacity. As with standard materials, tools are specified by the manufacturer's part or model number, or by an industry code.

The nonstandard kinds of tooling require elaborate specification. Tooling in this class is one of a kind and highly engineered. It is a make-to-order item. Detailed drawings of the tooling are necessary. Frequently the tool supplier works with the customer to design the item. The quality of this kind of tooling is especially critical. Whether the tooling is designed to position or hold material during processing, or to modify or extend the operation of processing equipment, the tooling must be built to specifications; otherwise, the quality of the material produced is unacceptable.

SUMMARY

LO 4.1 Explain the relationship between materials requirements, capacity planning, and inventory.

When planning to acquire materials, whether raw materials, component parts, or finished goods, the capacity must be considered for both the buyer and seller. Each materials acquisition must be translated into a capacity requirement by the supplier. Capacity management is defined as a systematic process of matching planned system outputs with the necessary capacity requirements.

Inventory is stored capacity. If capacity is insufficient to satisfy peak demand for a product with seasonal sales, finished goods inventory can be accumulated during periods of low demand.

LO 4.2 State the relationship of throughput time to inventory.

The delay between receipt of raw materials and the availability of the finished goods produced from them is throughput time (TPT). The concept applies also to single components of the supply chain; for example, we speak of the TPT for the plant or distribution center.

For the whole system, TPT should be as short as possible. Consumers prefer to obtain goods or services in the shortest possible time. If TPTs are long, it is more likely that the customer's requirements will change.

LO 4.3 Compare the order cycle as a link and as a set of activities.

Customers communicate orders and inquiries about the status of orders. Suppliers respond and initiate the movement of product to the customer. The link that is the order cycle is sometimes visualized as a conduit or pipeline. The pipeline is the means by which various resources flow: (1) information (orders, billings, inquiries); (2) material; (3) money (credit); and (4) title. Trade-off involves speed, reliability, inventory, and cost. The order cycle is not only a link but a set of activities: order preparation, order transmission, order processing, order transportation, and order receipt.

LO 4.4 Identify the components that impact customer satisfaction.

Whether the term *service level* or *fill rate* is used, the idea is the same: the fraction of customers' demand that is satisfied without delay, or received as promised. Customer service is only one dimension of customer satisfaction. The latter includes material availability and a whole lot more. Customer satisfaction is whatever it takes to make the customer happy. In this sense, it is defined by the customer, may be subject to change, and is subjective. Suppliers cannot say what customer satisfaction is *unless* they have talked with their customers.

LO 4.5 Compare objective and subjective measures of quality.

To some, quality is a technical matter. It has to do with engineering—both the process technology and product design. To others, quality is a statistical measure that uses sampling to achieve process control and make certain that inferior-quality material isn't shipped from the plant. There is a third view—that quality depends on motivation. What the opposing points of view forget is that different situations call for different treatments. Not all quality problems respond to the same remedies. A firm might have the very best process technology, but its people may be poorly motivated.

LO 4.6 Discuss the concepts of conformance and specifications as they relate to the quality of materials.

Disagreements between supplier and customer about quality often stem from misunderstandings about material specifications. Suppliers frequently interpret specifications in ways customers never intended. Qualified suppliers, given identical specifications, may come to quite different conclusions about what a customer wants. If one definition of quality is conformance to specs, the specifications must be *unambiguous*. The manner of specifying materials depends on the kinds of material ordered.

LO 4.7 Define maintenance, repair, and operating supplies by how they factor into materials management.

MRO materials are quite diverse; they are specified in various ways. The keys are quality and uniqueness. Generally speaking, operating supplies are standard

items and are specified by manufacturer or industry codes. Nonstandard items should be questioned by the purchasing manager.

LO 4.8 Define standard and nonstandard tooling related to specifications.

There are two kinds of tooling with respect to their specifications. The first kind is standard tooling. Various holding devices, partitioners, material cutting, and forming tools are standard with respect to their size and capacity. As with standard materials, tools are specified by the manufacturer's part or model number, or by an industry code.

The nonstandard kinds of tooling require elaborate specification. Tooling in this class is one of a kind and highly engineered. It is a make-to-order item.

KEY TERMS

Capacity management 72
Channel separation 74
Commodity 84
Customer service 76
Distribution channel 73
Lead time 76
Make-to-order (MTO) 77
Make-to-stock (MTS) 77
Order cycle 73
Pipeline 73
Throughput time (TPT) 73
Value 81

DISCUSSION QUESTIONS

1. Discuss the relationship between material requirements planning and capacity planning.
2. What is the relationship between capacity planning and inventory management?
3. What are the costs associated with quality? How does quality relate to the purchasing function?
4. Explain at least three expert views of the quality function. Which view do you agree with? Why?
5. Quality is a subset of customer satisfaction. What is meant by this statement? What is the definition of *value*?
6. What is meant by *specifying materials*?
7. How are maintenance, repair, and operating (MRO) supplies different from purchased components?
8. What skills are required to be an effective materials manager?

SUGGESTED CASES

Case 8: Central Texas Wine Distributors (CTWD)

Case 11: Delta Construction Systems (DCS)

Case 21: Morgan Summerfield (CCS)

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Benton, Jr., W. C., and H. J. Shin. "Manufacturing Planning and Controls: The Evolution of MRP and JIT Integration." *European Journal of Operational Research* 109 (1998), pp. 2–17.

Inventory Management

5

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Shelby Ross is the plant manager for the doors and molding department at Wood-Mark Products. Wood-Mark is very concerned about the company's lumber stockroom operations. There is no way to know what is available before you get to the storage area. There is usually a 50% chance of obtaining the needed lumber for a job. The stockroom situation is interfering with productivity.

Shelby prides herself on the fact that a customer can ask them for anything and he or she will receive it. For example, a customer last year asked them for three insulated redwood doors. Not only did Shelby know what these doors were, but she has a regular supplier that would send the material promptly. Wood-Mark feels that along with this "anything for the customer" attitude is an exceptional sales and service staff.

Wood-Mark currently does not have a formal inventory management system for the raw materials and finished goods they maintain in their warehouse. Wood-Mark conducts a complete inventory of raw materials and finished goods once each year. It requires 47 workers to count the items. The inventory count takes 2 days to complete, from

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

5.1 Explain the differences between independent and dependent demand.

5.2 Determine what to stock, how much to stock, and how much service to offer customers.

5.3 Demonstrate use of an ABC analysis to determine which inventory items account for the greatest dollar value.

5.4 Demonstrate how to manage inventories for independent demand using EOQ, EOQ for discounts, and calculation of safety stock.

5.5 Demonstrate how to manage inventories for dependent demand systems.

seven o'clock in the morning to five o'clock in the evening. After speaking with the plant manager, it became clear that Wood-Mark does not place a heavy emphasis on maintaining accurate inventory records. The president, Mr. Sanders, believes that since Wood-Mark is the only custom-door manufacturer in the city of Fort Worth, Texas, it does not need to compete on cost; therefore, there is no heavy concern about reducing inventory costs.

INTRODUCTION

The purchasing function is taking on increasing importance in today's industrial economy. Since materials constitute the largest single percentage of their purchasing dollars, profit-oriented firms have turned to professionally operated purchasing departments to make sure they are getting full value for their outlays on materials.

In many purchasing situations, a number of different considerations conflict with one another that influence the final purchasing decision. Rush orders usually cost more. Large-quantity orders lower the unit cost but may increase inventory. It is the task of the purchasing department to evaluate all of these considerations and to come up with the proper buying decision. This decision may have to be made based on inadequate information and under the pressure of time. The purchasing professional must be able to make profitable buying decisions under these conditions. The focus of this chapter is on helping the purchasing professional make profitable inventory management decisions.

Inventory is the lifeblood of any business. Most firms store thousands of different items. There are many inexpensive supply or operating type items. The type of business a firm is in will usually determine how much of the firm's assets are invested in inventory. Hospitals carry beds, surgical instruments, ventilators, food, pharmaceuticals, personal protective equipment, and other miscellaneous items. On the other hand, manufacturing firms carry office supplies, raw materials, component parts, finished products, and many other industry-related items. As shown in Figure 5.1, a large number of American firms spend from 30% to 80% of their sales dollar on materials purchased outside of the firm. These purchase costs include raw materials, component parts, packaging, and fuel, but they exclude spending on capital expenditures and services. These data show that purchasing and inventory management activities are key factors for the prosperity and survival of firms. Sound management of the purchasing-inventory interface will give firms a significant **competitive advantage** in any industry.

Competitive advantage Something that makes a company superior to its opponents in terms of value, differentiation, and focus.

FIGURE 5.1

Purchases as a Percentage of Shipments Value (Selected Industries Each With Sales Exceeding $1 Billion)

Tobacco manufacturing	0.19
Metal kitchen cookware, utensil, cutlery, and flatware (except precious) manufacturing	0.29
Pharmaceutical and medicine manufacturing	0.30
Retail bakeries	0.31
Ship building and repairing	0.31
Soap and other detergent manufacturing	0.31

Breweries	0.33
Analytical laboratory instrument manufacturing	0.34
Musical instrument manufacturing	0.37
Book printing	0.39
Explosives manufacturing	0.40
Sporting and athletic goods manufacturing	0.42
Electric lamp bulb and part manufacturing	0.42
Pump and pumping equipment manufacturing	0.44
Broom, brush, and mop manufacturing	0.45
Fertilizer manufacturing	0.47
Apparel knitting mills	0.47
Paper mills	0.48
Mattress manufacturing	0.50
Paint and coating manufacturing	0.51
Upholstered household furniture manufacturing	0.52
Aircraft manufacturing	0.52
Household appliance manufacturing	0.53
Dog and cat food manufacturing	0.53
Footwear manufacturing	0.53
Tire manufacturing	0.54
Motor and generator manufacturing	0.56
Farm machinery and equipment manufacturing	0.57
Sawmills	0.57
Electronic computer manufacturing	0.62
Coffee and tea manufacturing	0.63
Stationery product manufacturing	0.65
Metal can manufacturing	0.70
Motor home manufacturing	0.72
Cheese manufacturing	0.77
Automobile manufacturing	0.79
Petroleum refineries	0.83

Source: U.S. Bureau of the Census, Census of Manufacturers (2000).

Data link: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ASM_2016_31GS101&

Note: Calculation of purchases excludes spending on capital expenditures and services.

This chapter provides a framework for inventory management. First, a discussion of the traditional order-point system is presented. Second, a description of the dependent demand concept is outlined. The general MRP lot-sizing problem for time-phased requirements is used to illustrate the dependent-demand concept. Specifically in manufacturing, several well-known, time-phased, lot-sizing procedures are presented to illustrate. The chapter is divided into two major sections: independent-demand inventory systems and dependent-demand inventory systems.

INDEPENDENT VERSUS DEPENDENT DEMAND

LO 5.1 Explain the differences between independent and dependent demand.

To manage the various types of inventory, attributes of the items first must be analyzed in terms of cost, lead time, past usage, and the nature of demand. The nature of demand is perhaps the most important attribute. The nature of demand can be either independent or dependent. **Independent demand** is demand for end items (e.g., distribution items, finished goods, spare parts). Independent demand is unrelated to the demand for other items. In other words, demand for an independent item must be forecasted independently. **Dependent demand** is demand for a good or service that is derived from a second product or service. In manufacturing firms, raw materials, component parts, and subassemblies depend on the final item's demand. Thus, demand for a dependent item should not be forecasted independently. As an example, a completed automobile is an independent demand item that is forecasted. However, we know that each automobile requires a chassis assembly. It would make no sense to forecast the chassis assembly independently, simply because the wheels are dependent and are derived from demand for the automobile. Inventory management for dependent items is usually managed by material requirements planning. In distribution firms, demand is usually *independent*. The order quantities for each inventory item should be forecasted separately. Stock replenishment in independent-demand systems is usually determined by statistical inventory control or order-point systems.

Independent demand The demand for end items (e.g., distribution items, finished goods, spare parts).

Dependent demand The demand for a good or service that is derived from a second product or service.

INVENTORY MANAGEMENT OVERVIEW

LO 5.2 Determine what to stock, how much to stock, and how much service to offer customers.

Management of inventories is a major interest of purchasing managers. In many industries, the investment in inventories comprises a substantial share of the firm's assets (see Figure 5.1).

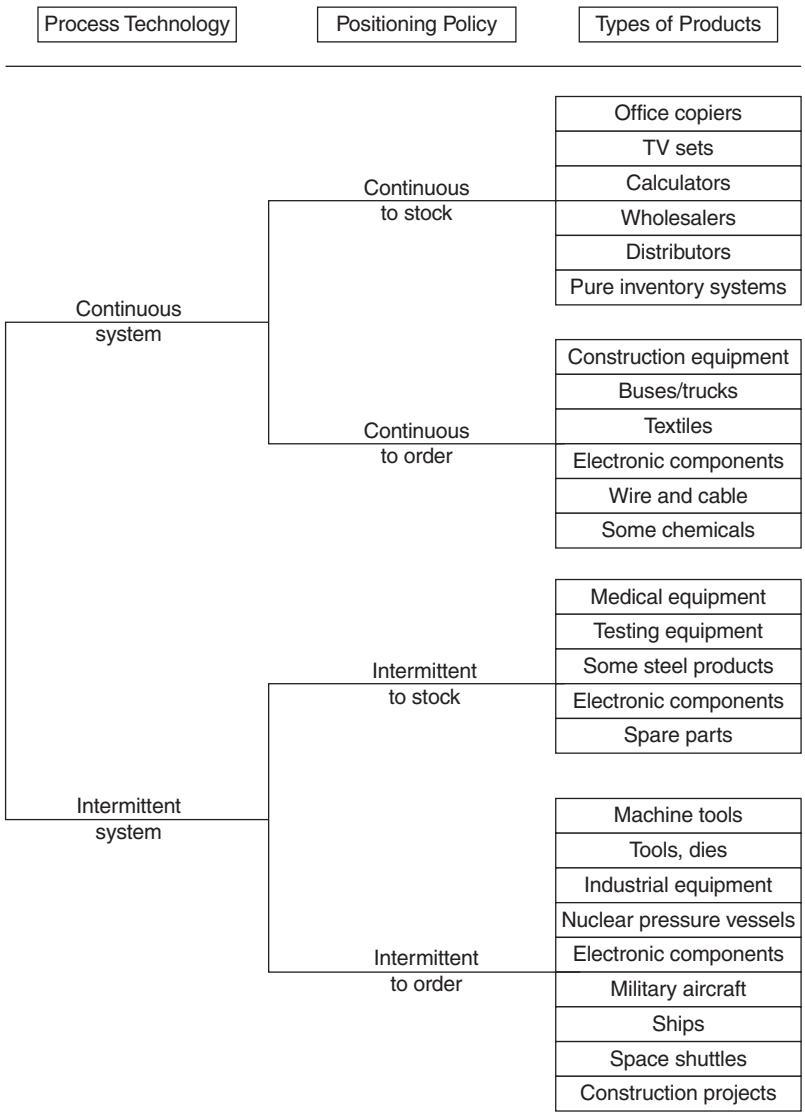
If the productivity of the inventory asset can be enhanced, the improvement will go directly to the bottom line. How does the purchasing professional know how much inventory to carry? How does the purchasing professional know when to place a replenishment order? Specifically, what guidelines should be used for making purchasing decisions? Remember, the purchasing function is directly influenced by inventory management decisions. Before inventory productivity can be improved, one must take a careful and critical look at the specific business entity. In the area of inventory management, the purchasing professional should make explicit decisions regarding the following:

1. *What to stock.* The purchasing professional, at the very minimum, must meet the requirements and needs of the manufacturer or distribution operation.
2. *How much to invest.* The purchasing professional must first review the level of capital support for inventory. This decision is usually made at the vice president level.

3. *How much service to offer.* What level of protection against stock-outs is acceptable for the competitive environment? It is impossible to achieve a service level of 100%.

As can be seen, none of these decisions is independent of the other. Moreover, combining these decisions is complex and may be closely correlated with the industry and the type of firm within the industry. In the case of a manufacturing firm, you must consider whether the production process is make-to-order, make-to-stock, or some hybrid of the two. For instance, if the process strategy in your industry follows a make-to-stock strategy, customer service becomes a key management concern. On the other hand, if you operate a distributor or retail store, you must make managerial decisions based on the potential for profitability. The production-inventory system taxonomy is shown in Figure 5.2.

FIGURE 5.2
Production-Inventory System Taxonomy



Continuous systems Produce standardized products through an assembly line.

Intermittent systems Produce nonstandardized products through a job shop.

Pure inventory systems Distribution stocking points, such as warehouses or distributors.

The production processing technology is divided into two categories: continuous systems and intermittent systems. The taxonomy is based on **continuous systems** producing standardized products through an assembly line, while **intermittent systems** are used to produce nonstandardized products through a job shop. Another category (not shown in the taxonomy) associated with continuous systems is pure inventory systems. **Pure inventory systems** are distribution stocking points, such as warehouses or distributors.

Batch operations or job shops are associated more with nonstandard products produced in discrete batches. The second-level classification of the taxonomy is the way in which goods and materials flow through productive systems and the function of inventories in facilitating this flow. An extensive literature has been dedicated to inventory over the past 40 years. Currently, inventories account for 60% to 80% of a typical industrial firm's assets. What's more, inventory serves as the lifeblood that allows businesses to operate competitively. Its existence either in the form of finished products, work-in-process, or raw materials is the lubricant of any production system. Inventories affect costs, profits, customer service, and investments in facilities. The purchasing manager must have a clear understanding of the role of inventory in the materials management system.

ABC CLASSIFICATION OF INVENTORY ITEMS

LO 5.3 Demonstrate use of an ABC analysis to determine which inventory items account for the greatest dollar value.

The inventory items that are the most important for a specific industry or firm should be those that account for the greatest dollar value. To determine which items these are, two variables must be considered: unit cost of each item and item demand. Inventory items can be classified into "A" items, which have a high-dollar usage, "B" items, which have an immediate-dollar usage, and "C" items, which have a low-dollar usage. In other words, those items that are the most demanded and most costly are the most important inventory items, and the items that are the slowest moving and least expensive are least important. To determine the usage value of an item, multiply the unit cost by annual sales volume. If a particular item costs $100 and 150 are sold in one year, then its usage value is $100 x 150, or $15,000. With only these two data points (sales and costs), you can not only rank all of your inventory items by importance but also take the first step toward controlling independent demand and distribution inventories. If you analyze what sells the most and what costs the most, a predictable pattern will emerge with most distribution inventories.

1. Certain items are demanded by a great many customers.
2. Most items are only demanded by certain customers.
3. Some items are demanded by few customers.

As a result of this general pattern, a small percentage of the total item usage accounts for a large proportion of total usage value. It is hypothesized that 80% of the total inventory cost is vested in approximately 20% of the items. Thus, managers should allocate 80%

of their managerial resources to the 20% A classification. It may make economic sense to carry larger quantities of B and C items and apply fewer managerial resources for less important B and C inventories. The following procedure is one way of implementing an ABC analysis:

1. Calculation of the annual usage value.
2. Sorting of the items regarding their annual usage value in decreasing order.
3. Calculation of the ratios of the annual usage per item and accumulated percentages.
4. Calculation of the ratios of the annual usage value per item and accumulated percentages.
5. Classify items into A, B, and C groups.

A relationship similar to the curve shown in Figure 5.3 is a result of the ABC analysis. An illustrative example is given in Figure 5.4 and Figure 5.5.

FIGURE 5.3
Typical ABC Analysis Curve

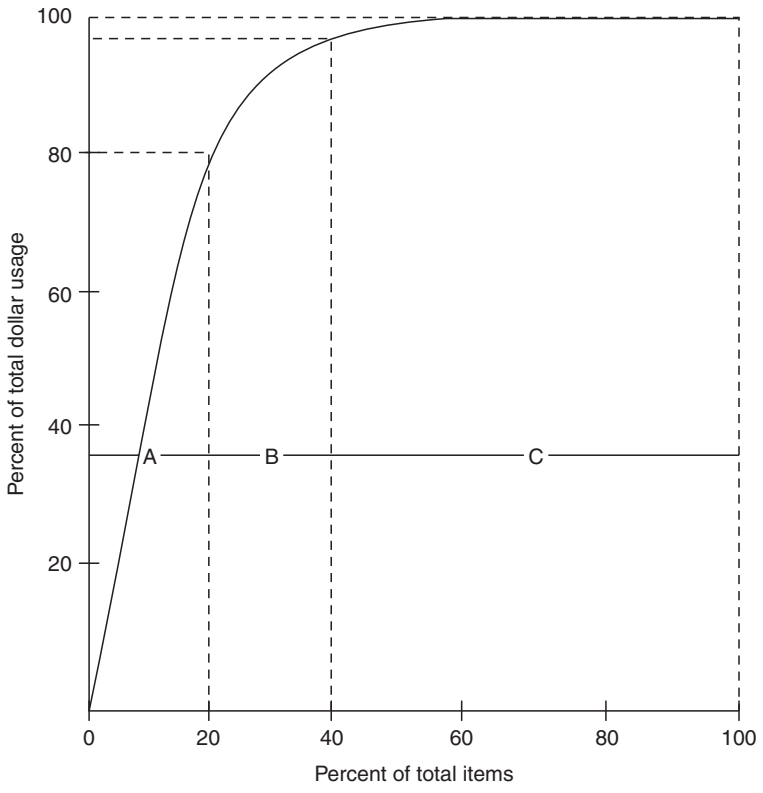


FIGURE 5.4
An ABC Analysis Illustration

Item	Annual Usage (Units)	Cost per Unit($)	Annual Usage Values($)
1	10,120	0.20	2,024
2	3,520	0.40	1,408
3	3,830	9.50	36,385
4	4,368	0.25	1,092
5	3,590	0.90	3,231
6	4,820	0.70	3,374
7	1,050	0.30	315
8	1,100	0.44	484
9	710	31.60	22,436
10	4,700	0.38	1,786

FIGURE 5.5
An ABC Analysis Solution

Item	Annual Usage Unit($)	Cost per Unit($)	Annual Usage Values($)	Cumulative Ratio of Annual Usage (%)	Cumulative Ratio of Usage Value (%)	Classification
3	3,830	9.50	36,385	50.16%	50.16%	A
9	710	31.60	22,436	30.93%	81.09%	A
6	4,820	0.70	3,374	4.65%	85.74%	B
5	3,590	0.90	3,231	4.45%	90.20%	B
1	10,120	0.20	2,024	2.79%	92.99%	B
10	4,700	0.38	1,786	2.46%	95.45%	C
2	3,520	0.40	1,408	1.94%	97.39%	C
4	4,368	0.25	1,092	1.51%	98.90%	C
8	1,100	0.44	484	0.67%	99.57%	C
7	1,050	0.30	315	0.43%	100%	C

INDEPENDENT DEMAND

LO 5.4 Demonstrate how to manage inventories for independent demand using EOQ, EOQ for discounts, and calculation of safety stock.

In this section, we are concerned with the control of end items. The inventory management concepts covered in this section are also applicable to retailing and distribution.

Recall the five primary functions of inventories from Chapter 4:

1. *Pipeline inventory.* The supply pipelines of the entire system require a considerable investment in inventory. If the system's volume is 1,000 units per week and it takes one day to transport from the supplier to the plant, there are 1/7 x 1,000, or about 143, units in transit on the average.
2. *Cycle stocks.* Assume the average unit sales volume is 5 units per week or 15 units in the 3-week ordering period. Thus, the firm must have no fewer than 15 units of cycle stock on hand when the order is placed for an average on-hand cycle stock of 15/2 = 7.5 units. During the 3-week replenishment period, cycle stock is required. The concept of average inventory is addressed in the next section.
3. *Seasonal inventories.* If demand follows a seasonal pattern, inventories can be accumulated during low-sales periods and depleted during high-usage periods to avoid problems associated with adjusting capacity.
4. *Safety stocks.* Safety stocks are designed to absorb random demand uncertainties.
5. *Decoupling stocks.* Decoupling inventory separates the various stages within a manufacturing process so the inventory associated with one stage of a manufacturing process does not slow down other parts of the process. As an example, say there are five separate stages in an assemble process. Finished (decoupling) inventory is located at each manufacturing stage. Each stage would be able to start work at the same time each day without waiting for the finished components from the previous stage. Stocks of inventories at major stocking points throughout the system make it possible to carry on each activity independently. That is, the presence of inventories allows for each work center to begin at the same starting time.

The Classical EOQ Model

The objective of an inventory system is the minimization of total operating costs. The **unavoidable costs** of operating pure inventory systems are ordering costs, stock-out costs, and holding costs. To illustrate the cost behavior of a fixed-order size system, let's look at the simple classical economic lot-size model (EOQ). The EOQ derives the optimal lot size for purchasing by minimizing the cost components involved (ordering costs and holding costs).

Unavoidable costs Ordering costs, stock-out costs, and holding costs.

The classical inventory model assumes the idealized situation shown in Figure 5.6, where Q is the order size.

Assume an annual requirement of A = 52,000 units, or an average of 1,000 units per week. If we ordered in quantities of 1,000 units, the cycle inventory, on the average, is $Q/2$ = 500 units. On the other hand, if the purchasing manager chooses to order in quantities of 500 units, the associated average inventory level falls to 500/2 = 250 (see Figure 5.6).

Upon receipt of an order, units are assumed to be withdrawn at a constant rate from the beginning level of Q units; this is illustrated in Figure 5.6. When inventory reaches the dotted line in Figure 5.6 (reorder point), a new order is placed for Q units. After a fixed lead time period, the units are replenished with the entire order quantity Q. The vertical line represents the instantaneous replenishment of Q. The inventory holding cost (C_H) will be proportional to the lot size. The relationship between the holding cost and ordering cost is shown in Figure 5.7.

FIGURE 5.6
Simple Classical Inventory Models

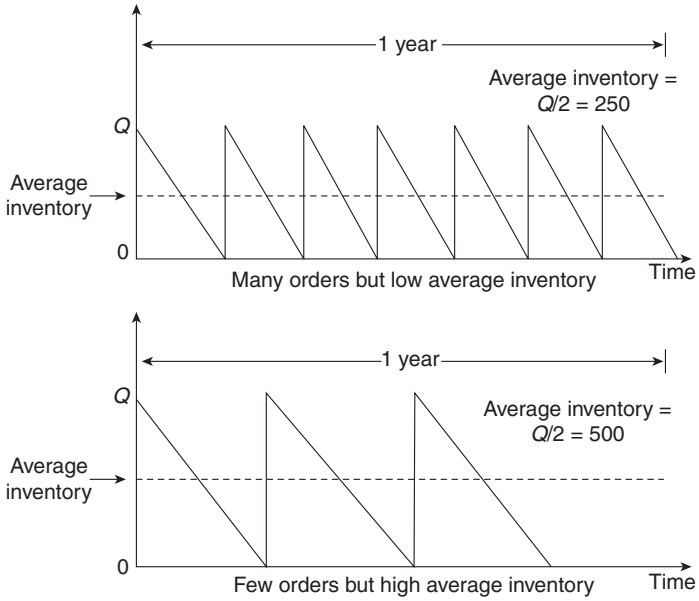
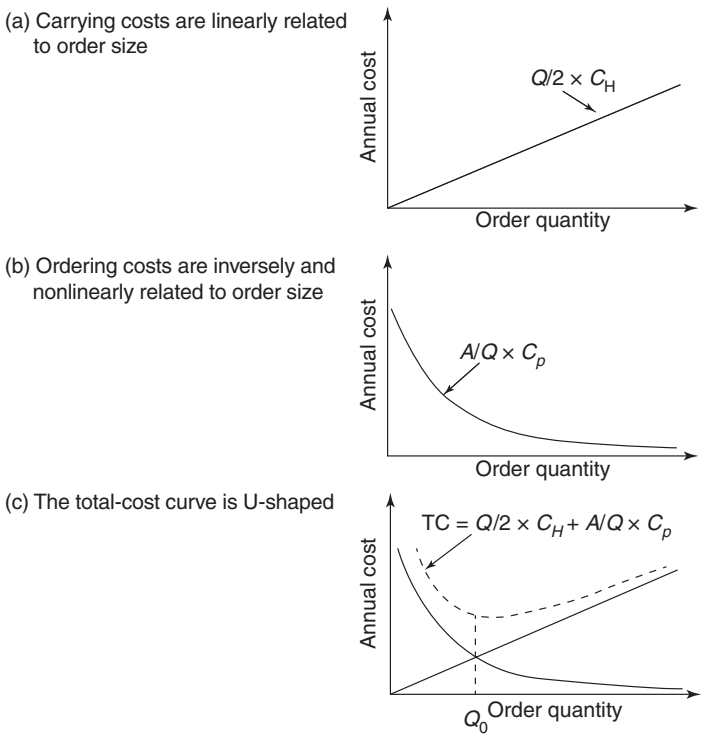


FIGURE 5.7
Total Cost Curve: (a) Carrying costs are linearly related. (b) Ordering costs are inversely and nonlinearly related to order size. (c) The total cost curve is U-shaped.



Inventory cost C_H is defined as the cost of carrying one unit of inventory for one year. The costs include insurance, taxes, interest, and obsolescence. As Q increases, the annual holding cost increases. The ordering cost C_p is defined as the cost of preparing and following up on an order. Thus, as Q increases, the annual incremental ordering cost decreases because fewer orders need to be placed.

Figure 5.7c shows the resulting total cost by adding the annual holding and ordering costs:

$$TC = [(A/Q \times C_p) + (Q/2 \times C_H)] \qquad \textbf{(Equation 1)}$$

where

A/Q = Number of orders per year

C_p = Cost of an order

$Q/2$ = Average inventory

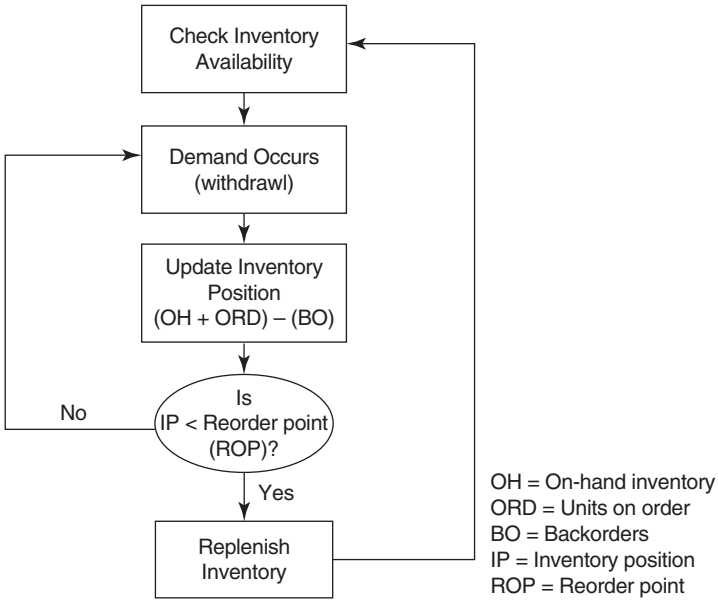
C_H = Unit inventory cost per year or item cost (P) times the annual carrying cost rate (r)

The new quantity Q is received as the inventory reaches zero, so the average inventory is $(Q + 0)/2$ or $Q/2$. Figure 5.8 shows a flow diagram for the basic EOQ model.

The sum of the two costs (ordering and holding) will be the total inventory cost per year for any purchased item. To derive the minimum-cost lot size (EOQ), take the first derivative with respect to Q and set it equal to zero. The calculus is used to determine the point of inflection on the total cost curve where it is no longer decreasing and beginning to increase.

$$\frac{\delta(TC)}{\delta Q} = -\left(\frac{A}{Q^2}\right)C_p + \frac{C_H}{2} = 0 \qquad \textbf{(Equation 2)}$$

FIGURE 5.8
Flow Diagram for Classical EOQ Inventory Systems



$$C_P \frac{A}{Q^2} = \frac{C_H}{2} \quad \textbf{(Equation 3)}$$

$$Q^2 = 2C_P \frac{A}{C_H} \quad \textbf{(Equation 4)}$$

The solution to Equation (2) is $Q^* = \sqrt{2AC_P/C_H}$ **(Equation 5)**

As can be seen by Equation 5, expensive items will be ordered frequently and in small quantities, and inexpensive items will be ordered less frequently and in larger quantities.

Once the most economical order quantity is known, several other measures can be taken:

1. The expected number of orders during the year, $N_O = A/Q$.
2. The expected time between orders, TBO = $1/N_O = Q/A$.
3. The reorder point, $R = (A/12) \times L$, where lead time, L, is expressed in months. If L is expressed in weeks, $R = (A/52) \times L$.

The minimum total cost per year is obtained by substituting Q^* for Q in Equation 1. The classical EOQ model assumes the following:

1. Constant demand
2. Constant lead time
3. Constant unit price
4. Fixed order cost per order
5. Fixed holding cost per unit
6. Instantaneous replenishment
7. No stock-outs allowed
8. No demand uncertainty
9. Quantity discounts are not available

The Classical EOQ Model With Quantity Discounts

From time to time, buying firms receive discounted price schedules from their suppliers. This usually means the price per unit is lower if larger orders are purchased. It may or may not be to the buyer's advantage to accept the quantity discount. The buyer must be careful not to compromise the economies of his or her firm's cost structure. Although the discount schedule may appear attractive in terms of material cost savings, higher holding costs may reduce overall profitability. At the same time, a specific discount schedule could produce economic advantages for both the buyer and seller.

The classical EOQ model assumes the per-unit material price is fixed. The quantity discount condition invalidates the total cost curve in Figure 5.7c. Quantity discounts induce a discontinuous total cost curve. Assuming the discount applies to *all units* (and not just

incremental units beyond the discount point), the minimum total cost point will be either at the point of discontinuity or at the traditional EOQ point compared with the original price.

Figure 5.9 shows the new total cost curve. As can be seen, the behavior of the EOQ does not change. The effect is a constant increase in the total cost curve. Specifically, there are separate discount curves for each price break. No one curve applies to the entire range of quantities; each curve applies to a portion of the curve (the solid portion).

A *five-step method* can easily be used for determining the minimum-cost order quantity:

Step 1. Calculate the economic order quantity using the minimum unit prices. If this quantity falls within the range for which the vendor offers the discount price, it is a valid economic order quantity and will result in the minimum cost for the particular item.

Step 2. If the EOQ calculated in Step 1 is not valid (i.e., is less than the break quantity), find the total annual cost for each price break quantity.

Step 3. Calculate an EOQ for each unit price.

Step 4. Calculate the total annual cost for each valid EOQ determined in Step 3.

Step 5. The minimum-cost order quantity is that associated with the lowest cost in either Step 2 or Step 4.

An example of quantity discounts is given in Example 5.1. (For a more comprehensive discussion of quantity discounts, see Benton, 1985; Rubin & Benton, 1993, 2002a & b).

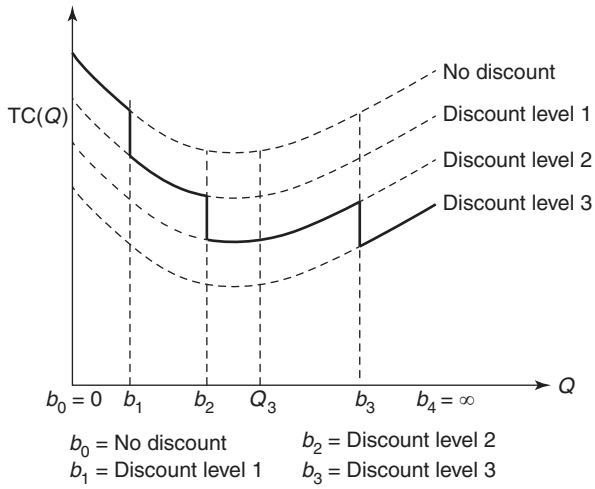
Demand Uncertainty and Safety Stock

When there is **uncertainty in demand**, safety stock must be considered. **Safety stock** is extra inventory held to protect against randomness in demand or lead time. Safety stock is needed to cover the demand during the replenishment lead time in case actual demand is greater than expected demand.

Uncertainty in demand Occurs during times when a business is unable to accurately predict consumer demand for its products or services.

Safety stock Extra inventory held to protect against randomness in demand or lead time.

FIGURE 5.9
Total Cost Curve for All Units With Quantity Discounts



Example 5.1

QUANTITY DISCOUNT EXAMPLE

The Value City Hardware Company purchases 10,000 units of product #605 each year. Recently, the supplier offers the units for sale at $10.00 per unit for up to 799 units and $8.75 per unit for orders of 800 units or more. What is the most economic order quantity if the order cost is $50.00 per order and the holding cost is 40% per unit per year? The total cost for the single price break quantity of 800 units is as follows:

$$Q_{(\$8.75)} = \sqrt{2CpA/C_H}$$
$$= \sqrt{2(50)(10{,}000)/(8.75)(0.40)}$$
$$= 535 \text{ units (not valid)}$$

1. Calculate the economic order quantity using the minimum unit prices. If this quantity falls within the range for which the vendor offers the discount price, it is a valid economic order quantity and will result in the minimum cost for the particular item.

   The EOQ with the minimum unit price of $8.75 is invalid since it is not available for quantities of fewer than 800 units (i.e., since 535 < 800).

2. If the EOQ calculated in Step 1 is not valid (i.e., is less than the break quantity), find the total annual cost for each price break quantity.

$$Q_{(\$10{,}00)} = \sqrt{2CpA/C_H}$$
$$= \sqrt{2(50)(10{,}000) / (\$10.00)(0.40)}$$
$$= 500 \text{ (valid)}$$

$$TC_{DQ} = AP + C_p^* (A/Q) + (Q/2)C_H$$

$$TC_{(800)} = 10{,}000(8.75) + 50(10{,}000/800) + (800/2)(0.40)(\$8.75)$$

$$TC_{DQ}\ 87{,}500 + \$625 + \$1{,}400 = \$89{,}525$$

4. Calculate an EOQ for each unit price.

The EOQ for the $10 unit price is valid.

3. Calculate the total annual cost for each valid EOQ determined in Step 3. The total cost of the valid EOQ with $10 is as follows:

$$TC_{(500)} = 10{,}000(\$10) + 50(10{,}000/500) + (500/2)(0.40)(\$10.00) = \$102{,}000$$

5. The minimum-cost order quantity is that associated with the lowest cost in either Step 2 or Step 4.

Comparing the total costs of the single price break quantity and the valid EOQ, the minimum cost order $89,525 occurs at 800 units. The discount is attractive, and a lot of 800 units should be ordered.

As an example, consider an inventory system with an average daily demand of five units; if lead time is six days, then the expected demand during the lead time will be five units times six days, or 30 units. The distribution of demand during the lead time is assumed to follow a normal distribution, as shown in Figure 5.11.

Figure 5.10 illustrates the concept of safety stock. As can be seen the reorder point is the sum of the demand during lead time and the safety stock. In Figure 5.10 the lead time is constant while the demand during lead is uncertain. Now turning our attention to the normal distribution shown in Figure 5.11 and supper imposed in Figure 5.10 it can be seen that order replenishment cycle, stated differently, if the maximum level of demand occurs during the replishment cycle a stockout will occur unless the appropriate level of safety stock is available.

Figure 5.10 illustrates the impact of safety stock. Specifically, in Figure 5.10 safety stock covers demand during the replenishment cycle. If a variation in demand occurs, safety stock can be used to protect against stock-outs.

An example of the fixed-order quantity model with demand uncertainty is given in Example 5.2.

FIGURE 5.10
The Impact of Safety Stock

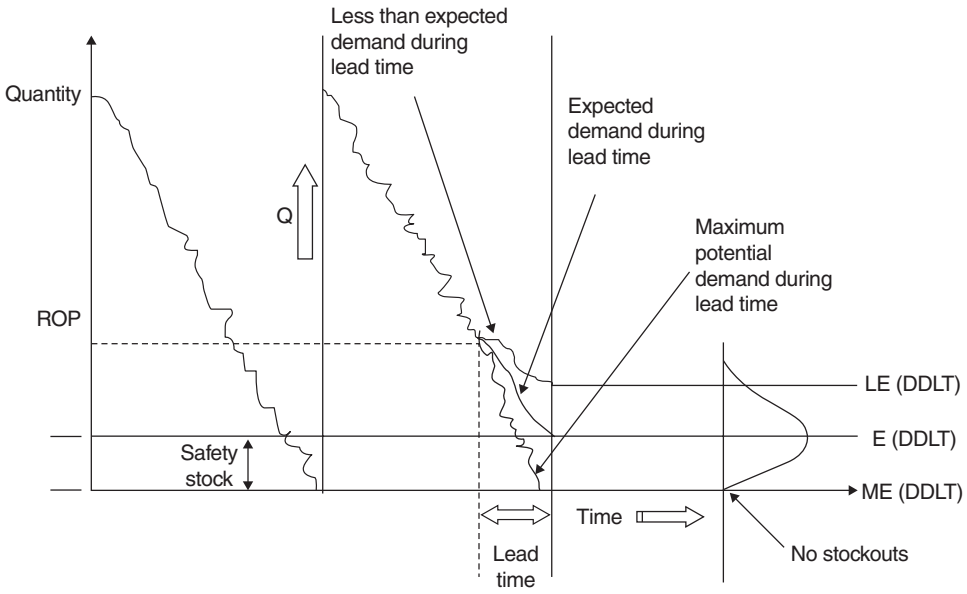
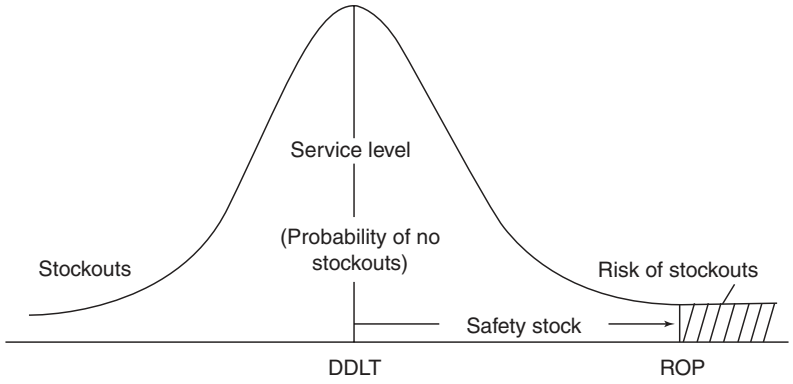


FIGURE 5.11
Normal Distribution of Demand During Lead Time (DDLT)



Example 5.2

DETERMINING SAFETY STOCK

Consider a small retail outlet that has normally distributed demand during lead time, a mean of 1,000 units, and standard deviation of 20 units per week. Lead time interval is two weeks. What reorder point should be used in order to average no more than one stockout every 20 reorder cycles? Also, for safety stock = 30 determine the service level if we choose to carry 30 units of safety stock.

SOLUTION

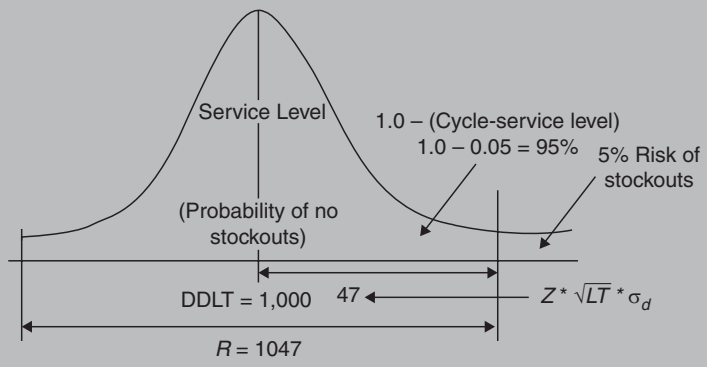
Service level = 1/20 = .05

1 – .05 = 95%

Z = 1.645 (see Z table in Appendix A)

$$\text{Reorder point} = \text{DDLT} + Z\sqrt{LT} \times \sigma_d$$
$$= 1{,}000 + 1.645 \times \sqrt{2} \times 20$$
$$= 1{,}047$$
$$\text{Safety Stock} = Z\sqrt{LT} \times \sigma_d = 1.645 \times \sqrt{2} \times 20$$
$$= 47$$
$$Z = (\text{ROP} - \text{DDLT}) / (\sqrt{LT} \times \sigma_d)$$
$$= (1{,}030 - 1{,}000) / (1.41 \times 20)$$
$$= 1.06$$

This equates to a service level of 85.54 percent (see Z table).



DEPENDENT DEMAND SYSTEMS

LO 5.5 Demonstrate how to manage inventories for dependent demand systems.

Reorder point (statistical inventory control) techniques are based on the assumption of uniform requirements per unit time. If this assumption of the demands is unrealistic, these techniques can lead to inappropriate inventory decisions.

For components of assembled products, the demands are not usually constant per unit time, and depletion is anything but gradual. Inventory depletion for component parts tends to occur in discrete "lumps" because of lot sizing of the final product. Requirements dependent on the final product are usually discontinuous and lumpy since requirements for these components depend on when the product is built. In some periods, there may be a few or no component requirements, and in the next, a requirement for many will occur. As an example, Figure 5.12 shows a case in which customer demand is fairly uniform, but because of the build schedules, the requirements for the components are "lumpy." The build schedule shows periods of zero requirements before a requirement of 50 component parts is encountered. This requirement sequence, very common to component parts, is not handled well with traditional non-time-phased order-point techniques.

FIGURE 5.12
Lumpy Requirements Example

On hand = 50 units Safety stock = 5 units Lead time = 1 period								
Periods	1	2	3	4	5	6	7	8
Projected customer demand	15	15	15	10	15	10	10	10
Build schedule				50				50
Component requirements			50				50	

With the order-point system, the purchasing manager does not plan for future requirements but reacts to the current situation, which may require expediting to prevent a materials shortage. In these situations, expediting is used as a substitute for planning future requirements. An improved basis for planning to meet future needs would be to extend the requirement information throughout enough time periods to cover the entire manufacturing lead time. This provides the time-phased requirement information that is the basis for **material requirements planning (MRP) systems**.

Material requirements planning (MRP) systems Material requirements planning is a production planning and control *system* used to manage manufacturing processes.

MRP systems use substantially better information on future requirements than is possible by the traditional non-time-phased order-point system. MRP systems are helpful for companies with assembled products that have component requirements dependent on the final product. The system provides information to better determine the quantity and timing of component parts and purchase orders than is possible with the non-time-phased order-point system.

The Material Requirements Concept

The MRP concept provides the basis for projecting future inventories in a manufacturing operation. MRP can help improve the traditional non-time-phased order-point system because it allows the operating manager to plan requirements (raw material, component parts) to meet the final assembly schedule. That is, MRP provides a plan for component and subassembly availability that allows certain end products to be scheduled for final assembly in the future. Once a firm's final assembly schedule has been determined and the product bills of materials have been finalized, it is possible to precisely calculate the future materials needs for the final assembly schedule. The product bill of materials for a given finished product can be broken down, or "exploded," and extended for all component parts to obtain that product's exact requirements for each component part.

The General Lot-Sizing Problem

The general lot-sizing problem for **time-phased requirements** for a component part involves converting the requirements over the planning horizon (the number of periods into the future for which there are requirements) into planned orders by batching the requirements into lots. The specific method for determining the order quantities for a part is given by a lot-sizing procedure. In many cases, the **lot-sizing procedure** is based on the minimization of the sum of ordering and inventory carrying costs subject to meeting all requirements for each period. An ordering cost is incurred for each purchase order placed. A carrying cost is charged against the ending inventory balance in each period. The sum of these two cost components is the total inventory cost.

Time-phased requirements Delays release of orders for components until they are needed and offsets the requirements by item lead time (lead time offset).

Lot-sizing procedure Process based on the minimization of the sum of ordering and inventory carrying costs subject to meeting all requirements for each period.

Lot-sizing procedures evaluate orders that cover the requirements for one or more periods. For example, from Figure 5.13, a minimum of 80 units must be ordered for period one (to meet that period's requirement), but other alternatives would include an order of 180 (two periods' requirements), 304 (three periods' requirements), and so on.

In order not to be out of stock, there must be an order received in the first period in which there is a requirement not covered by inventory (net requirement). In order to fill the first net requirement, the firm will incur the cost of ordering (all costs associated with placing and receiving an order). It may be less expensive to combine the first net requirement with another requirement and to hold the additional units in inventory until they are needed rather than to pay for another order. Additional net requirements for periods beyond the first should be included as long as the cumulative units, times the number of periods to be held, times the cost to hold a unit for one period, are less than or equal to the order cost. When this is no longer true, another order is less costly. In general, this is the criterion used to establish the purchase order quantity for the lot-sizing procedures.

Quantity Discounts for the Variable Demand Case

It was shown in the previous section that MRP provides time-phased requirements to determine planned orders using lot-sizing procedures. The general lot-sizing problem is to batch requirements to minimize the sum of ordering and carrying costs each time an order is to be placed. Up until now, conditions for quantity discounts have not been discussed.

Price break Quantity at which a price changes.

There are situations where the purchase price of a unit can vary extensively as different quantities are purchased. The quantity at which a price changes is called a **price break**. Price breaks occur because the suppliers provide incentives to buy in larger quantities compatible with their cost structure. In addition, similar discounts are offered by transportation companies, the price break occurring at full-carload shipments as opposed to shipping at less than truckload (LTL).

There may be a number of purchase discount contract structures available to a purchasing manager. Consider one very common possibility—a single discount purchase price that applies to "all units" ordered when the order quantity (lot size) exceeds a specified discount quantity.

Because of the quantity discount, determination of the best lot size for any particular situation can be very difficult. Under what conditions should a particular discount be taken? It is not sufficient to compare the lower purchase cost per unit at the higher volume with the higher cost per unit. It is necessary to analyze the impact on total inventory cost before deciding to order the higher quantity.

The total cost per unit must be considered when making the choice of lot sizes for a particular unit when quantity discounts are available. Various lot-sizing procedures will be compared with the objective of minimizing the total cost per unit, which equals [(Total purchase cost/Total number of units purchased) + (Sum of the setup costs/Number of units purchased) + (Sum of the inventory carrying costs/Number of units used)].

FIGURE 5.13
Net Requirements for 12 Periods

Order cost = $92 Inventory carrying cost = $0.50/period/unit												
Period	1	2	3	4	5	6	7	8	9	10	11	12
Net requirements	80	100	124	50	50	100	125	125	100	100	50	100

In addition to determining the size of the order, the purchasing manager must schedule delivery so that the requirements are met. When the requirements are uncertain (subject to random variation as plans become reality), this means the purchasing manager must provide a prespecified level of "service" to manufacturing.

In an inventory system, whenever the inventory position will be insufficient to cover the requirements during the delivery lead time, a purchase order should be released. The inventory position for a particular period is the sum of the stock on hand and the stock already on order.

The purchase order should represent sufficient inventory to last through the lead time. When requirements are uncertain (as they are in most cases), it is obvious that the purchase order should be set equal to the planned requirements and the maximum reasonable requirements over the lead time. An allowance is added to the planned inventory for protection against uncertainty inherent in the planned requirements. This allowance is called *safety stock*.

The safety stock should be set to achieve a prespecified service level. Setting safety stock so as to achieve a prespecified service level enables fair comparison of the alternative lot-sizing procedures. The service level, *S*, is defined as

S = (The number of units required that were in inventory)/(The number of units required)

For example, a 99% service level means that 99% of the units required were in inventory when they were needed.

The purchase quantity discount (PQD) lot-sizing procedures evaluated here provide orders that cover one or more periods' requirements. In all of the procedures, requirements for successive periods are accumulated for an order until, at some integer number of periods of requirements, the quantity ordered is at least enough to qualify the entire order for a quantity discount. The next step is to determine if the discount qualifies by splitting the order for the period being considered. If the discount is not desirable, the order quantity is determined as though no discount existed. As an example, the least unit cost (LUC) PQD lot-sizing procedure is used to illustrate how a PQD lot-sizing procedure might work.

For the LUC PQD lot-sizing procedure, requirements are accumulated and unit costs are calculated for each period at least through the period in which the quantity discount is reached. The calculations are continued until the unit cost increases. Next, the unit cost for the exact discount quantity is calculated and compared to the lowest unit cost for a full period's requirements. The quantity purchased is that which provides the lowest unit cost.

Figure 5.14 presents an example of applying the LUC procedure using data from Figure 5.13.

In Figure 5.14, the ordering cost of $92 is incurred once it has been determined an order must be placed. The inventory cost is accumulated at $0.50 per unit times the number of periods it will be carried until the period in which it is used. The purchase price is $500 per unit until more than 368 units are purchased. At a lot size of 368, the purchase price drops to $447.55, but 14 units (368-354) more than needed for four periods must be purchased. The additional inventory cost of these 14 units is 14 x $0.50 x 4 = $28, since they would not be used until Period 5. Total cost per unit is the total cost divided by the lot size (cumulative requirements). When the cost per unit increases (as with a 5-period supply) and the discount quantity has been surpassed, the LUC procedure chooses as the lot size the quantity that provides the minimum cost per unit (i.e., $448.55, lot size = 368). This example illustrates the essentials of the PQD lot-sizing problem.

If a discount is available, there is a price differential (lower price) for ordering an increased number of units. In this chapter, the discount applies to all units provided an amount at least

FIGURE 5.14
Least Unit Cost PQD Example

Order cost = $92 Inventory cost = $0.50/period/unit Base price = $500.00 Discount price = $447.55 Discount quantity = 368							
Least Unit Cost							
	Period's Supply	**Requirements**	**Lot Size**	**Order Cost**	**Inventory Carrying Cost**	**Total Cost**	**Unit Cost**
	1	80	80	$92	$0	$40,092.00	$501.15
	2	100	180	$92	$50	$90,142.00	$500.79
	3	124	304	$92	$174	$152,266.00	$500.88
Yes→	4	50	354	$92	$249	$177,341.00	$500.98
	4*	14	368	$92	$277	$165,067.40	$448.55
	5	50	404	$92	$377	$181,279.20	$448.71

The total cost per unit is calculated for orders of one period's planned requirement and so on through the period in which the discount quantity is reached. The discount quantity cost per unit is also computed. In the example above the least unit cost occurs at the discount quantity in Period 4.

*Indicates that the discount quantity (368 units) is more than a four-period supply.

as big as the discount quantity is purchased. In situations where discounts are not available, the price per unit is constant regardless of the number of units ordered.

Illustration of Various Variable-Demand Lot-Sizing Models

A significant amount of attention has been given to the variable-demand order lot-sizing problem. Both developmental and comparative literature are discussed in this section.

Among the better-known lot-sizing methods for the single-item, nondiscount, time-phased, certain-demand models are (1) lot for lot, (2) economic order quantity, (3) periodic order quantity, (4) least unit cost, (5) McLaren's order moment, (6) Silver–Meal, and (7) the Wagner–Whitin dynamic programming algorithm. The procedures of these lot-sizing methods all determine how the period net requirements should be combined into production lots, or purchase orders. A description is given for each lot-sizing method, along with an example problem using the data shown in Figure 5.13.

Example Calculation for the Lot-for-Lot Discount Procedure for Variable Demand

The lot-for-lot (LFL) method places an order for each period in which there is a net requirement. Thus, no inventory is carried from period to period. This method is usually used when setup costs are low or inventory carrying costs are high. Figure 5.15 shows the lot sizes of the LFL lot-sizing method for the example problem. The resulting lot sizes of the LFL method produce an order in each period in which there is a positive net requirement.

Example Calculation for the Economic Order Quantity Procedure for Variable Demand

The economic order quantity (EOQ) method for determining the quantity to order was first worked out by F. W. Harris. With this method, the quantity ordered will always be greater than or equal to the economic order quantity. The objective of the method is to balance opposing costs (inventory carrying versus ordering). Figure 5.16 shows the lot sizes and costs for the example problem.

Example Calculation for the Periodic Order Quantity Procedure for Variable Demand

The periodic order quantity (POQ) lot-sizing method is based on the economic order quantity (EOQ). As shown in Figure 5.17, the EOQ method is insensitive to time-phased demand for the 12 periods of demand. The POQ method is an adjustment to the EOQ method for time-phased demand. The EOQ is converted to the equivalent number of periods of demand to be included in a lot. The EOQ is calculated and then divided by the average demand. This result is then rounded to the nearest integer value. Figure 5.17 shows the lot sizes and costs for the example problem. In the example problem, the POQ method performs better than the EOQ method.

FIGURE 5.15
Example of Lot-for-Lot Lot-Sizing Procedure

Required Receipts Schedule		
Period	**Net Requirements**	**Required Receipts**
1	80	80
2	100	100
3	124	124
4	50	50
5	50	50
6	100	100
7	125	125
8	125	125
9	100	100
10	100	100
11	50	50
12	100	100

Total ordering cost = 12 × 92 = $1,104
Total inventory carrying = 0 ↓ = 0
Total ordering plus inventory cost = $1,104

FIGURE 5.16
Example of the EOQ Lot-Sizing Procedure

Ordering cost (C_P) = $92
Inventory carrying cost (C_H) = $0.50/unit/period
Average demand ($\bar{A}$) = 92/period

$$EOQ = \sqrt{2 \times \bar{A} \times C_P / C} = \sqrt{2 \times 92 \times \$92/.5} = 184$$

Required Receipts Schedule

Period	Net Requirements	Required Receipts
1	80	184
2	100	
3	124	184
4	50	
5	50	184
6	100	
7	125	184

(*Continued*)

FIGURE 5.16 (Continued)

8	125	184
9	100	
10	100	184
11	50	
12	100	

Total ordering cost = 7 X $92 = $644
Total carrying cost = 855 units x 0.5/period = 427.5
Total ordering plus inventory carrying costs = $1071.50

FIGURE 5.17
Example of POQ Lot-Sizing Procedure

EOQ = 184 units
$\bar{A}$ = 92 units/period
Periodic order quantity = EOQ/$\bar{A}$ = 184/92 = 2 periods

Required Receipts Schedule		
Period	**Net Requirements**	**Required Receipts**
1	80	180
2	100	
3	124	174
4	50	
5	50	150
6	100	
7	125	250
8	125	
9	100	200
10	100	
11	50	150
12	100	

Total ordering cost = 6 × $ 92 = $552.00
Total carrying cost = 575 units × 0.5/period = 287.50
Total ordering plus inventory carrying costs = $839.50

Example Calculation for the Least Unit Cost Procedure for Variable Demand

The objective of the least unit cost (LUC) lot-sizing method is to determine the economic lot size based on the least unit cost per item. For the LUC procedure, net requirements are accumulated and unit costs are calculated for each period.

The calculations are continued until the unit cost increases. The quantity purchased is that quantity that provides the lowest unit cost. Figure 5.18 shows the lot sizes and costs for the example problem. In the example problem, an order was coincidently scheduled every two periods.

FIGURE 5.18
Example of LUC Lot-Sizing Procedure

Period	Net Requirement	Cumulative Requirement	Excess Inventory	Periods Carried	Carrying Cost Unit Cum.	Setup Cost	Total Cost	Unit Cost
1	80	80	0	0	0	$92	$40,092	$501.15
2	100	180	100	1	50	$92	$90,142	$500.79
3	124	304	124	2	174	$92	$152,266	$500.88
3	124	124	0	0	0	$92	$62,092	$500.74
4	50	174	50	1	25	$92	$87,117	$500.67
5	50	224	50	2	75	$92	$112,167	$500.75
5	50	50	0	0	0	$92	$25,092	$501.84
6	100	150	100	1	50	$92	$75,142	$500.95
7	125	275	125	2	175	$92	$137,767	$500.97
7	125	125	0	0	0	$92	$63,592	$500.74
8	125	250	125	1	67.50	$92	$125,159	$500.64
9	100	350	100	2	167.50	$92	$175,259	$500.74
9	100	100	0	0	0	$92	$50,092	$500.92
10	100	200	100	1	50	$92	100,142	$500.71
11	50	250	50	2	100	$92	$125,192	$500.77
11	50	50	0	0	0	$92	$25,092	$501.84
12	100	150	100	1	50	$92	$75,142	$500.95

Required Receipts Schedule		
Period	**Net Requirements**	**Required Receipts**
1	80	180
2	100	
3	124	174
4	50	
5	50	150
6	100	
7	125	250
8	125	

(*Continued*)

FIGURE 5.18 (Continued)

9	100	200
10	100	
11	50	150
12	100	

Total ordering cost = 6 × $92 = $552.00
Total carrying cost = 575 units × 0.5/period = $287.50
Total ordering plus inventory carrying cost = $839.50

Example Calculation for the McLaren Order Moment Procedure for Variable Demand

The McLaren order moment (MOM), in its simplest version, accumulates requirements for consecutive periods into a tentative order until the accumulated part periods (one unit carried in inventory for one period) reach or exceed a specified part-period target. The MOM method compares the carrying cost incurred by including the requirements above the target with the cost of placing a new order. Either the requirements are included in the current lot or a new lot is started, depending on which cost is less. Figure 5.19 shows the lot sizes and costs for this example.

Example Calculation for the Silver–Meal Procedure for Variable Demand

The Silver–Meal lot-sizing method is based on minimum cost per period. As shown earlier, the fixed EOQ approach does not perform well when the demand varies from one period to the next. The Silver–Meal method selects the order quantity so as to minimize the total relevant costs per unit of time. The basic objective of Silver–Meal is to evaluate the total cost per period for successive periods until the first time the new period's total cost exceeds the current period's total cost. Figure 5.20 shows the lot sizes for the example problem.

Example Calculation for the Wagner–Whitin Procedure for Variable Demand

Wagner and Whitin developed a dynamic programming-based lot-sizing method that explores all the various alternatives in setting order quantities to minimize total cost over a planning horizon. The Wagner–Whitin method guarantees optimal solutions for lot-sizing problems when requirements are known with certainty over a fixed number of periods and the carrying cost is nondecreasing over time.

The technical description of the procedure is beyond the scope of this chapter, but Figure 5.21 shows the resulting lot sizes for the example problem for comparison purposes.

Numerous articles and papers have been written on the comparison of various time-phased lot-sizing methods. Under certain experimental conditions, even the EOQ procedure performed just as well as the optimizing method (the Wagner–Whitin algorithm).

The lot-sizing methods in this section have been used extensively in material requirements planning systems. The principles of the economic order quantity (EOQ), the least unit cost, and McLaren's order moment lot-sizing methods have emerged as the most effective managerial approaches to the variable-demand lot-sizing problem.

FIGURE 5.19

Example of MOM Lot-Sizing Procedure

Target = order moment target
EOQ = 184 units
A=Average demand/period = 92/period
TBO=Expected time between orders = 184/92 = 2 periods

$$\text{Target} = A\left[\sum_{t=1}^{T^*-1} t + (\text{TBO} - T^*)T^*\right]$$

Where T^* is defined as the largest integer less than TBO
Thus, the target for the example problem is

$$\text{Target} = 92\left[\sum_{t=1}^{T^*-1} 1 + (2 - 1^*)1^*\right] = 184$$

Period	Requirement	Cumulative Requirement	Part-Periods	Cumulative Part-Periods
1	80	80	80 × 0 = 0	0
2	100	→ 180	100 × 1 = 100	100
3	124	304	124 × 2 = 248*	348
3	124	124	124 × 0 = 0	0
4	50	174	50 × 1 = 50	50
5	50	→ 224	50 × 2 = 100	150
6	100	324	100 × 3 = 300	450
6	100	100	100 × 0 = 0	0
7	125	→ 225	125 × 1 = 125	125
8	125	350	125 × 2 = 250	375
8	125	125	125 × 0 = 0	0
9	100	→ 225	100 × 1 = 100	100
10	100	325	100 × 2 = 200	300
10	100	100	100 × 0 = 0	0
11	50	→ 150	50 × 1 = 50	50
12	100	250	100 × 2 = 200	250
12	100	→ 100	100 × 0 = 0	0

Required Receipt Schedule

Period	Net Requirements	Required Receipts
1	80	180
2	100	0
3	124	224
4	50	0
5	50	0
6	100	225
7	125	0
8	125	225
9	100	0
10	100	150
11	50	0
12	100	100

Total ordering cost = 6 X $92 = $552.00
Total inventory cost = 525 X $.5/period = $262.50
Total ordering plus carrying costs = $814.50

→ indicates the lot size

* The 124 units required in period 3 must be carried for two periods

FIGURE 5.20

Example of the Silver–Meal Lot-Sizing Procedure

Period	N.Requirement	Cumulative Requirements	Excess Inventory/Cost	Ordering Cost	Total Cost	Cost Per Period
1	80	80	$-	$92.00	$40,092.00	$40,092.00
2	100	180	$50.00	$92.00	$90,142.00	$45,071.00
2	100	100	$-	$92.00	$50,092.00	$50,092.00
3	124	224	$62.00	$92.00	$112,154.00	$56,077.00
3	124	124	$-	$92.00	$62,092.00	$62,092.00
4	50	174	$25.00	$92.00	$87,117.00	$43,558.50
5	50	224	$75.00	$92.00	$112,167.00	$37,389.00
6	100	324	$225.00	$92.00	$162,317.00	$40,579.25
6	100	100	$-	$92.00	$50,092.00	$50,092.00
7	125	225	$62.50	$92.00	$112,654.50	$56,327.25
7	125	125	$-	$92.00	$62,592.00	$62,592.00
8	125	250	$62.50	$92.00	$125,154.50	$62,577.25
9	100	350	$162.50	$92.00	$175,254.50	$58,418.17
10	100	450	$312.00	$92.00	$225,404.00	$56,351.00
11	50	500	$512.00	$92.00	$250,604.00	$50,120.80
12	100	600	$762.00	$92.00	$300,854.00	$50,142.33

Required Receipts Schedule		
Period	**Net Requirements**	**Required Receipts**
1	80	80
2	100	100
3	124	224
4	50	
5	50	
6	100	100
7	125	500
8	125	
9	100	
10	100	
11	50	
12	100	100

Total ordering cost = 6 × $92 = $552
Total carrying cost = 975 units × 0.50/period = $488
Total ordering plus inventory carrying cost = $1,040

FIGURE 5.21
Example of the Wagner–Whitin Lot-Sizing Procedure

Required Receipts Schedule		
Period	**Net Requirements**	**Required Receipts**
1	80	180
2	100	0
3	124	224
4	50	0
5	50	0
6	100	225
7	125	0
8	125	225
9	100	0
10	100	150
11	50	0
12	100	100

Total ordering cost = 6 x $92 = $552.00
Total inventory cost = 525 x 0.5/period = 262.50
Total ordering plus carrying costs = $814.50

SUMMARY

LO 5.1 Explain the differences between independent and dependent demand.

The nature of demand can be either independent or dependent. Independent demand is demand for end items. Independent demand is unrelated to the demand for other items. In other words, demand for an independent item must be forecasted independently. Dependent demand is demand for a good or service that is derived from a second product or service.

LO 5.2 Determine what to stock, how much to stock, and how much service to offer customers.

In many industries, the investment in inventories comprises a substantial share of the firm's assets. If the productivity of the inventory asset can be enhanced, the improvement will go directly to the bottom line. The purchasing function is directly influenced by inventory management decisions such as what to stock, how much to stock, and what service level to provide. Before inventory productivity can be improved, one must take a careful and critical look at the specific business entity.

LO 5.3 Demonstrate use of an ABC analysis to determine which inventory items account for the greatest dollar value.

To complete an ABC analysis two variables must be considered: unit cost of each item and item demand. Inventory items can be classified into "A" items, which have a high-dollar usage; "B" items, which have an immediate-dollar usage; and "C" items, which have a low-dollar usage. In other words, those items that are the most demanded and most costly are the most important inventory items, and the items that are the

slowest moving and least expensive are least important. To determine the usage value of an item, multiply the unit cost by annual sales volume. With only these two data points (sales and costs), you can not only rank all of your inventory items by importance but also take the first step toward controlling independent demand and distribution inventories.

LO 5.4 Demonstrate how to manage inventories for independent demand using EOQ, EOQ for discounts, and calculation of safety stock.

The objective of an inventory system is the minimization of total operating costs. The unavoidable costs of operating pure inventory systems are ordering costs, stock-out costs, and holding costs. The EOQ derives the optimal lot size for purchasing by minimizing the cost components involved (ordering costs and holding costs). The classical EOQ model assumes the per-unit material price is fixed. Quantity discounts induce a discontinuous total cost curve. Assuming the discount applies to *all* units (and not just in *incremental* units beyond the discount point), the minimum total cost point will be either at the point of discontinuity or at the traditional EOQ point compared with the original price. Safety stock is needed to cover the demand during the replenishment lead time in case actual demand is greater than expected demand.

LO 5.5 Demonstrate how to manage inventories for dependent demand systems.

Requirements dependent on the final product are usually discontinuous and lumpy since requirements for these components depend on when the product is built. In some periods, there may be a few or no component requirements, and in the next, a requirement for many will occur.

An improved basis for planning to meet future needs would be to extend the requirement information throughout enough time periods to cover the entire manufacturing lead time. This provides the time-phased requirement information that is the basis for material requirements planning (MRP) systems.

KEY TERMS

Competitive advantage 90
Continuous systems 94
Dependent demand 92
Independent demand 92
Intermittent systems 94
Lot-sizing procedure 105
Material requirements planning (MRP) systems 105
Price break 106
Pure inventory systems 94
Safety stock 101
Time-phased requirements 105
Unavoidable costs 97
Uncertainty in demand 101

DISCUSSION QUESTIONS

1. Why is inventory management important to the efficiency of the purchasing function?
2. What are the differences between independent and dependent demand?
3. Discuss the various inventory costs.
4. What is the relationship between purchasing and the classical EOQ model?
5. How are inventory decisions related to forecasting?
6. How are quantity discounts evaluated when using the classical EOQ model?
7. What is meant by ABC analysis?
8. How is safety stock determined in the classical EOQ model?
9. What are the differences between the classical EOQ inventory system and MRP?
10. What are the cost implications of various lot-sizing methods?

SUGGESTED CASES

Case 8: Central Texas Wine Distributors (CTWD)

Case 18: Medical Laser Equipment, Inc. (C)

Case 24: Philadelphia Aircraft Equipment, Inc.

Case 25: Precision Manufacturing Systems, Inc.

EXERCISES

5.1 Jane sells travel kits for $12.50 each. Each kit costs $10. The annual demand is 5,200 kits. The carrying cost is 20% per unit per year. Jane currently orders 500 kits at a time, and the cost of placing an order is $50. Calculate the following:

a. Average inventory

b. Number of orders placed per year

c. Annual inventory carrying cost

d. Annual ordering cost

e. Total annual cost

5.2 If the order quantity is increased to 1,000 kits, recalculate 5.1a–5.1e and compare the results.

5.3 If Jane decided to use the EOQ to manage inventories, compare with the results in 5.2a–5.2e.

5.4 Acme Remanufacturing decided to implement an EOQ system for a fast-moving repair item. The annual demand is 400,000 units, each costing $8. Ordering costs are $32 per order, and inventory holding costs are 20%. Calculate the following:

a. EOQ in units

b. Number of orders per year

c. Total annual cost

5.5 LTD, Inc. uses the EOQ as their ordering approach. The demand for a specific SKU is 10,000 units a year, unit cost is $10, ordering cost is $30, and the cost of holding inventory is 20%. The supplier offers a discount of 3% on orders of 1,000 or more. What will be the savings if the discount is attractive?

5.6 Refer to problem 5.5. The supplier offers a 2% discount on orders of 5,000 units. Calculate the purchase cost, the ordering cost, the carrying cost, and the total cost if orders of 5,000 units are placed. Compare the results and calculate the savings if the discount is taken.

5.7 Fiber Systems stocks and sells aftermarket auto motherboards. It costs the firm $256 each time it places an order with the manufacturer for motherboards. The cost of carrying one motherboard in inventory for a year is $168. The store manager estimates that total annual demand for the computers will be 1,000 units with a constant demand rate throughout the year. Fiber's policy is never to have stock-outs. The store is open for business 7 days per week. Determine the following:

a. Optimal quantity per order

b. Minimum total annual inventory costs

c. Number of orders per year

d. Time between orders (in working days)

5.8 Fiber assumed with certainty that the ordering cost is $256/order and the inventory carrying cost is $168/unit/year. However, the inventory model parameters are frequently only estimates that are subject to some degree of uncertainty. Consider four cases of variation in the model parameters as follows: (a) both ordering cost and carrying cost are as originally estimated; (b) both ordering cost and carrying cost are 20% less than originally estimated; (c) both ordering cost and carrying cost are 20% higher than originally estimated; (d) ordering cost is 20% higher and carrying cost is 20% lower than originally estimated. Discuss your findings.

5.9 Classic Sign Company operates 300 days per year. The company pays $120 for blank signs from a local manufacturer. The annual holding cost per sign blank is estimated to be 25%. The shop sells

an average of 30 fabricated signs per week. The ordering cost for each order is $150. Determine the optimal order quantity and the total minimum cost.

5.10 TLT Body Shop uses a highly flammable solvent. It must have the product delivered by special cargo trucks designed for the safe shipment of chemicals. The delivery cost for the solvent is $670 each time an order is placed. The solvent is packaged in 1-gallon plastic containers. The cost of holding the chemical in storage is $220 per gallon per year. The annual demand for the chemical, which is constant over time, is 1,283 gallons per year. The lead time from time of order placement until receipt is 14 days. The company operates 250 working days per year. Compute the optimal order quantity, total minimum inventory cost, and the reorder point.

5.11 The 14–0 Carryout Store stocks Scarlet and Gray (S&G) beer mugs. Demand is 21,200 per year. It costs $220 per order of mugs, and it costs $2.35 per mug per year to keep the mugs in stock. Once an order for mugs is placed, it takes 7 days to receive the order from the distributor. Determine the following:

a. Optimal order size

b. Minimum total annual inventory cost

c. Reorder point

5.12 The Apple Valley Company makes apple butter to supply to local street vendors in Monterrey, California. Apple Valley can make 4,800 pounds of apple butter per day, and demand from the street vendors is 190 pounds per day. Each time Apple Valley makes apple butter, it costs $106 to set up the production process. The annual cost of carrying a pound of apples in a refrigerated storage area is $9.50. Determine the optimal order size and the minimum total annual inventory cost.

5.13 The Scarlet and Gray Brewery produces Buckeye Light Beer, which it stores in barrels in its warehouse and supplies to its distributors on demand. The demand for Buckeye Light is 144 barrels of beer per day. The brewery can produce 200 barrels of Buckeye Light per day. It costs $56 to set up the production process. The beer is stored in a refrigerated warehouse at an annual cost of $80 per barrel. Determine the economic ordering quantity and the minimum total annual inventory cost.

5.14 The purchasing manager for Worthington Industries must determine a policy for ordering boring drills to operate 5 horizontal boring machines. Each machine requires exactly 30 boring drills per day to operate, and the firm operates 250 days per year. The purchasing manager has determined that the ordering cost is $80 per order, and the holding cost is 23% of the average dollar value of the inventory held. The purchasing manager has negotiated a contract to obtain boring drills for $265 per drill for the coming year.

a. Determine the optimal quantity of boring tools to receive in each order.

b. Determine the total inventory-related costs associated with the optimal ordering policy.

c. If 5 days' lead time is required to receive an order of drills, how many drills should be on hand when the order is placed?

5.15 The Dallas Fire Department uses 10,000 alkaline flashlight batteries per year, which cost $5 each. The cost of ordering batteries is estimated to be $50. The current interest rate suggested by the city council is 22%. The supplier has suggested that you could get a discount of 3% for orders of 2,000 batteries at a time. Should you take advantage of this special offer?

5.16 The bookstore at Ohio State University purchases jackets emblazoned with the Ohio State logo from a vendor. The supplier sells the jackets to the store for $43 per jacket. The cost to the bookstore for placing an order is $270, and the annual carrying cost is 22% of the cost of a jacket. The bookstore manager estimates that 3,500 jackets will be sold during the year. The supplier has offered the bookstore the following all-unit volume discount schedule.

Determine bookstore's optimal order quantity, given this quantity discount information.

Order Size	Discount
1–299	0%
300–499	2%
500–799	3%
800+	4%

5.17 Determine the optimal order quantity of jackets and total annual cost in problem 5.16 if the carrying cost is a constant $15 per jacket per year.

5.18 The purchasing manager for the Medco Research Laboratory orders letterhead forms and stationery from an office products firm in boxes of 700 sheets. The company uses 10,000 boxes per year. Annual carrying costs are $2.50 per box, and ordering costs are $84. The following all-unit discount price schedule is provided by the office supply company.

Order Quantity (Boxes)	Price per Box
200–999	$13
1,000–2,999	$12
3,000–4,999	$11
5,000+	$10

Determine the optimal order quantity and the total annual inventory cost.

5.19 Lee's Machine Shop has estimated net requirements for a particular part as follows:

Month

	1	2	3	4	5	6	7	8	9	10	11	12
Requirements	200	20	30	40	140	500	500	500	500	80	0	200

a. Apply the economic order quantity and the Silver-Meal (S-M) to solve this problem.

b. What important assumptions are involved in each of the approaches used in part (a).

The cost per unit is $500. Ordering costs associated with this part are $100. Estimated inventory carrying cost is $3 per unit per month calculated on average inventory. Currently, no parts are available in inventory. The company wishes to know when and how much to order over the next 12 months.

5.20 The Beam Brake Company is trying to decide which of several lot-sizing procedures to use for its MRP system. The following information pertains to one of the typical component parts:
Setup cost = $100/order.
Inventory cost = $1.25/unit/week.
Current inventory balance = 10 units.

Week

	1	2	3	4		6	7	8
Demand Forecast	55	35	25	0	105	15	75	10

a. Apply the EOQ, POQ, and Part-Period balancing (PPB) lot-sizing procedures and show the total cost resulting from each procedure. Calculate inventory carrying costs on the basis of average inventory values. Assume orders are received into the beginning inventory.

b. Indicate advantages and disadvantages of using each procedure in part (a).

5.21 Apply the McLaren order moment (MOM) lot-sizing procedures to the following 12 periods of requirements data, indicating order receipts' size and period. Assume order costs are $125/order placed and $1.5 inventory carrying costs on the basis of *ending* inventory values. Calculate inventory carrying costs.

Period

	1	2	3	4	5	6	7	8	9	10	11	12
Requirements	40	20	5	30	30	55	65	40	95	0	20	15

APPENDIX: AREAS UNDER THE NORMAL CURVE

Area under the standard normal curve from 0 to z, shown shaded, is $A(z)$

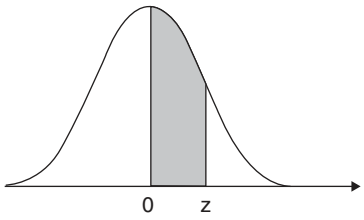
Examples If Z is the standard normal random variable and $z = 1.54$, then

$A(z) = P(0 < Z < z) = .4382,$

$P(Z > z) = .0618,$

$P(Z < z) = .9382,$

$P(|Z| < z) = .8764.$



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0673	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	-1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	4591	.4599	.4608	.4616	.4625	.4633
1.8	4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857

2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	4976	4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	4988	.4989	.4989	.4989	.4990	.4990

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6 Just-in-Time (Lean) Purchasing

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

6.1 Describe lean production systems.

6.2 Explain the differences between JIT and MRP.

6.3 Explain the relationship of the kanban production control system to the JIT system.

6.4 Discuss the relationship between JIT and purchasing.

6.5 Name critical JIT purchasing advantages.

6.6 Identify the activities needed to implement JIT purchasing.

6.7 Determine the role of culture in the implementation of JIT purchasing.

6.8 Analyze the impact of JIT purchasing on a buying firm.

At the beginning of purchasing class, Professor Allen asked Morgan, "How are suppliers affected by JIT systems?"

Morgan responded, "In a JIT system, the suppliers could be conceptualized as an extension of the buying firm's operation even though they are outside the boundaries of the buying firm. Thus, as the buying firm improves its responsiveness to the demand variability, the suppliers also have to operate in sync. They are required to deliver in smaller quantities and more frequently."

Is this an acceptable response?

.....

INTRODUCTION

There has been a shift in manufacturing business processes in practically every American industrial setting. The so-called lean thinking paradigm now includes the purchasing function. Lean concepts have had a

significant effect on profitability in almost all industrial settings. The key lean principles focus on people, postponement, efficiency, and the elimination of waste. All of these key business principles have a direct effect on the purchasing function.

Over the last couple of decades, Japan has achieved new levels of productivity and product quality. Much of the Japanese success in the global market is attributed to its people-oriented management style and innovative manufacturing techniques developed around just-in-time and total quality control concepts. The just-in-time (JIT) system is no longer an esoteric concept in the manufacturing world today. In the face of intense global competition, many firms in the United States are looking at improved techniques to manage their manufacturing operations. While debates continue regarding the applicability of JIT concepts outside Japan, a comprehensive survey of JIT practices in the United States found that 45% of the firms contacted had implemented JIT programs and another 22% were planning to implement JIT the following year. JIT has evolved from a novel manufacturing concept based on a philosophy of trust and commitment of the entire organization. The benefits of implementing a JIT system impact all entities involved in supply chain management.

The purchasing department plays an important role in the profitability of any manufacturing firm. To improve their on-time delivery performance, some Chinese firms have implemented the JIT philosophy in purchasing. As an example, Dongfeng Citroen Automobile Company (DCAC), a Sino-French joint venture in China, has established close relationships with several suppliers through JIT purchasing. DCAC reported that the relationship has improved the timeliness of delivery and reduced inventory costs (Zhixiang, 2004). This chapter describes the potential advantages of JIT in the purchasing function and discusses some of the common obstacles encountered in the implementation process. In doing so, a brief review of lean production systems is given in the next section.

LEAN PRODUCTION SYSTEMS

LO 6.1 Describe lean production systems.

In its simplest form, "the manufacturing process" is a composition of the material flows. The **just-in-time (JIT) system** is designed to manage the flow of materials, components, tools, and associated information. JIT production is based on planned elimination of all waste and on continuous improvement. JIT is also referred to as *lean production*. An organization driven by a JIT philosophy can improve profits and return on investment by reducing inventory levels, reducing variability, improving product quality, reducing production and delivery lead times, and reducing setup costs. With JIT (lean), the entire manufacturing system from purchasing to shop floor management can be measured and controlled. Therefore, the JIT (lean) system is a powerful management tool that could easily determine the success or failure of the manufacturing system.

Just-in-time (JIT) system System in which materials are purchased, transported, and processed "just in time" for their use in a subsequent stage of the manufacturing process; an operations management philosophy whose objectives are to reduce waste and cycle time. Operationally, JIT minimizes inventory at all levels.

JIT applies primarily to repetitive manufacturing processes in which the same products and components are produced over and over again. The general idea is to establish flow processes (even when the facility uses a job shop or batch process layout) by linking work centers so that there is an even, balanced flow of materials throughout the entire production process similar to that found in an assembly line. To accomplish this, an attempt is made to reach the goals of driving all inventory buffers toward zero and achieving the ideal lot size of one unit.

For more than three decades, JIT and MRP production systems have followed two independent research streams. As the popularity of JIT motivated by the success of Japanese manufacturing firms has grown, numerous global practitioners initiated complete changeovers from the traditional MRP-based methods to JIT methods.

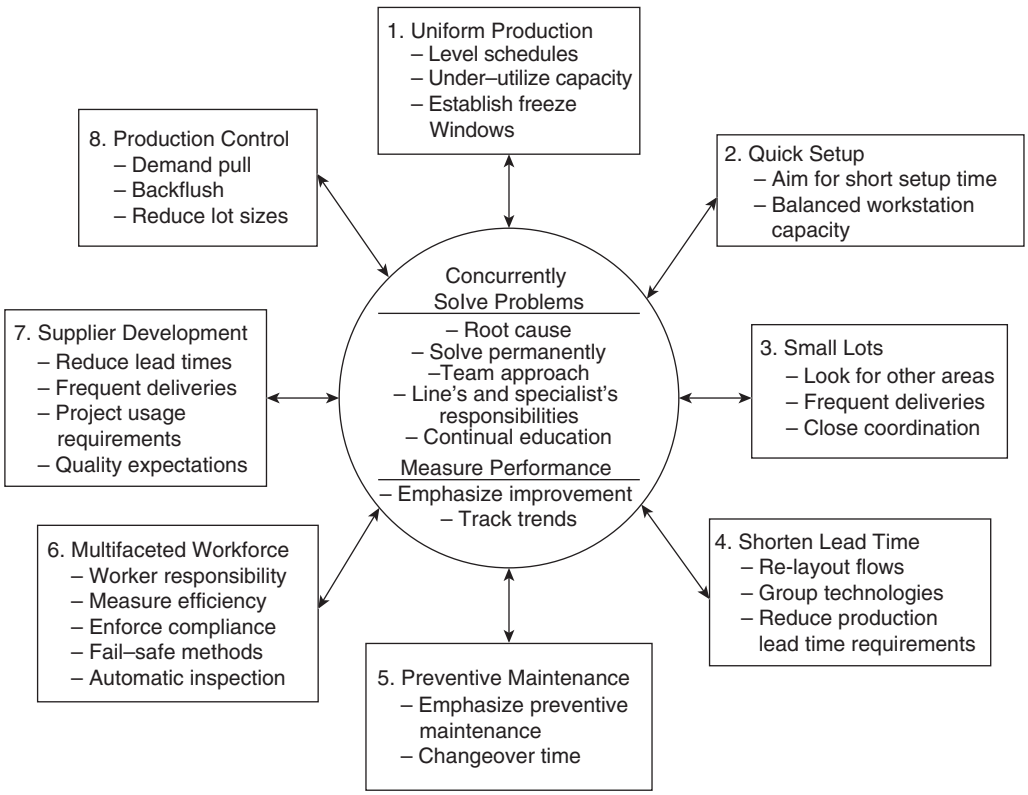
There rarely exists a pure JIT production system in practice. Even at Toyota, the inventor of the JIT system, production smoothing is planned by the master production schedule (MPS), and the material requirement plan is followed based on the MPS, using a bill of materials (BOM). This type of manufacturing planning has been adopted by most automobile manufacturers. The integration between MRP and JIT in literature reflects the trend toward a more realistic hybrid manufacturing environment.

The current shift toward the so-called lean thinking manufacturing environment is one of the major motivations for future JIT research. There is also a strong need to organize the previous JIT studies and provide directions for innovative JIT implementations and research focus. The conceptual framework for JIT is shown in Figure 6.1.

The following practices are considered essential for a comprehensive JIT implementation:

1. *Uniform production* (also known as *heijunka*). Create a uniform load on each workstation through constant daily production and producing the same mix of

FIGURE 6.1
JIT Conceptual Framework



products each day, using a repeating sequence. Meet demand fluctuations through end-item inventory rather than through fluctuations in production level. Use of a stable production schedule also permits the use of *backflushing* to manage inventory: an end item's bill of materials is periodically exploded to calculate the usage quantities of the various components used to make the item, eliminating the need to collect detailed usage information on the shop floor.

2. *Quick setup times.* Aim for short setup times—this can be done through better planning, process redesign, and product redesign. A good example of the potential for improved setup times can be found in the airline industry, where Southwest Airlines can turn around 30 full-capacity flights per day between Dallas and Houston. (How long does it take American Airlines to turn around just one flight? Answer: At least 2 times as long since most American Airlines flights are not 45-minute turnaround flights.) Southwest's efficiency is the result of a team effort using the correct aircraft (container) size and a coordinated, well-rehearsed process.

3. *Small lot sizes.* Reducing setup times allows economical production of smaller lots; close cooperation with suppliers is necessary to achieve reductions in order lot sizes for purchased raw materials and component parts since this will require more frequent deliveries.

4. *Short lead times.* Production lead times can be reduced by moving workstations closer together, applying group technology and cellular manufacturing concepts, reducing queue length, and improving the coordination and cooperation between downstream processes. Delivery lead times can be reduced through close cooperation with supplying organizations, possibly by inducing suppliers to locate closer to the factory.

5. *Preventive maintenance.* Use machine and worker idle time to maintain equipment and prevent breakdowns.

6. *Multifaceted workforce.* Workers should be trained to operate several machines, to perform maintenance tasks, and to perform quality inspections. In general, JIT requires teams of competent, empowered employees who take responsibility for their own work.

7. *Supplier development.* All defective items must be eliminated since there are no buffers of excess parts. A *quality at the source* (*jidoka*) program must be implemented to give workers the personal responsibility for the quality of the work they do and the authority to stop production when something goes wrong. Techniques such as "JIT lights" (to indicate line slowdowns or stoppages) and "tally boards" (to record and analyze causes of production stoppages and slowdowns to facilitate correcting them later) may be used.

8. *Kanban production control.* Use a control system such as a *kanban* (card) system (or other signaling system) to convey parts between workstations in small quantities (ideally, one unit at a time). In a large sense, JIT is *not* the same thing as a kanban system, and a kanban system is not required to implement JIT (some companies have instituted a JIT program along with an MRP system), although JIT is

required to implement a kanban system and the two concepts are frequently equated with one another.

This chapter proceeds in the following order: First, the JIT production system is discussed. Second, the kanban production control system is presented. Third, the JIT purchasing framework is evaluated. Next, the role of culture is discussed. Finally, a critical analysis of the JIT philosophy is conducted.

JUST-IN-TIME PRODUCTION SYSTEM

LO 6.2 Explain the differences between JIT and MRP.

JIT is Toyota's manufacturing philosophy to minimize waste, and the JIT production system is a subsystem controlled by kanban. The kanban-controlled JIT production system is based on the premise of minimizing work-in-process inventories (waste) by reducing or eliminating discrete batches. The reduced lot sizes not only contribute to production efficiency and product quality but also reduce the overall costs associated with production in the JIT manufacturing environment. This proposition holds true only when certain conditions are sustained. The success of Toyota's kanban-controlled production system is supported by smoothing of production, standardization of jobs, reduction of setup times, improvement of activities, design of machine layout, and automation of processes (automation with a human touch). In fact, the JIT production system appears most suitable for repetitive manufacturing environments. Smoothing production is a relatively simple concept. If demand is constant, then it is really easy to smooth production or to level it. After all, if you know each day, every day, how much you need to produce, then it is really easy to produce what you need.

Continuous improvement The ongoing improvement of products, services, or processes through incremental improvements.

Improvements in the kanban-controlled production systems have followed a pragmatic approach: **continuous improvement**. Therefore, success of the JIT production system must be explained in conjunction with continuous improvement. Experience and commitment of the workers on the shop floor to continue to improve performance and methods are the major drivers of the JIT production system. A host of cases and evidence from the literature indicate that JIT success has been achieved not by the predetermined scheduling technique but by the aggressive continuous improvement effort.

The JIT production system is not a panacea. As with the MRP system, there are also operational problems with the JIT system. In fact, there is a list of reasons why the Toyota manufacturing system may not work for all firms. The reasons include cultural differences, geographical dispersion of suppliers, supplier power, different management styles, and so forth.

The Toyota manufacturing system has been viewed in different ways by a variety of researchers. The JIT production system is often called a *lean production system* because it uses less of every resource compared with the conventional mass production system (Womack, Jones, & Ross, 1990). On the other hand, the JIT system is viewed as a conventional *reorder point* system with extremely small lot sizes (Zipkin, 1991). The most common standpoint in understanding the JIT production system is that the JIT production is a *pull* system as opposed to the conventional push system. In the MRP/JIT comparison or integration literature, the pull nature of the JIT production system has been discussed extensively. Thus, it is only natural to portray the push/pull debates in conjunction with the MRP/JIT studies (also see Benton & Shin, 1998).

KANBAN PRODUCTION CONTROL SYSTEM

LO 6.3 Explain the relationship of the kanban production control system to the JIT system.

Kanban is the Japanese word for "card." The **kanban card** contains the part number, the part description, the type of container, and various workstation information. A **kanban production control system** uses simple, visual signals to control the movement of materials between work centers, as well as the production of new materials to replenish those sent downstream to the next work center. The kanban card is attached to a storage and transport container. The kanban card is used to provide an easily understood, visual signal that a specific activity is required. Kanbans are similar to fixed-order inventory systems where an order for Q is placed when the inventory level falls below the reorder point. The reorder point is determined based on the demand during the lead time. The only inventory required is during the replenishment lead time.

Kanban card A card that contains the part number, the part description, the type of container, and various workstation information.

Kanban production control system A system using simple, visual signals to control the movement of materials between work centers, as well as the production of new materials to replenish those sent downstream to the next work center.

In a dual-card kanban system, there are two main types of kanban:

1. *Production kanban* signals the need to produce more parts. Each kanban is physically attached to a container.
2. *Withdrawal kanban* signals the need to withdraw parts from one work center and deliver them to the next work center.

The kanban-controlled manufacturing system functions as a pull system. As discussed earlier, in a **pull system**, removing an end item (or a fixed lot of end items) triggers the order release, by which the flow of materials or components is initiated. In contrast, a **push system** allows for the production or material flow in anticipation of future demand. The second way is to examine the structure of the information flow (see Olhager & Ostlund, 1999). In a pull system, the physical flow of materials is triggered by the local demand from the next server. The local demand in this system is signified by the local information, empty kanbans. In this context, the pure pull system is a decentralized control strategy in which the ultimate goal of meeting demand (orders) is disregarded in the local servers (individual stations). However, a push system uses global and centralized information. Global information of customer orders and demand forecasts is released and processed to control all the levels of production in the push system.

Pull system A system in which an end item (or a fixed lot of end items) is removed triggering the order release, by which the flow of materials or components is initiated.

Push system A system that allows for the production or material flow in anticipation of future demand.

In some pull systems, other signaling approaches are used in place of kanban cards. For example, an empty container alone (with appropriate identification on the container) could serve as a signal for replenishment. Similarly, a labeled, pallet-sized square painted on the shop floor, if uncovered and visible, could indicate the need to go get another pallet of materials from its point of production and move it on top of the empty square at its point of use.

A kanban system is referred to as a pull system because the kanban is used to pull parts to the next production stage only when they are needed. In contrast, an MRP system (or any schedule-based system) is a push system in which a detailed production schedule for each part is used to push parts to the next production stage when scheduled. Thus, in a pull system, material movement occurs only when the workstation needing more material asks for it to be sent, while in a push system the station producing the material initiates its movement to the receiving station, assuming that it is needed because it was scheduled for production. The

weakness of a push system (MRP) is that customer demand must be forecast and production lead times must be estimated. Bad guesses (forecasts or estimates) result in excess inventory, and the longer the lead time, the more room for error. The weakness of a pull system (kanban) is that following the JIT production philosophy is essential, especially concerning the elements of short setup times and small lot sizes, because each station in the process must be able to respond quickly to requests for more materials. The dual-card kanban rules follow:

1. No parts are made unless there is a production kanban to authorize production. If no production kanban are in the "inbox" at a work center, the process remains idle, and workers perform other assigned activities. This rule enforces the "pull" nature of the process control.
2. There is exactly one kanban per container.
3. Containers for each specific part are standardized, and they are always filled with the same (ideally, small) quantity. (Think of an egg carton, always filled with exactly one dozen eggs.)

Decisions regarding the number of kanbans (and containers) at each stage of the process are carefully considered because this number sets an upper bound on the work-in-process inventory at that stage. For example, if 10 containers holding 12 units each are used to move materials between two work centers, the maximum inventory possible is 120 units, occurring only when all 10 containers are full. At this point, all kanbans will be attached to full containers, so no additional units will be produced (because there are no unattached production kanbans to authorize production). This feature of a dual-card kanban system enables systematic productivity improvement to take place. By deliberately removing one or more kanbans (and containers) from the system, a manager also will reduce the maximum level of work-in-process (buffer) inventory. This reduction can be done until a shortage of materials occurs. This shortage is an indication of problems (accidents, machine breakdowns, production delays, defective products) that were previously hidden by excessive inventory. Once the problem is observed and a solution is identified, corrective action is taken so that the system can function at the lower level of buffer inventory. This simple, systematic method of inventory reduction is a key benefit of a dual-card kanban system.

A Simple Kanban Example

An illustration of the push and pull manufacturing concepts is given in this example. Traditional MRP manufacturing systems use *push* systems, where the goal is to ensure all workstations and equipment are optimally used. A result of this is that where there are a series of operations (fabrication, assembly, and finished goods), they are independently optimized. Thus, if an earlier operation is faster than a later operation, increasing levels of inventory will build at the succeeding workstation as in Figure 6.2.

As shown in Figure 6.2, overproduction is an element of waste. Less inventory also reduces the amount of scrap or rework required when a defect is discovered. And since less inventory means shorter lead times, it takes up space, uses up working capital, and is liable to damage and devaluation. The ultimate inventory pile is at the end of the assembly process, where finished goods are stacked up in warehouses, waiting for customers to buy them.

The principle of pull is that control is transferred from the beginning of the line to the end. Thus, in the example shown in Figure 6.2, Operation B needs to control what Operation

FIGURE 6.2
Traditional Production Planning System (Push System)

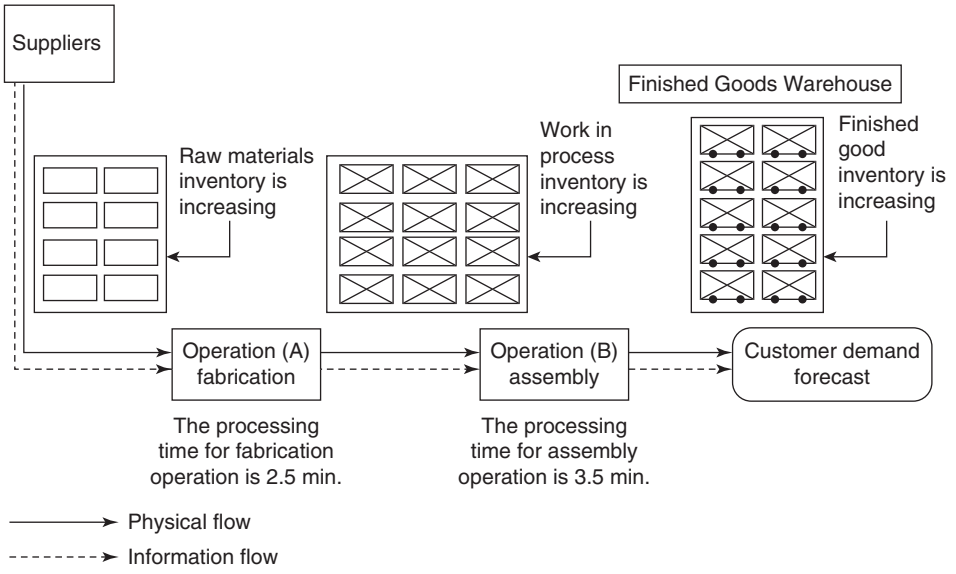
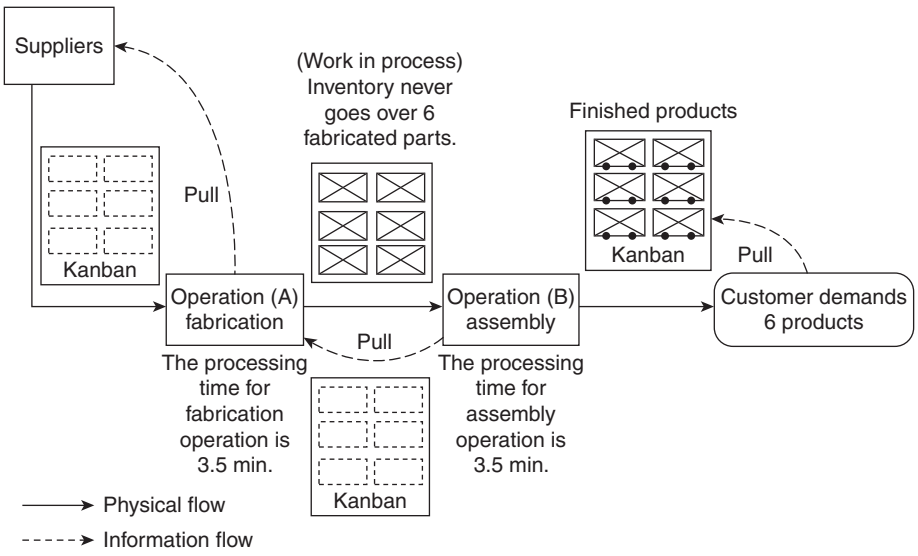


FIGURE 6.3
JIT Kanban Production Phasing System (Pull System)



A gives them. The secret of this is the kanban card. A kanban card is a control device that effectively says to the recipient, "Give me *N* items, and *N* items only. When you have done that, stop! Wait until you get the next kanban card." Figure 6.3 now shows the changed conversation between the suppliers, Operation A, and Operation B. Operation A now may stand idle for a while, which may seem like a cost, but it is not as great as the cost of idle inventory.

The objective of the pull system is to see how small a number of items you can pull with a kanban. A certain number is needed to manage natural variation in the process, but no more than the minimum is needed for the natural variation. Reducing the number of items pulled, even by one, is an effective way of highlighting problems and bottlenecks in the system. For example, reducing the kanban number in the example to five may lead to Operation B being idle sometimes, but if some process improvement is done on it, it may even be able to handle as low as four kanban items.

Determining the Number of Kanbans (Containers)

The formula for determining the number of kanbans needed to control the production of a particular product/component part is

$$\text{Number of kanbans} = \frac{\text{average demand during lead time + safety stock}}{\text{container size}}$$

$$N = \frac{dL + S}{C}$$

where

N = Number of kanbans or containers

d = Average demand per unit of time

L = Lead time; the time it takes to replenish an order

S = Safety stock, usually given as a percentage of demand during lead time or the level of expected variance

C = Container size

To promote continuous improvement, the container size is usually set at a smaller level than the demand during lead time, say, 10% of daily demand. This approach will result in reducing the number of kanbans. Fewer kanbans causes work methods and process problems to become visible.

Example 6.1

DETERMINING THE NUMBER OF KANBANS NEEDED

Marcus works as an operator at Health First, a supplement manufacturer. He is asked to process an average of 90 bottles an hour through his workstation. One kanban is attached to each container, a container holds six bottles, and it takes 20 minutes to receive new bottles from the upstream workstation. The safety stock level is set at 10%. How many kanbans are required for the bottling process?

SOLUTION

$$N = \frac{(90 \times 0.33) + (90 \times 0.33 \times 0.10)}{6}$$

$$\frac{29.7 + 2.97}{6} = 5.44$$

* We can round either up or down. If we round down, we would be promoting continuous improvement. If we round up, we would be allowing more inventory into the process.

SIGNIFICANCE OF JIT PURCHASING

LO 6.4 Discuss the relationship between JIT and purchasing.

The cost of raw materials has traditionally been a serious concern of top management. Over the years, material cost, as a proportion of total cost of the end product, has risen sharply and is as high as 80%. Consequently, the role of the purchasing function in a manufacturing organization has become increasingly important. The JIT production control system focuses on reducing both raw materials and work-in-process inventories. Specifically, JIT requires that the right materials are provided to workstations at the right time. The purchasing function is heavily involved in making necessary arrangements with suppliers so the material flows are possible in the manufacturing plant. The role of purchasing is becoming increasingly important even in nonmanufacturing environments where long cycle times from customer requests through service delivery create serious problems for such organizations.

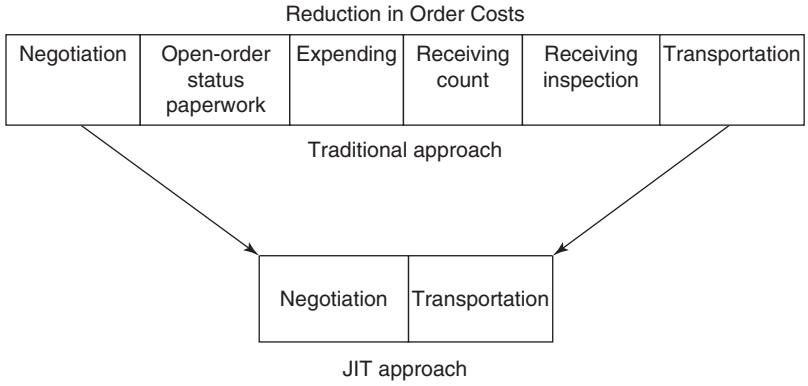
The function of purchasing is to provide a firm with component parts and raw materials. Purchasing also must ensure that high-quality products are provided on time, at a reasonable price. A comparison of critical elements associated with JIT purchasing and traditional purchasing approaches follows:

1. *Reduced order quantities.* One of the most crucial elements of the just-in-time system is small lot sizes. Traditionally, long and infrequent production runs have been considered beneficial for the overall productivity of a manufacturing organization. However, long production runs usually lead to high levels of raw material and finished-goods inventories. Large setup times have been the primary motivating factor for longer production runs. The JIT concept reduces setup times and the associated costs by introducing clever changeover techniques and simpler product designs. This permits more frequent production runs and smaller lot sizes. In turn, the JIT purchasing function becomes responsible for more frequent but smaller orders compared to the traditional case. Under the traditional manufacturing system, suppliers, on average, ship enough materials to cover 2 months of production; since adopting JIT, the lot size has been trimmed to less than 3 weeks. If frequent purchase orders are to be a viable option, traditional inventory theory suggests that order costs be minimal for JIT purchasing to be cost-effective. Indeed, the JIT philosophy strives to drive the ordering costs down to a bare minimum. A breakdown of the ordering costs associated with conventional purchasing practices is shown in Figure 6.4. Under the JIT purchasing approach, the relationship between the supplier and buyer allows the ordering costs to be reduced to simplify the negotiation and transportation costs.

All the intermediate costs are eliminated once the supplier meets the requirements of a Class A supplier. A substantial decrease in the ordering costs permits a greater number of orders to be placed over shorter intervals.

2. *Frequent and "on-time" delivery schedules.* Supplier performance can be measured more accurately under the JIT purchasing approach compared to the

FIGURE 6.4
Lean Order Cost Example



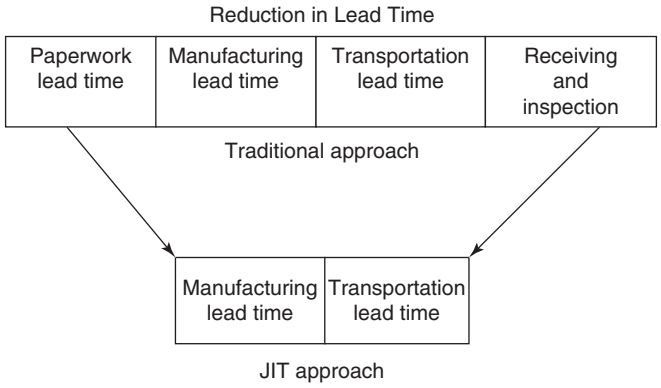
traditional one. To obtain small lot sizes for production, the order quantity size needs to be reduced and corresponding delivery schedules need to be made more frequent. The "on-time" windows have been reducing systematically over the years. In the pre-JIT days, "on time" meant anything arriving up to 12 days ahead of the nominal schedule, and as late as 6 days. On average, today JIT buyers set the window at 5 days early and 2 days late. Yet the surprising fact is that on-time deliveries increased from 62% to 79% despite the 11-day reduction in delivery window time (see Radovilsky, Grotcher, Mistry, & Yip, 1996).

3. *Reduced lead times.* To maintain low inventory levels, it is critical that replenishment lead times be as short as possible. The JIT philosophy inherently attempts to reduce lead times for order completions. Under traditional purchasing practices, the lead time is made up of the following components: paperwork lead time, manufacturing time for supplier, transportation lead time, and time spent on receiving and inspection. A comparison between the JIT approach to lead time and the traditional approach is shown in Figure 6.5. Use of EDI and RFID technology also enhances lead time reduction.

Under the JIT system, suppliers are usually associated with the company on a long-term basis. Consequently, it is possible for them to reduce paperwork significantly. Also, the supplier may be able to reduce the manufacturing time because of the guaranteed volumes. As a result of building quality into the products, the receiving and inspection time spent by the buyer usually decreases. Replenishment lead times also may be reduced by locating a supplier close to the buying firm's plant.

4. *High quality of incoming materials.* Japanese manufacturers attempt to reduce incoming material inspection as much as possible. To eliminate the associated receiving inspection costs, great emphasis is placed on the quality of incoming materials under the JIT system.

FIGURE 6.5
Lean Lead Time Example



Xerox provides a good example of the unnecessary resources spent on the incoming inspection of goods in its pre-JIT days. All deliveries from suppliers had to pass through Xerox's Webster plant in upstate New York before they could be redirected to the appropriate plants around the United States. In some instances, component parts from West Coast suppliers were first shipped to the East Coast for inspection and shipped back to the West Coast manufacturing plants. The JIT approach favors material inspection at the supplier's plant. Motivation for the suppliers to furnish high-quality materials is cultivated by long-term agreements and strategic relationships between buyers and suppliers. JIT purchasing, therefore, plays a critical role in improving product quality at the manufacturing source.

5. *Reliable suppliers.* Since the JIT system does not provide for buffer stocks, unreliable supply, in terms of delivery time and quality of incoming material, may lead to frequent problems in production. Consequently, reliability of supply is a critical consideration in the selection of JIT suppliers. Since JIT purchasing has gained popularity within the United States, the purchasing function has been preoccupied with trimming the overall supplier base in a quest for so-called superior suppliers. Xerox, for example, reduced its supplier base by nearly 4,700 over a period of one year (Inman, 1992). Ford has reduced its supplier base by nearly 25% over the past decade. As an example, Ford reduced its stamping supply base from 150 suppliers to 11. Of those 11, 7 are minority owned, supporting Ford's supplier diversity efforts.

The number of superior suppliers is on the rise as JIT promotes the concept of fewer but better suppliers. A summary of the comparison between the traditional and JIT purchasing approaches is shown in Table 6.1. JIT purchasing systems are much more difficult to manage. If JIT purchasing systems are not properly implemented and managed, the synergies will be lost and the system will collapse. However, significant advantages are realized if these elements are implemented successfully.

TABLE 6.1
Comparison Between Traditional and Just-in-Time (Lean) Purchasing Approaches

	Traditional Purchasing	JIT Purchasing
Order quantities	Based on trade-offs between ordering and carrying costs	Based on small lot sizes for production
Delivery schedules	Infrequent, primarily because high ordering costs involved	Frequent because of small lot sizes and low ordering costs
Delivery windows	Relatively wide	Very narrow
Delivery lead times	Relatively long and relaxed	Stringent and reduced significantly
Parts quality	Responsibility of the quality function in the organization	Responsibility of supplier
Supplier base	Fairly broad	Considerably smaller

PURCHASING BENEFITS

LO 6.5 Name critical JIT purchasing advantages.

Implementation of JIT purchasing assists the purchasing function in its major objectives of improving quality of incoming materials and supplier delivery performance, along with reducing lead times and cost of materials. Some of the critical JIT purchasing advantages for the manufacturer are discussed here.

1. *Reduced inventory levels.* JIT purchasing facilitates the reduction in inventory levels and the associated inventory holding costs. Asian firms like Toyota have been able to reduce inventory levels to such an extent that their inventory turnover ratios have gone up to over 60 times per year, compared to corresponding ratios of 5–8 times per year reported by most American manufacturers. U.S. manufacturers have been trying to reduce inventory levels by using JIT purchasing techniques. NCR's Ithaca plant, for instance, has been successful in reducing its number of days of inventory from 110 to 21 within 3 years of implementing JIT. However, a strong debate exists as to whether manufacturers shift the burden of inventories to suppliers using the guise of JIT. This issue will be addressed later. Reduced inventory levels are indeed one of the benefits of the JIT system, which basically stresses continuous improvement and elimination of waste.
2. *Improved lead-time reliability.* Compared to traditional purchasing approaches, delivery lead times under the JIT system are considerably shorter. Lead-time reliability is usually much better for JIT systems. This implies higher levels of customer service and lower safety stock requirements for the company. Lower levels of safety stock contribute significantly to reduced working capital requirements for the firm.
3. *Scheduling flexibility.* JIT emphasizes scheduling flexibility by reducing purchasing lead times and setup times. Such flexibility prevents confusion in the manufacturing plant and offers unique competitive advantages to manufacturing firms since they are capable of adapting to changes in the environment more quickly.

4. *Improved quality and customer satisfaction.* JIT purchasing results in improved quality and corresponding levels of higher customer satisfaction. Since high-quality products are critical in achieving a competitive advantage in today's global business world, manufacturers gain immensely by implementing the JIT production control system. High-quality incoming materials result in savings associated with reduced rework and scrap.

5. *Reduced costs of parts.* As cooperation and relationships between suppliers and manufacturers build up in a JIT system, so do the opportunities to conduct an extensive value analysis and focus on reducing the cost of parts purchased. A comprehensive JIT progress report indicates that supplier costs were reduced by 11% when they adopted the JIT system in cooperation with their customers. Long-term commitments on the part of the manufacturer allow volume purchases, development of supplier learning curves, and overall productivity increases.

6. *Constructive synergies with suppliers.* A JIT purchasing program involves close technical cooperation with suppliers. This particularly means the cooperation between manufacturing and design engineers. Because of smaller lot sizes and frequent delivery schedules, suppliers are in a position to receive quick feedback regarding any potential manufacturing or design problems. Also, manufacturing is in a position to implement engineering changes quicker because of the reduced inventory levels. The JIT progress report mentioned above indicates that supplier quality improved by 26% since the JIT system was adopted.

7. *Cost decreases.* It is well documented that JIT reduces physical inventory levels. Reductions in physical inventory also will have a favorable impact on the following:

    - Reduced insurance premiums associated with the storage of inventory
    - Reduced inventory holding costs
    - Reduced labor cost in storerooms and material handling costs
    - Reduced clerical and administrative costs
    - Reduced waste from the manufacturing process
    - Reduced obsolescence costs
    - Reduced depreciation of handling and storage equipment

Each of the cost savings will result in a leaner, more profitable operation.

IMPLEMENTATION OF JIT PURCHASING

LO 6.6 Identify the activities needed to implement JIT purchasing.

As attractive as the JIT purchasing philosophy might initially seem, it is quite difficult to implement. The switch to a JIT system presents formidable challenges. Marketing must be prepared to change its behavior when its customers are using the JIT system. Some of the common problems associated with implementing the JIT system are as follows:

1. *Lack of cooperation from suppliers.* In a detailed survey of U.S. firms involved with JIT manufacturing, 47% of the respondents indicated they had serious problems with some of their suppliers. Many suppliers see little incentive in adopting the JIT approach when the primary benefits of the program go to the buyer. Also, there seems to be a lack of commitment from the buyers, who treat the suppliers as independent parties and foster intense competition among them. Moreover, many suppliers feel a considerable strain in providing the good-quality materials to the buyer in the right quantity and at the right time on an ongoing basis.

   These problems may be resolved to some extent by educating and training the suppliers in JIT purchasing. This may be done by conducting intensive presentations and group discussions at the suppliers' plants, supplemented with continuing in-house training with the help of selected quality-control and engineering personnel from the manufacturer's plant. Manufacturers using the JIT purchasing concept must realize that long-term materials cost reductions are possible only if supplier costs are reduced. The manufacturer, therefore, must assist the supplier in identifying possible areas where improvements can be made. Some of the important expectations of suppliers involved with JIT programs are listed in Table 6.2.

   Therefore, emphasis needs to be shifted from the competitive and adversarial relationship between the manufacturer and supplier to a long-term cooperation-oriented relationship. Companies that have made JIT work smoothly at the supply end, such as Dell and Hewlett–Packard, have developed elaborate mechanisms for supplier relations, with an emphasis on partnership rather than impatient demands. One of the important secrets to JIT success is to keep no secrets from suppliers.

TABLE 6.2
Expectations of JIT Suppliers

1. A long-term business agreement
2. A fair return on supplier investment
3. Adequate time for thorough planning
4. Accurate demand functions
5. Correct and firm specifications
6. Parts designed to match supplier's process capability
7. Smoothly timed order releases
8. A fair profit margin
9. Fair dealings with regard to price
10. A minimum number of change orders
11. Prompt payment of invoices

2. *Lack of top management support.* Implementation of the JIT philosophy requires a cultural change in the organization. Such a concept cannot be implemented successfully without total support from top management. However, another survey of U.S. manufacturing firms indicated that 48% did not receive total support from top management in their efforts to implement the JIT manufacturing system. Some of the lack of enthusiasm during the past decade from top management in the United States stems from the heavy focus on short-term planning, skepticism about the suitability of JIT in the American context, and frustration from the numerous problems encountered in the implementation process.

An attitudinal change is required to get top management involved in the implementation process. Visits to other companies that have implemented a JIT program, coupled with positive

JIT results experienced by other firms, may serve to provide the necessary motivation for general managers who are initially skeptical about the program.

3. *Lack of employee readiness and support.* Many firms report lack of support from their employees as being one of the major problems encountered in the implementation of JIT. Often such resistance is encountered because the employees are required to change their long-standing work habits or because they interpret the new system as being a threat to their jobs. Also, the JIT system requires most employees to assume more problem-solving responsibilities on the job, which may lead to additional frustration.

   Education and training are very important to winning the support of employees. They need to have a thorough understanding of how JIT purchasing will be a major factor in the long-term growth and profitability of the firm, and that their professional future depends on the successful implementation of the JIT system.

4. *Lack of support from design engineering personnel.* Design engineering is responsible for making technical specifications for the materials a company buys. Often the purchasing function in an organization does not receive adequate support from engineering functions, and, as a result, purchasing is often unable to advise suppliers on material quality design options. Thirty-nine percent of the firms surveyed using JIT practices in the United States indicated that they had serious problems regarding lack of support from engineering.

   The solution to this problem is an operating climate that permits or promotes a high level of integration in all operations, including production, material control, design and process engineering, and purchasing. Such an environment is conducive to resolving problems. Suppliers also will reap benefits from the improved interaction between engineering and other personnel because they may resolve some of the quality problems with buyers more quickly and effectively.

5. *Low product quality.* If suppliers fail to provide materials of adequate quality on a regular basis, production slowdowns and stoppages will occur regularly. The study reports that 53% of American manufacturing firms implementing JIT cited this factor to be a major obstacle.

   To overcome this problem, a quality management program needs to be developed by JIT buyers that helps identify critical quality characteristics during the design and manufacturing stages of the supply process. A supplier quality certification program can be implemented that ensures that parts leaving the suppliers' plants meet all quality specifications. Nissan has implemented a supplier audit program in which six Nissan engineers regularly audit the local suppliers' plants and provide assistance on quality issues.

6. *Lack of support from carrier companies.* Table 6.3 gives an indication of the huge sums of money that the purchasing function of some major firms spends every year to move materials in and out of the factory. Few buying firms, however, work closely with carriers to develop long-term relationships that provide for highly structured delivery schedules that lower costs. Buyers have traditionally accepted terms offered to them by the carriers with regard to their inbound freight.

TABLE 6.3
Annual Expenditure on Freight

Company	Dollars Spent
General Motors	$7,300,000,000
Ford	$6,500,000,000
International Paper	$3,200,000,000
General Electric	$2,500,000,000
Chrysler	$1,200,000,000

However, increased freight activity because of JIT has not entirely been an easy ride for carriers. As a result of deregulation, transportation becomes a more competitive and quality-driven business; most manufacturing firms have begun to realize that there are significant savings possible in negotiating better terms with carriers. There has been a substantial reduction in the number of carriers used over cooperation between buyers and carriers; computer interfaces are being used by some buyers to help carriers update the buyer's information system as materials move through the carrier's system. Specific contractual features are becoming popular to meet the unique delivery requirements of the buyer.

7. *Lack of communication.* Effective development and implementation of the JIT system require integration of important functional areas such as purchasing, manufacturing, quality, production, and transportation. Lack of proper communication among these areas poses a major obstacle to the implementation of JIT. While there is no easy solution to this problem, the purchasing function in an organization must assume the responsibility of calling on top management regularly for leadership and support.

ROLE OF CULTURE

LO 6.7 Determine the role of culture in the implementation of JIT purchasing.

A crucial issue to be considered is the relevance of culture in the successful implementation of the JIT system in a country. Honda's culture and its focus on group-oriented activities are particularly suitable to the implementation of the JIT production control system. Harmony in the organizations provides for better manufacturer–supplier relationships at Toyota and Honda. Moreover, long-term relationships between supplier and manufacturer are the norm of doing business in Japan. Severance of a business relationship between manufacturer and supplier has a strong stigma associated with it, which both manufacturers and suppliers try to avoid as much as possible.

In the United States, however, such relationships between manufacturers and suppliers are a little more difficult to cultivate. Traditionally, businesses in the United States are so short-term oriented that they have their immediate interests in mind. Moreover, the level of employee and supplier commitment to the JIT concept is not as uniform and high as it is in Japan. This does not mean that JIT is not a viable concept in the United States. It is not advisable, however, for U.S. firms to blindly emulate the Japanese JIT approach. In fact, U.S. firms should try to tailor JIT to their needs and circumstances. Some firms in the United States have developed and implemented their own version of JIT under different names, such as ZIPS (zero inventory production systems), MAN (material as needed), and nick of time. A case study on JIT indicates how Hutchinson Technology (a publicly held company that manufactures a variety of products for computer peripheral and military markets) organized and implemented JIT manufacturing (Ray, 1990). The major difficulties encountered in the process included the inability of purchasing personnel to make the immense cultural transformation and the lack of resources to effect the change properly. Despite these difficulties, their JIT purchasing program has been successful.

Greater geographic separation between supplier and manufacturer in the United States is also a major impediment to the implementation process according to one survey (Freeland, 1991). The survey also indicates that JIT does not imply single sourcing in the United States, as it does in Japan. This reflects the reality of the marketplace in the United States and efforts of manufacturers to adjust to JIT as best they can.

CRITICAL ANALYSIS OF THE JIT CONCEPT

LO 6.8 Analyze the impact of JIT purchasing on a buying firm.

Most of the testimonials published on JIT systems exalt the simplicity inherent in the system processes and procedures. However, the key issue for a firm in the United States is whether it is simple to implement JIT in an existing manufacturing environment. Does JIT really provide the solution to most manufacturing problems in the United States? It is also worth investigating whether traditional purchasing approaches have been outdated in light of JIT purchasing.

Just-in-time came under intense scrutiny when Japanese manufacturers stormed into U.S. markets and took away a substantial share from the U.S. automobile industry. Subsequent investigations revealed, much to the relief of U.S. manufacturers, that it was not only the work culture in Japan that provided the Japanese an edge but also the JIT approach to manufacturing management. Many U.S. manufacturers have been in strong pursuit of this manufacturing revolution and manufacturing excellence that JIT was portrayed to bring. Several manufacturing firms that adopted the JIT approach early include General Motors, Hewlett–Packard, Ford, and Dell. Unfortunately, the excitement about the radically new manufacturing approach, coupled with the romantic version of JIT put forward by many, lulled quite a few manufacturers into believing that JIT would bring instantaneous results for their companies. Too many companies turned to JIT looking for a relatively painless financial cure that would yield substantial short-term benefits. Over the years, these companies have come to realize the tremendous effort and commitment required to make a JIT system run smoothly.

The radical proponents of JIT manufacturing in the United States during the 1980s and 1990s, the so-called JIT revolutionaries, are to some extent responsible for this initial misunderstanding. The practitioners painted an extremely romantic picture of JIT, emphasizing simplicity and efficiency, along with an illusion that employee morale would be high and relations between buyers and suppliers would be completely harmonious. They also called for immediate action and changeover to JIT without really considering the possible ramifications of implementation in the United States. Nor did they convey the message that driving obstacles and impediments out of the system would take serious and substantial effort, commitment, and time.

The pragmatic version of JIT put forth by Japanese authors focuses on the details of the production process. Here the emphasis is on identifying impediments to the smooth flow of materials and innovative techniques to overcome those problems. The Japanese perspective clearly stresses the need for careful and slow implementation, following thorough preparation. It takes time to change attitudes of the workforce and nurture long-term relationships with suppliers.

The transition to JIT has not necessarily been a smooth one for many companies in the United States. However, this does not imply that switching from a pure MRP system to a JIT or hybrid system was a mistake for most companies. There are two serious drawbacks with the MRP production control system. First, the master production schedule that drives

MRP is based on estimated customer requirements, and second, MRP's production control system uses a "push" system for manufacturing goods. That is, the purchasing function places orders for materials in large lot sizes even though the material may not actually be required, and one workstation pushes materials to the next regardless of actual production requirements. Changes in demand, estimates, or forecasts may allow inventory to pile up in the plant. Frequent adjustments to the master production schedule make the production system extremely nervous and place enormous pressures on purchasing. However, it must be admitted that MRP is an elegant technique for exploding materials requirements for production. This system has increasingly become easier to implement with the advent of sophisticated computing technology. It is not surprising to find some Western manufacturers who still use MRP for ordering purchased materials but require that delivery schedules be based on the kanban system.

Another critical issue for JIT manufacturers is the variability in product demand. The JIT system seems to work best when its smooth production and low inventory requirements are aimed at meeting a relatively stable product demand. However, demand patterns are not stable for all products. To induce a relatively stable demand, companies using JIT manufacturing often consolidate their product lines. They emphasize high quality and low cost of the product, but not variety and availability. This suggests that not all marketing strategies are compatible with the JIT system.

Does this mean that JIT, as a concept, is not particularly suited to manufacturers in the United States? Certainly not. The basic concept is as applicable in the United States as it is in Japan. The JIT system does yield substantial benefits where it has been implemented properly. Undoubtedly, proper implementation of JIT is the key to its success. There are significant benefits to other functional areas as well. However, it should be realized that JIT is not a panacea for all manufacturing problems and scenarios. A comprehensive study by Krajewski, King, Ritzman, and Wong (1987) revealed that selection of a production or inventory system can be of less importance than the improvement in the manufacturing environment itself. Keeping this in mind, manufacturers in the United States should evaluate the potential benefits of a JIT system from their own perspective, not from that of the romantic visionaries.

SUMMARY

LO 6.1 Describe lean production systems.

JIT is referred to as lean production. An organization driven by a JIT philosophy can improve profits and return on investment by reducing inventory levels, reducing variability, improving product quality, reducing production and delivery lead times, and reducing setup costs. With JIT (lean) the entire manufacturing system from purchasing to shop floor management can be measured and controlled.

LO 6.2 Explain the differences between JIT and MRP.

The JIT production system is often called a *lean production system* because it uses less of every resource compared with the conventional mass production system. The JIT system is viewed as a conventional *reorder point* system with extremely small lot sizes. The most common standpoint in understanding the JIT production system is that the JIT production is a *pull* system as opposed to the conventional push system. The JIT production system is not a panacea. As with the MRP system, there are also operational problems with the JIT system. In fact, there is a list of reasons why the Toyota manufacturing system may not work for all firms. The reasons include cultural differences, geographical dispersion of suppliers, supplier power, different management styles, and so forth.

LO 6.3 Explain the relationship of the kanban production control system to the JIT system.

Kanban is the Japanese word for "card." The kanban card contains the part number, the part description, the type of container, and various workstation information. A kanban production control system uses simple, visual signals to control the movement of materials between work centers, as well as the production of new materials to replenish those sent downstream to the next work center. The kanban card is attached to a storage and transport container. The kanban card is used to provide an easily understood, visual signal that a specific activity is required.

LO 6.4 Discuss the relationship between JIT and purchasing.

The role of the purchasing function in a manufacturing organization has become increasingly important. The JIT production control system focuses on reducing both raw materials and work-in-process inventories. Specifically, JIT requires that the right materials are provided to workstations at the right time. The purchasing function is heavily involved in making necessary arrangements with suppliers so that the material flows are possible in the manufacturing plant. The function of purchasing is to provide a firm with component parts and raw materials.

LO 6.5 Name critical JIT purchasing advantages.

Some of the critical JIT purchasing advantages for the manufacturer are as follows:

- *Reduced inventory levels.* JIT purchasing facilitates reduced inventory levels and the associated inventory holding costs.
- *Improved lead-time reliability.* Compared to traditional purchasing approaches, delivery lead times under the JIT system are considerably shorter. Lead-time reliability is usually much better for JIT systems.
- *Scheduling flexibility.* JIT emphasizes scheduling flexibility by reducing purchasing lead times and setup times.
- *Improved quality and customer satisfaction.* JIT purchasing results in improved quality and corresponding levels of higher customer satisfaction.
- *Reduced costs of parts.* As cooperation and relationships between suppliers and manufacturers build up in a JIT system, so do the opportunities to conduct an extensive value analysis and focus on reducing the cost of parts purchased.
- *Constructive synergies with suppliers.* A JIT purchasing program involves close technical cooperation with suppliers.

LO 6.6 Identify the activities needed to implement JIT purchasing.

As attractive as the JIT purchasing philosophy might initially seem, it is quite difficult to implement. The switch to a JIT system presents formidable challenges. Marketing must be prepared to change its behavior when its customers are using the JIT system.

LO 6.7 Determine the role of culture in the implementation of JIT purchasing.

A crucial issue to be considered is the relevance of culture in the successful implementation of the JIT system in a country. Honda's culture and its focus on group-oriented activities are particularly suitable to the implementation of the JIT production control system. Harmony in the organizations provides for better manufacturer–supplier relationships at Toyota and Honda. In the United States, however, such relationships between manufacturers and suppliers are sometimes more difficult to cultivate.

LO 6.8 Analyze the impact of JIT purchasing on a buying firm.

It is worth investigating whether traditional purchasing approaches have been outdated in light of JIT purchasing. Many U.S. manufacturers have been in strong pursuit of this manufacturing revolution and manufacturing excellence that JIT was portrayed to bring. Several manufacturing firms have adopted the JIT approach.

KEY TERMS

Continuous improvement 126
Just-in-time (JIT) system 123
Kanban card 127
Kanban production control system 127
Pull system 127
Push system 127

DISCUSSION QUESTIONS

1. What is meant by just-in-time (JIT) purchasing?
2. What are the elements of JIT purchasing?
3. What are problems associated with implementing JIT purchasing?
4. What are some of the expectations of suppliers? What is the role of culture in the implementation of JIT?
5. What are some advantages of JIT purchasing? Please compare JIT purchasing with traditional purchasing.
6. How does JIT purchasing affect order costs and lead time?
7. Does JIT really provide the solution to most manufacturing problems in the United States?

SUGGESTED CASES

Case 8: Central Texas Wine Distributors (CTWD)

Case 11: Delta Construction Systems (DCS)

Case 21: Morgan Summerfield (CCS)

Case 25: Precision Manufacturing Systems, Inc.

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PART III

Fundamentals of Purchasing and Supply Chain Management

7 Purchasing Procedures, E-Procurement, and Systems Contracting

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

7.1 Identify the steps in the standard purchasing cycle.

7.2 Describe systems contracting and the efficiencies achieved by using it.

7.3 Identify the technical requirements for e-procurement.

7.4 Explain the advantages and disadvantages of reverse auctions.

7.5 Define EDI and state its role in e-procurement.

7.6 Explain RFID technology.

7.7 Discuss the challenges to consider when introducing new technologies.

Nikki Jamison, the director of purchasing for Advanced Computer Logic (ACL), Inc., was becoming increasingly concerned about the large number of orders placed for some of the company's least-expensive component parts. Last year while reviewing the purchasing process for the electronic actuator components, Nikki discovered that each of the departments in the fabrication division was purchasing the same actuator components but from nine different suppliers.

Nikki called Tom Camp, the electronic component buyer, and expressed her concern. "Tom, investigate why we are buying the same inexpensive components from nine different suppliers. There should be no more than three suppliers for these components. Provide me with data and your suggestions at your earliest convenience."

INTRODUCTION

A typical purchasing department is responsible for the acquisition of a broad range of materials and supplies. Factors such as the sales volume, the number of employees, and the functional sophistication play a role in the purchasing activities. These activities can be either complex or simple. In most cases, large multidivisional firms like IBM, Ford, and Toyota usually establish a set of systematic policies based on their overall corporate missions.

Purchasing directives usually serve as the road map for all material (OEM) and supply (MRO) transactions. The driving force behind any purchasing corporate policy considers the following objectives:

1. Spend corporate funds wisely.
2. Operate in a professional manner.
3. Purchase the right materials in the right quantities, at the right time and price, from the right source.
4. Practice the highest level of ethical standards to ensure confidence among all parties.

PURCHASING PROCEDURES

LO 7.1 Identify the steps in the standard purchase order cycle.

The standard purchase order cycle is shown in Figure 7.1. Consider a simple situation in which the training department for a medium-size firm is purchasing 2,000 three-hole binders:

1. Work area involved: training department
2. Material required: three-hole binders
3. Specification: three holes, inside pocket, company logo
4. Point of need: training department
5. Procedure: training manager determines need for binders and issues a materials requisition

This sort of simple transaction is repeated daily in every firm.

Moreover, this example shows the difference between buying and purchasing. In general, the **purchasing process** refers to buying goods and services for the purpose of adding value by a manufacturer organization. **Buying** typically means procuring items for resale. Finished items are sold to a retailer by a manufacturer or distributer and are eventually sold to consumers for profit. Sometimes the terms are used interchangeably. The specific documentation for the procurement cycle is given in Figure 7.2.

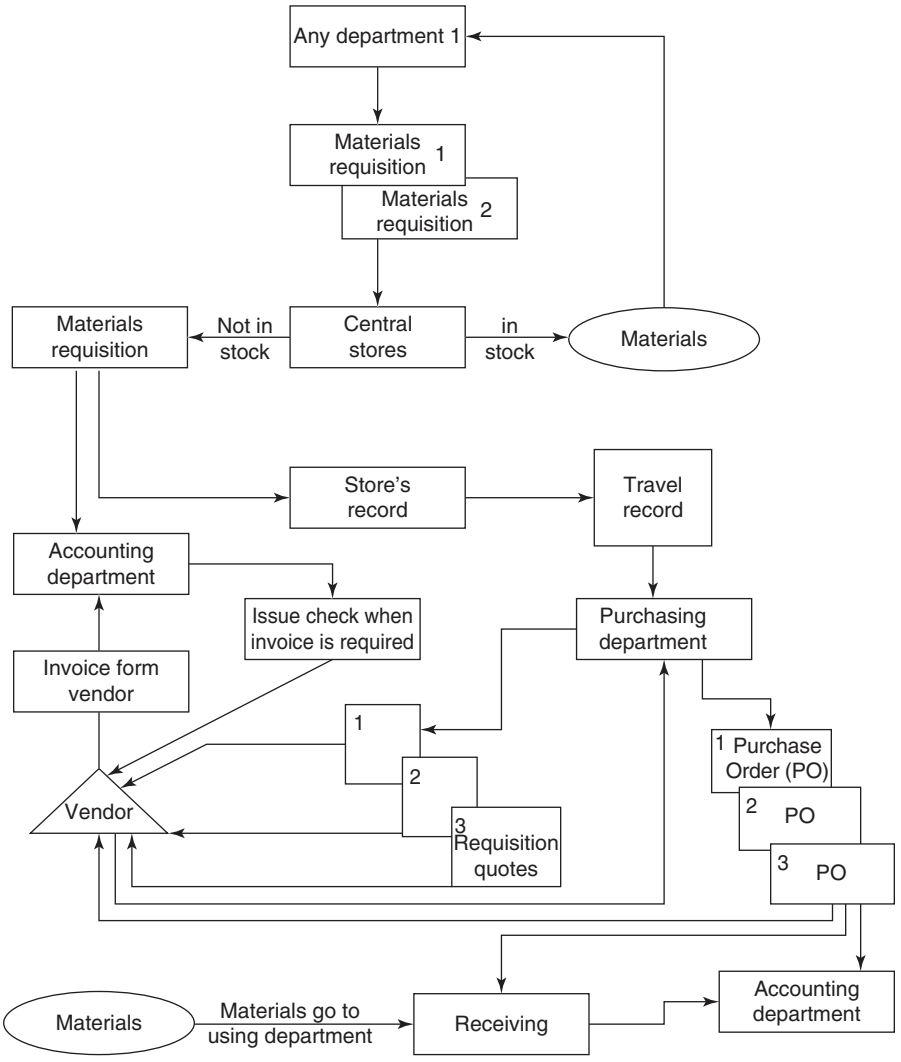
Purchasing process Buying goods and services for use by the buying organization.

Buying Procuring items for resale.

Details for the third purchasing objective became evident when the material requirements arose:

1. The right material: vinyl three-hole binder
2. The right quality: standard

FIGURE 7.1
Standard Purchase Order Cycle



3. The right quantity: 2,000 units
4. The right place: the training area
5. The right time: now

Thus, based on the above criteria specified by the department manager, the main functions of the purchasing department are to

1. determine the supplier,
2. negotiate the actual price, and
3. determine the delivery date.

FIGURE 7.2
Documentation for the Procurement Order Cycle

1. Requisition material
   a. Purchase requisition
   b. Purchasing requisition (vendor may be specified by requisitioning department)
2. Issue a purchase order
   a. Distribute order
3. Receive material
   a. Issue receipt (scan and/or sign for delivery)
4. Receive and handle invoice
   a. Check for three-way matching of invoice, PO, and shipment receipt
   b. Schedule payment (based on payment terms)

This procedure is also systematically followed for many items other than binders. To what other items can we apply this buying/purchasing method? More than 75% of a firm's procurement activities are routine. Unfortunately, many firms spend more than 75% of the time buying low-value routine supplies. This level of commodity purchasing is increasingly automated. However, knowledge of the standard purchasing cycle must be understood by all purchasing professionals.

When the need for the binders was apparent, the supply of binders was replenished from the training materials storage area. The storeroom attendant is usually held responsible for maintaining inventory levels. Most storerooms are full of inexpensive items, and 90% of stores' transactions are for low-value routine materials related to nonproductive requirements. Acquisition of supplies from the company storerooms in most cases is a relatively simple process. The requisitioner creates a requisition in the appropriate software, commonly an ERP system such as SAP. The system automatically checks whether the requisitioner has the authority to make a purchase of that value and/or under that budget line and sends requests for additional approval if necessary. If the materials are available in stock, the requisition can be filled quickly and with little further processing. Many companies have adopted catalogs (also called e-catalogs) of approved products for users to browse; this is partly done to encourage requisitioners to request items that are readily available by making it easier to request a standard item than it is to request something not normally kept in stock. Anything that requires human handling can lead to productivity losses. As an example, if 30 employees each make three round trips to the stores (to see what's available, to place orders, to follow up on orders), we can estimate the loss in productivity. Assume it takes each employee an average of 20 minutes (including waiting time); with a labor rate of $15 per hour, the total cost is $450 per day (30 hours x $15).

From the information just given, it is easy to see that, even for the simplest materials, purchasing involves many different people and often involves manually executed steps that can be costly and lead to inaccuracies. The routine practice of this type of transaction is the basic motivation for establishing system contracts.

SYSTEMS CONTRACTING

LO 7.2 Describe systems contracting and the efficiencies achieved by using it.

Systems contracting A stockless inventory method for ordering and stocking MRO and related items.

Systems contracting is a stockless inventory method for ordering and stocking MRO and related items. The use of systems contracting will aid the firm in reducing ordering and inventory costs. The systems contracting process requires the use of a negotiated agreement between buyers and sellers. The agreement includes the following terms: the type of material, scope of contract, price, billing policy, stocking policy, and delivery requirements. Systems contracting is an efficient form of purchasing based on reductions in processing and administrative costs.

In today's online environments, systems contracting approaches often lie behind businesses' internal product catalogs. As an example, Partners HealthCare (the network that includes Brigham and Women's Hospital and Massachusetts General Hospital) maintains an approved "Partners Supply Chain Management Catalog" of items. New products must go through a rigorous new product evaluation process, with scrutiny by a value analysis team, and benchmarking against industry and market conditions. The catalog is the user-friendly front-end that allows requisitioners to see what products are available and how much they cost on a per-unit basis. The systems contract behind the catalog contains more details, such as how often price changes will be considered, how much should be kept in stock, and how frequently the buyer should be invoiced (typically monthly).

In recent years, top-level managers have made substantial commitments in time and money to improve the efficiency of all facets of their operations. Primary emphasis has been placed on improved production capacity as evidenced by the increased use of automation to reduce process overhead. Information technology has become a vital tool for tracking and controlling process operations from the raw material stage to the finished product.

Profit center A business unit that uses resources to generate revenues.

Total cost of ownership (TCO) The purchase price of a product and its transportation cost, plus indirect handling, inspection, quality, rework, maintenance, and all other "follow-on" costs associated with the purchase, including costs of disposal.

To extend this commitment to increasing productivity in all departments within a given facility, many companies have adopted the concept of **profit centers**. As a profit center, each department makes a direct contribution to the overall success of the total organization. Regardless of whether the purchasing, maintenance, and accounting departments are formally recognized as profit centers, these areas represent a source of potential savings to any company. The purchasing professional, in conjunction with storeroom personnel and the accounting department, can reduce costs and create value by making decisions that consider the whole system, not just the price of one item.

Purchasing professionals are primarily charged with the responsibility for controlling the **total cost of ownership (TCO)**.

The true cost of an item is its purchase price, plus fixed, variable, and overhead costs. Beyond the direct costs are the total procurement costs. The cost of procurement includes the following steps:

1. Identify need
2. Requisition material
3. Inquire with potential suppliers
4. Evaluate bids/quotes
5. Issue purchase order

FIGURE 7.3
Total Cost Savings From Implementing a Systems Contract

Total Sales $186,250.00	Transactions 541	Total Lines 1,712
The estimated savings to Chlorine Products on the above volume using systems contracting:		
1. Issuing of purchase order to include forms, preparation, mailing, and so forth, using $25.00 per PO issued		$13,525.00
2. Reduction of inventory to include holding costs (taxes and insurance) estimated at 8% of volume		$14,900.00
3. Expediting—for example, time to write letters and make phone calls, obtain high-cost logistics support		$1,850.00
4. Receiving time, including report generation		$1,000.00
5. Pilferage and obsolescence of inventory		$800.00
6. Price protection—manufacturer's price increases that normally would be passed on immediately but due to 90-day protection results in savings of approximately 10%		$18,625.00
Total savings Systems contracting also eliminated approximately 6,500 pieces of paper.		$50,700.00

6. Expedite order
7. Document receipt of material
8. Receive and handle invoice
9. Issue payment

A detailed example of a systems contract is given in the appendix.

Systems contracting is most used for low-cost, high-volume commodities. An example of savings from a systems contract is given in Figure 7.3. New information technologies have extended the range of possibilities and the benefits that can be attained from innovative purchasing procedures and systems.

E-PROCUREMENT

LO 7.4 Identify the technical requirements for e-procurement.

The commercial purchasing literature has used the term **e-procurement** for a variety of electronic procurement systems. In the past, communicating with vendors by e-mail instead of snail mail was sometimes considered part of e-procurement. Today, e-procurement typically refers to the adoption of more specialized e-procurement software. Implementing these software packages can be costly, particularly in terms of training employees and getting suppliers to participate.

e-procurement
A specialized software system used to communicate with vendors.

A wide variety of e-procurement tools are available on the market, and it is critically important to use tools that fit the buyer–supplier relationship in question. In a previous section, catalogs were briefly mentioned as a buyer-controlled tool used by internal requisitioners to request preapproved products. These can be particularly important in industries

like health care, where buying only from approved sources is critically important for customers' health and safety. Supplier-controlled catalogs also exist, which typically display more detailed product information suited to their users (i.e., purchasers and buyers). These can be particularly well-suited to close business relationships that benefit from ongoing cooperation and frequent communication. There are also third-party marketplaces (e.g., Amazon Business) that can be particularly useful for "the long tail" of demand for items only rarely needed. Additional e-procurement tools are discussed in later sections of this chapter. Table 7.1 lists many uses of e-procurement tools, indicating how varied these tools can be.

TABLE 7.1
Use of E-Procurement Technology (% of Respondents)

E-Procurement Use	
Purchasing operations	28.3%
Inventory management applications	23.1%
Purchase from catalogs	17.1%
JIT delivery programs	9.4%
Communicate with vendors	15.3%
Communicate out of stock	13.9%
Negotiate with vendors	2.1%
Track order and ship date delays	4.2%
Check vendor price quotes	18.6%
Manage supplies' inventory levels	6.3%
Warning damage/expiration notification	0.7%
Field warehouses/depots inventory levels	0.0%
Transportation applications	2.9%
Emergencies affecting inventory	4.7%
Pickups, regional distribution centers	1.4%
Field depots on out of stock	1.4%
Drop-offs, regional distribution centers	0.7%
Ordering processing applications	1.4%
Monitor on-time arrivals of carriers	1.4%
Monitor vendors' order efforts	0.0%
Manage claims and overall performance	0.7%
Check vendor credit	0.0%
Vendors' deliveries to depots	0.7%

Obtain price quotes/bids from vendors	1.4%
Vendors' raw material stock levels	0.0%
Production scheduling applications	1.4%
Provide vendor information from queries	0.7%
Coordinate schedules with vendors/field depots	0.7%
Vendor ratings on overall performance	1.4%
Exchange data with vendors/field depots	0.0%
Process returns/damaged products	1.4%
Coordinate with JIT of vendors	0.7%
Ratings of on-time carriers' performance	1.4%
Coordinate schedules with affiliated units	1.4%

Source: Sigala (2006).

Two Broad E-Procurement Purchasing Categories

It is important to first understand the two broad categories of purchased materials, goods, and services in order to fully appreciate the role of e-purchasing: direct and indirect materials. *Direct materials* are directly related to the production of the finished goods, and *indirect materials* are any commodity or service not directly involved in the production of finished goods. Direct materials tend to be purchased in quantities based on complicated production planning and control systems. Some direct material purchasing situations may involve long, intricate negotiations. Many high-technology manufacturing firms purchase fully assembled component systems. Because of the long contract development and predictable high volumes, the number of transactions is relatively low compared to low-cost, high-transaction-volume indirect purchases. For many manufacturing firms, the direct materials account for 60% to 80% of the spend and 10% to 20% of the transactions. On the other hand, indirect materials and services account for 20% to 40% of the spend and 80% to 90% of the total number of transactions.

Indirect Materials Purchasing

Indirect purchasing can be divided into two categories: **operating resource management (ORM)** and **maintenance repair and operations (MRO)**. *ORM purchasing* is a term used for purchasing office equipment, furniture, office supplies, forms, computers, travel services, maintenance services, light bulbs, janitorial supplies, and many other relatively low-cost items. MRO purchasing is concerned with critical maintenance and replacement parts, highly engineered machine parts, and manufacturing equipment. Many e-procurement software vendors do not separate these two categories of indirect costs. It is unwise to lump ORM and MRO together. It is easy to see that critical-mission-driven machine parts are more important than office supplies and light bulbs. MRO buyers must select suppliers with high quality and technical support. A detailed comparison of ORM and MRO purchasing is given in Table 7.2. The problem with indirect purchasing is the lack of standardization, tedious paperwork,

Operating resource management (ORM) A category of indirect purchasing used for the basic operating needs of a business (e.g., office equipment, travel services, and janitorial supplies).

Maintenance repair and operations (MRO) A category of indirect purchasing used for critical maintenance of equipment and purchase of manufacturing equipment.

TABLE 7.2
Comparison of ORM and MRO Purchasing

Criteria	Noncritical (ORM)	Critical (MRO)
Number of orders Quantity per order Delivery criticality	Moderate Few to moderate Generally low	Often hundreds of thousands Varies from one to thousands Routine or critical to the point of work stoppage for delivery failures
Ratio of single source	Low	High percentage (up to 30 by count, more by value) may be single/very limited sources
Service/contracts	Some	Almost always required—performance is critical in many cases
Accounting tie-back	Generally only to GL account	May be multiple—to work order, equipment, GL, and other accounts; capital tie-back as well
Controlled inventory Internal item master	Rarely None	Always Frequently—usually critical functionality
Supplier performance measurement	Minimal—usually by contract	Almost always—variable measurement criteria

delays, and errors. Another problem is the tendency for employees to intermittently buy indirect items "off contract." This practice is referred to as maverick buying. E-procurement is an excellent platform for purchasing indirect materials.

The world of business-to-business commerce has become essential to the purchase of ORM and MRO items. E-procurement has fundamentally transformed the traditional indirect purchasing function. E-procurement has led to significant cost savings and coordinated efficiency. Online-driven indirect purchasing reduces the day-to-day waste in the manual purchasing system. Electronic purchasing for indirect materials is far more efficient than making phone calls. Transaction costs account for approximately 40% of the cost of purchasing materials and managing the supply function. For low-value, low-risk, nonrecurring goods and services, purchasing cards (also known as pcards) are often a good idea. These are corporate credit cards. Organizations typically issue policies and procedures on their use and are able to set various kinds of limits to ensure that employees comply with those policies (and to ensure that someone is notified when a questionable transaction does go through). Beyond the traditional individual user cards, pcards can also be assigned to departments, suppliers, and accounts payable (which uses the card to pay approved low-value invoices). The main advantage of pcard programs is that administrative costs are reduced without much loss of visibility on corporate spend.

For MRO purchasing, as mentioned, a buyer's objectives are very different. One relevant technique is spare parts pooling. Some critical maintenance and replacement parts, called critical spares, are very expensive yet relatively rarely required. Rather than having every location keep every critical spare in stock at all times, some companies participate in spares pooling programs. This practice is particularly common in the airline industry. Participants in pooling programs need to have confidence that a spare will be available nearby when required: They require visibility on inventory levels, locations, and lead times. That visibility is enabled by modern software.

Direct Materials Purchasing

Direct materials purchasing includes both arms-length, transactional purchases of interchangeable commodity parts and the purchase of complex, custom-built parts from important business partners. The same tools are not effective for both categories. A suitable tool for the former category, reverse auctions, is discussed separately in the next section. An example of the latter category is Emerson Electric, is one of the world's largest supplier of sophisticated computer air-conditioning and power security systems. Emerson has successfully implemented an e-procurement system for sourcing strategic direct operating materials. Emerson issues purchase orders to suppliers through its system, but more importantly, it also allows each strategic supplier access to the database that contains forecast information, open orders, and usage history on the items supplied by the supplier. Each supplier can easily access a report containing all the open purchase orders between the supplier and Emerson. The system facilitates real-time communication and reduces the administrative burden by allowing suppliers to directly access the information they need (instead of e-mailing update requests to the buyer).

Purchase-to-Pay (P2P) and Source-to-Contract (S2C) Processes

One way that software companies describe their e-procurement packages is by explaining what processes are enabled by the software. Purchase-to-pay (P2P) systems are more common. These systems support the purchase order cycle presented in Figure 7.1. One example is the cloud-based P2P system that Northumbria University in Newcastle, England, rolled out in 2017. Mark Gill, the commercial director responsible for the implementation, emphasized the importance of engagement and user experience, as well as rolling out one clearly defined purchasing process and applying it to everyone—only then looking to see what exceptions were needed. Northumbria's P2P successfully reduced their purchase order times to 24 hours after a requisition has been made.

E-procurement software that supports the source-to-contract (S2C) process is also available. This software focuses on contract life cycle management (CLM) rather than purchase order management. For example, the Carolina Hurricanes NHL team implemented a cloud-based solution from SciQuest in 2015. The software provides a central repository of contract-related information (increasing visibility and accessibility), reduces time to create sponsorship and event contracts through the use of approved terms and templates, sends alerts and reminders, and ensures security and an audit trail.

P2P and S2C are both important processes that can be enabled by e-procurement. Figure 7.4 shows examples of products and services on a continuum from generic to complex. Companies that frequently contract for customized services, like the Carolina Hurricanes, may benefit more from solutions with strong support for S2C, while companies that mainly buy generic products will benefit more from automating the P2P process.

The traditional purchasing approach is being transformed by new technologies that create value by (1) focusing on reducing the total cost of ownership, (2) streamlining the purchasing and sourcing processes, and (3) enabling business innovation. Figure 7.5 highlights some of these benefits. Table 7.3 highlights companies' e-procurement solutions and shows the benefits these systems helped them achieve. The ability to access the world market for goods and services has become a key competitive advantage, and this is redefining the way companies manage their supply chains.

FIGURE 7.4
Commodity Continuum

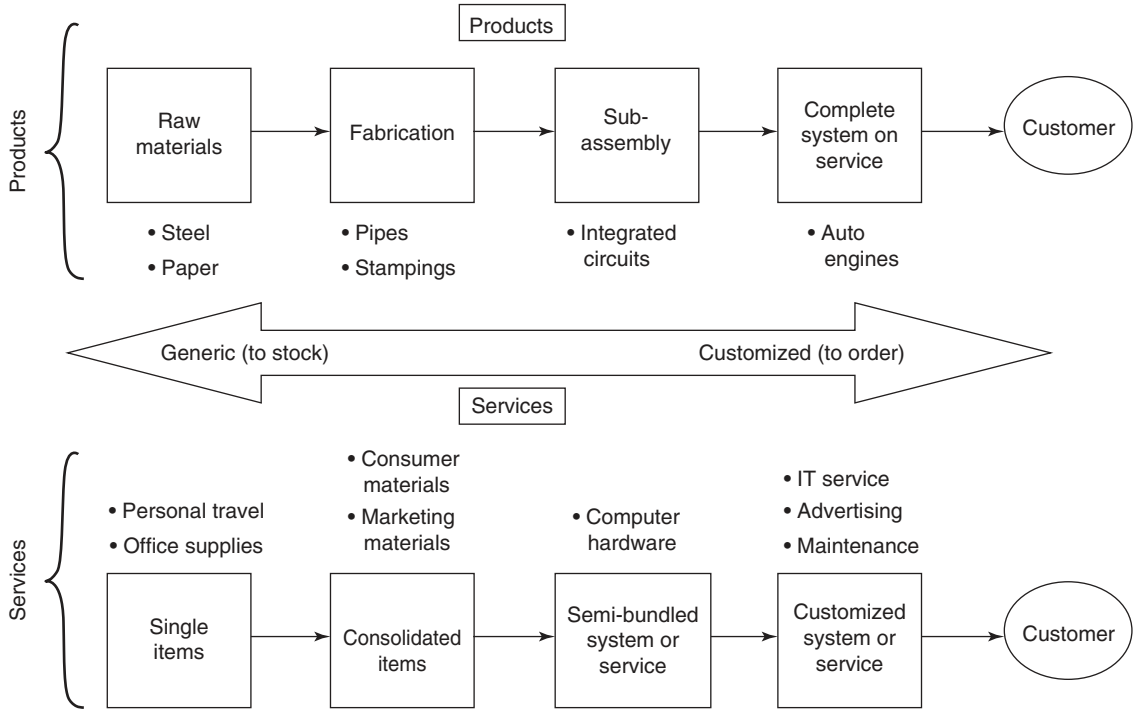


FIGURE 7.5
Benefits of E-Procurement

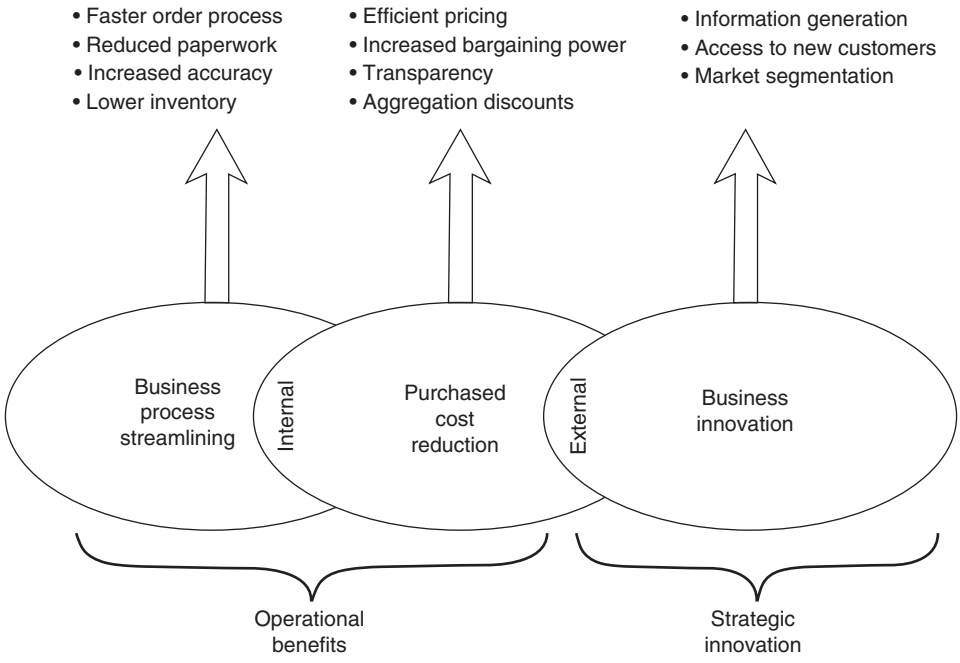


TABLE 7.3
Best Practices in e-Procurement Implementations

Company	Business Type	E-Procurement Solution Provider	Monetary Results and Benefits	Nonmonetary Results and Benefits
Research Triangle Institute	Nonprofit organization with more than 2,500 employees and annual spending of $150 million. Field research and development work in pharmaceutical, advance technologies, education and training, and economic and social development.	E-Plus, Inc.	1. Savings of $300,000 a year. 2. Enhanced spend leverage and strategic sourcing saved $1 million in 2005. 3. Enabled RTI to reduce its cost per order by 70%, from $85 to approximately $25. 4. Dollar savings of about $500,000 a year.	1. Enables RTI supply managers to make better spending decisions and improves the budgeting process. 2. Has improved cycle and delivery time by 5 to 7 days. Traditionally, it takes 30 days. 3. System has improved user productivity. 4. Away from day-to-day tactical buying activities.
Service Master	A $3.8 billion U.S. company that serves 10.5 million homes and businesses every year. Field: chemical	Katera	1. Cost savings through improved contract pricing and pricing compliance, which is conservatively estimated at 3% across the board. 2. Additional savings ranging from 7% to 20% through increased spending leverage and sourcing activity.	1. Allows for easier spend aggregation and a more efficient sourcing process. 2. Reduction of requisition-to-payment cycle. 3. One purchasing platform with the ability to collect data, track orders, track receipts, and monitor compliance, as well as create supplier scorecards.
University of Pennsylvania	University of Pennsylvania, or Penn, is a private, Ivy League university in Philadelphia established in 1740.	Oracle; SciQuest	1. Penn attributes $77.4 million in total product cost savings. 2. Purchasing estimates savings of $7.7 million resulting from the enablement of Penn Marketplace suppliers.	1. Improvement in contract compliance and pricing compliance. 2. Average cycle time (online purchase order creation to electronic order transmission to supplier) has fallen from 18 days to less than 1 for more than 92% of all purchase orders. 3. Improved administrative processes and reduced the number of full-time employees needed to process transactions.

(*Continued*)

TABLE 7.3 (Continued)

Hewett-Packard	HP is a global company with annual sales of $80 billion that employs 140,000 worldwide in more than 170 countries. Annual spend is about $60 billion—$13 billion in indirect and the rest in direct materials and services.	Ariba	1. Achieved over $1.8 billion total negotiated savings and spend reduction. 2. Operation expense was reduced from 0.95% of total spend in 2002 to 0.75% in fiscal year 2005.	1. Contract compliance has reached approximately 80%. 2. The spend management solution has enabled HP procurement professionals to address more corporate spend and focus more on strategic supply initiatives.
FedEx	FedEx has over 370 facilities in the United States and Canada and a presence in over 211 countries worldwide. FedEx, $20 billion value, consists of FedEx Express, FedEx Ground, FedEx Freight, FedEx Custom Critical, FedEx Trade Networks, and FedEx Services.	Ariba	1. FedEx has seen savings of up to 40%.	1. Overall purchasing cycle times have been reduced from 20% to 70%. 2. Transfer procurement professionals to more strategic activities. 3. FedEx reduced the number of suppliers by more than half, from 90,000–110,000 down to 40,000–50,000. Of the 2,500 suppliers that FedEx does regular business with, 75 are currently enabled on the Ariba system. 4. Able to have largest volume buys.

REVERSE AUCTIONS

LO 7.4 Explain the advantages and disadvantages of reverse auctions.

The Internet revolutionized commodity purchasing. Reverse auctions may be the most significant of the many changes to the purchasing process that resulted from the world going online. Businesses that use reverse auctions have given testimonials of savings of more than 50%. For example, General Electric reported savings of more than $600 million from putting $12 billion in contracts up for bid. The use of reverse auctions has even spread into the construction industry and governmental agencies.

Reverse auction An online, declining-price auction between one buying organization and a group of prequalified suppliers. The bidding process is in real time. In most cases, the supplier with the lowest total cost bid is awarded the contract.

The purpose of a traditional auction is to create competition between bidders. A seller offers a good or service, and bidders compete with one another by increasing the current bid price. At the end of the auction, the highest bidder wins the item. **Reverse auctions** are different: Instead of many buyers competing to buy something from one seller, many sellers compete to sell something to one buyer. First, the buying firm initializes the auction by submitting a description of the product or service. Sellers then place bids based on their offer to fulfill the buyer's needs. The competition between the sellers drives the price down,

FIGURE 7.6
Reverse Auction Steps

Reverse Auction Steps
1. Define market specifications
2. Identify suppliers
3. Perform pre award review
4. Approve suppliers' listing
5. Identify specific terms and conditions
6. Invite suppliers
7. Set up auction
8. Conduct auction
9. Write up contract

instead of up, so the buyer pays less at the expense of the seller. Finally, the buyer chooses the winning bidder. Although price is often the most important factor, the winner is not necessarily the highest or the lowest bidder but may be selected by the buyer according to some other predetermined combination of factors. Figure 7.6 lists the steps involved in conducting a reverse auction.

Reverse auctions are not the solution for all commodity buying. For example, if there are too few sellers, reverse auctions will not yield the best price. By definition, the price in reverse auctions is driven down by competition, so if only limited competition exists the price will not decrease enough to save substantial amounts of money. A more serious downside of reverse auctions is the buyer–seller relationship damage that may result from using this method of buying. The buyer runs the risk of alienating both current and potential sources for the goods or services involved.

Reverse auctions can be used to gain market information (e.g., new suppliers, prices, new methods). Buyers should recognize that reverse auctions may not support trust and cooperation in their relationships with suppliers, depending on the context. Requests for quotes (RFQs) are an alternative approach to benefiting from market competition that may be less harmful to buyer–supplier relationships. However, a drawback of RFQs, for both buyers and suppliers, is the greater manual processing involved. With modern reverse auction platforms, the entire bidding process can be concluded in under an hour, while the cycle time for RFQs is much longer.

ELECTRONIC DATA INTERCHANGE (EDI) AND PURCHASING

LO 7.5 Define EDI and state its role in e-procurement.

Electronic data interchange (EDI) is the direct computer transmission of orders and other transaction information in a specific standardized format. In purchasing, EDI is usually used for the electronic transmission of orders and invoices between buyers and sellers. Although EDI predates the Internet, it continues to be used today; many transmissions have shifted to the Internet from other transmission methods, but the EDI documents themselves are unchanged.

Electronic data interchange (EDI) The direct computer transmission of orders and other transaction information in a specific standardized format.

RADIO FREQUENCY IDENTIFICATION (RFID)

LO 7.6 Explain RFID technology.

Radio frequency technology (RFID) A universal term given to any technology that uses radio waves to identify and track items.

Radio frequency technology (RFID) is a universal term given to any technology that uses radio waves to identify and track items. Items such as a product, a container, an automobile, an animal, or a person can all be automatically identified and tracked through RFID technology. RFID originated in the government sector during World War II but gained momentum much more recently due to drastic price reductions and increased availability. RFID is a flexible technology that works particularly well in fast-moving and highly automated distribution centers.

RFID technology can be constructed in many ways, but the most common procedure is to store a serial number on a microchip and attach it to a coiled antenna. In manufacturing applications, this may be built directly into the product, or it can be affixed with adhesive paper to form a "smart label" or RFID tag. Readers convert radio waves from the tags into data that are decoded and transformed into information.

RFID technology can be contrasted with barcode technology. One of the major drawbacks in using barcodes is that identifying items requires line of sight; the product has to be correctly oriented relative to the scanner. With RFID technology, line of sight is not required. For example, a container of products on a conveyor belt can be accompanied by an RFID tag that contains its routing information; when the container passes a reader, the reader can read the tag and automatically route the container to the correct destination.

RFID systems are also distinguishable by their frequency ranges. Low-frequency (30–500 KHz) systems are often associated with the shortest reading ranges and are most commonly used in security access, product tracking, and inventory-level controls. High-frequency (850–950 MHz and 2.4–2.5 GHz) systems offer much longer read ranges, sometimes over 100 feet, and at high reading speeds. High-frequency systems are mainly used for railroad car tracking and automated toll collection.

Advantages of RFID include reduced labor costs, simplified business processes, improved inventory control, increased sales, and reduced shrinkage. Since RFID tags do not require contact or line of sight, they can be read through snow, fog, ice, paint, and crusted grime (unlike barcodes).

Companies considering adoption of new technologies must ask themselves questions relating to the adoption decision and system design. Questions relating to RFID adoption are provided to illustrate this decision and planning process.

Companies considering RFID implementation must ask themselves these questions:

- Does the company need RFID to keep pace with competitors?
- Will RFID offer a competitive advantage for the company?
- Will the company have the power to manage its business without accurate information about its processes and inventory (which could be gained from RFID)?
- Will RFID cost-effectively improve the ability of the company to serve its customers?
- Will RFID save the company money in the long term?

Companies designing their RFID system implementation must ask themselves these questions:

- About the item environment:
  - What is the item to be tagged?
  - In what ways will the tag be read? In groups or individually? Over what distances? While exposed to what environment?
  - Are there concerns with temperature, damage potential, handling equipment?
  - What business processes need to be changed in order to work with RFID?
  - What physical changes (if any) to the item or its dimensions are needed?
- About the system environment:
  - What is the configuration of the manufacturing facility, warehouse, store, shipping dock, or other location?
  - What are the physical surroundings?
  - Do the items sit for a long period or are they frequently moved?
  - Is there machinery that can interfere with our system?
  - What are the distances involved with reading the item?
- About the data requirements:
  - What are the tag data storage requirements?
  - What are the data transmission requirements?
  - What back-end data storage is required? Storage size, editing, backups and copies, transmission speeds?

Further questions must also be asked about the tag mounting, reader capabilities, antenna selection and placement, and software. RFID can become a solution that provides great benefits: cost reductions, increased accuracy, improved workforce efficiency, and improved ability to execute, but there are many issues a company needs to examine before making any decisions. See Example 7.1 for a sample RFID analysis.

Example 7.1

RFID ANALYSIS: PANTHER MACHINE, INC.

Panther Machine, Inc., located in Wixom, Michigan, is a manufacturer of multipiece crankshafts. It produces crankshafts for items such as chainsaws. Its largest customer is Frigidaire, a European company. Panther has several suppliers of raw materials, such as raw steel, counterweights, and pins, and outsources some of these from China to cut costs. Shafts are turned in-house, although Panther is looking at possibly outsourcing this operation. The plant is divided into three cells: (1) CSI, which produces one part, the 062, for Electrolux; (2) VICI, which produces two parts, the 979 and 980, for another customer, Homelite; and (3) Lawn and Garden, which

(*Continued*)

(Continued)

produces many different parts for both customers and includes robot lines. The 062 part in CSI and the 979 and 980 parts for VICI sell for almost $7 each, so those are the major money-making parts, compared to the other parts, which sell for an average of $1–$2.

Parts are boxed and placed on skids and shipped daily in volumes of one thousand to tens of thousands per skid. Panther recently underwent a complete reengineering of processes and labor with a consulting firm. It implemented a new, extremely complex operating system that tracks inventory, shipments, and customer demand and integrates all the scheduling processes with a production log filled out at each machine each day to use capacity as efficiently as possible and give daily production reports. Panther was able to implement lean manufacturing and value stream mapping to streamline its processes and has been able to increase profits this year due to these changes. Total revenue brought in for an average month is around $2.3 million, with about $2 million of those sales coming from the customer Frigidaire. So far in the year 2008, the company has brought in revenue of $21.3 million. This compares to revenue of $24.4 million for the year 2007.

Recently, the president attended an industrial conference on implementing RFID technology. In the past, Panther has relied on technology as a competitive weapon. Should Panther implement RFID technology?

Panther should not implement an RFID system. Given the company size and resource base, an RFID system would result in major disruptions. It appears that the newly implemented tracking system is working well. The current system must first be carefully evaluated before implementing any new technology. Also, since the parts that Panther manufactures and distributes are not high-value items, the company would probably not benefit from using an RFID system. As noted throughout this section, decisions made by the customers (retailers) may come into play. If Frigidaire demands that its suppliers implement RFID systems, Panther Machine, Inc., would have to weigh the costs of implementing such a system with the benefits of continuing to be Frigidaire's top supplier.

ADOPTING NEW TECHNOLOGIES

LO 7.7 Discuss the challenges to consider when introducing new technologies.

Introducing major new technologies into organizations will almost always result in some combination of social, technical, psychological, and structural changes. When managers or employers resist the logical arguments presented in support of a new technology, they may not be resisting the technical aspects of the proposed change as much as the perceived social or psychological ramifications. Workers know these changes may lead to layoffs, or their job descriptions may change, following adoption of new technologies. The consequences of adopting new technologies are usually uncertain.

One way to overcome resistance to change is to focus on the process of change itself. The Lewin-Schein theory of change is a concise description of this process consisting of the following three steps:

1. *Unfreezing*: Creating an awareness of the need for change and a climate of receptivity to change
2. *Moving*: Changing the magnitude or direction of the forces that define the initial situation; developing new methods and/or learning new attitudes
3. *Refreezing*: Reinforcing the changes that have occurred, thereby maintaining and stabilizing a new equilibrium situation

Organizational change requires difficult planning. Before implementation takes place, management should authorize use of the necessary resources to educate the people involved and obtain commitment and support from them. Communicate the specifics of the change, including how it affects jobs and how individuals should interface with the new system. Major organizational change requires top management support, commitment to the project, influence (which varies over the project life cycle; changes are easier to make in the early stages), and institutionalization. **Institutionalization** is the process through which the system becomes incorporated as an ongoing part of organizational activities. This can occur through diffusion of the system of other users, changing the work of employees, and changing the structure and process of the organization.

Institutionalization
The process through which the system becomes incorporated as an ongoing part of organizational activities.

Procurement plays a key role in the adoption of nonprocurement technologies as well. Purchasing professionals are involved in the purchase of new software packages, and purchasing processes can enable, or interfere with, a firm's ability to access new innovations developed by suppliers.

Effective E-Procurement Implementation

This section offers general advice on how to implement a standard e-procurement software package. Of course, the first step in successful e-procurement implementation is to select the right package for the task at hand. Consider the total procurement costs in your organization, including how often various tasks have to be performed in your industry. Remember to consider the suppliers' user experience, as well as your own, and be sure to pay enough attention to training and change management when planning your implementation project.

1. Start with noncritical items. An initial e-procurement system should reduce the manual processing involved for purchasing and reduce order complexity by standardizing the exchange process between supplier and buyer.
2. Bring all internal stakeholders on board with your new procurement process to establish internal customer behavior.
3. Streamline, map, test, troubleshoot, and improve the process before expanding it to external suppliers. Work with a favored supplier to test the system.
4. Leverage your system once it's running. Exploit your full purchasing power by using reverse auctions. Invite new suppliers to participate once the system has proven itself.
5. Aggregate buyers within your organization to increase your purchasing power and gain better pricing.
6. Use an incremental approach to expand your system. It is not possible to have uniform relationships with all suppliers, nor are all purchasing requirements the same. Sort purchasing needs into groups that can use a similar process and a similar template.
7. Once the bumps have been ironed out of the system, expand the scope of your implementation to other spend categories.

Cybersecurity

Purchasing professionals play an important role in the cybersecurity of their firms. In previous sections of this chapter, we discussed various tools that link firms with their suppliers. These links can be weaknesses as well as strengths: Modern companies are sometimes hacked via their suppliers or customers. Overall security is only as strong as the weakest part of the supply chain. Firms must ensure that confidential information is transmitted securely and that it is only shared with other firms capable of maintaining the same level of care.

SUMMARY

LO 7.1 Identify the steps in the standard purchase order cycle.

Purchasing directives usually serve as the road map for all material (OEM) and supply (MRO) transactions. The driving force behind any purchasing corporate policy considers the following objectives: (1) spend corporate funds wisely, (2) operate in a professional manner, (3) purchase the right materials in the right quantities, at the right time and price, from the right source, and (4) practice the highest level of ethical standards to ensure confidence among all parties. The main functions of the purchasing department are to determine the supplier, negotiate the actual price, and determine the delivery date.

LO 7.2 Describe systems contracting and the efficiencies achieved by using it.

Systems contracting is a stockless inventory method for ordering and stocking MRO and related items. The use of systems contracting will aid the firm in reducing ordering and inventory costs. The systems contracting process requires the use of a negotiated agreement between buyers and sellers. The agreement includes the following terms: type of material, scope of the contract, price, billing policy, stocking policy, and delivery requirements. Systems contracting is an efficient form of purchasing based on reductions in processing and administrative costs.

LO 7.3 Identify the technical requirements for e-procurement.

E-procurement typically refers to the adoption of more specialized e-procurement software. Implementing these software packages can be costly, particularly in terms of training employees and getting suppliers to participate. A wide variety of e-procurement tools are available on the market, and it is critically important to use tools that fit the buyer–supplier relationship in question.

LO 7.4 Explain the advantages and disadvantages of reverse auctions.

Reverse auctions may be the most significant of the many changes to the purchasing process that resulted from the world going online. An advantage of using reverse auctions is cost savings. Another advantage of this tactic is increased market information. A disadvantage is that a lack of competition may inhibit the realization of any savings. This practice may also damage the buyer–seller relationship as the buyer may alienate current and potential sources of goods and services. Businesses that use reverse auctions have given testimonials of savings of more than 50%. The purpose of a traditional auction is to create competition between bidders.

LO 7.5 Define EDI and state its role in e-procurement.

In purchasing, EDI is usually used for the electronic transmission of orders and invoices between buyers and sellers. Although EDI predates the Internet, it continues to be used today; many transmissions have shifted to the Internet from other transmission methods, but the EDI documents themselves are unchanged.

LO 7.6 Explain RFID technology.

Radio frequency technology (RFID) is a universal term given to any technology that uses radio waves to identify and track items. Items such as a product, a container, an automobile, an animal, or a person can all be automatically identified and tracked through RFID technology. RFID technology can be contrasted with barcode technology. One of the major drawbacks in using barcodes is that identifying items requires line of sight; the product has to be correctly oriented relative to the scanner. RFID does not require line of sight.

LO 7.7 Discuss the challenges to consider when introducing new technologies.

Implementing new technologies into organizations will almost always result in some combination of social, technical, psychological, and structural changes. One way to overcome resistance to change is to focus on the process of change itself. Cybersecurity also poses challenges in the use of digital systems.

KEY TERMS

Buying 145
Electronic data interchange (EDI) 157
E-procurement 149
Institutionalization 161
Maintenance repair and operations (MRO) 151
Operating resource management (ORM) 151
Profit center 148
Purchasing process 145
Radio frequency technology (RFID) 158
Reverse auction 156
Systems contracting 148
Total cost of ownership (TCO) 148

DISCUSSION QUESTIONS

1. What are the procedural objectives for sound purchasing systems?
2. What are the main functions of a purchasing department?
3. What is systems contracting?
4. What is meant by total cost of ownership?
5. What are reverse auctions? What is EDI? How have they changed the purchasing function?
6. What are the steps in the Lewin–Schein theory of change?
7. What is RFID? How does it work? What are its advantages and disadvantages?
8. What are the advantages and disadvantages of purchasing technologies?
9. How has the Internet changed the purchasing function?

SUGGESTED CASES

Case 3: The Auction Case

Case 10: Custom Doors, Inc.

Case 11: Delta Construction Systems (DCS)

APPENDIX: SYSTEMS CONTRACT AGREEMENT

_____, herein designated the "Buyer," agrees to buy, and McJunkin Corporation, herein designated the "Seller," agrees to sell upon the following terms and conditions:

1. Material: Pipe, valves, and fittings (etc.) meeting the specifications set forth in Schedule A attached hereto and made a part hereof. Items not listed in Schedule A should be priced as per Schedule B.
2. Scope: Buyer's purchase requirements for its _____ plant(s) and/or _____ construction site(s).
3. Price: Seller's prices are set forth in Schedule A and discounts as posted in Schedule B. Seller shall submit to Buyer a list of standard price sheets under Schedule B to be considered for the purpose of this provision. Changes in these price sheets or of specific items on Schedule A shall occur only on January 1, April 1, July 1, and October 1. The Seller must advise the Buyer by the end of the first working day of the previous month (December, March, June, and September) those items to be revised. Items on which no notice has been given by the above deadline will remain in effect until the next price change date. This price change pattern

can only be overridden when both Buyer and Seller mutually agree to an abnormal change, affecting either party, and immediate action should be taken, that is, abnormal manufacturer price change, allocations. If any price change is unacceptable, Buyer shall have the right to terminate the items(s) so affected from the contract by giving Seller written notice thereof on or before the effective date of the proposed price adjustment.

4. Billing: Seller shall submit a summary invoice on the _____ th of each month covering shipments made during preceding billing period. Prices shown shall be net and shall include the case discount. Buyer shall remit the total amount due no later than the _____ th working day following receipt of said invoice.
5. Stock: The Seller agrees to maintain adequate inventories of the items contained in Schedule A (and Schedule C) to prevent backorders and to ensure prompt delivery. Buyer and Seller will mutually agree on inventory quantities until a usage level is established. Once a level has been established, the Seller will only be responsible for maintaining the agreed-on quantities over a specific time period. If the Buyer's purchases exceed established inventory levels by more than ___ percent during this time period, Seller will be given a reasonable time to replenish his stock. If Buyer does not exceed inventory level and cannot accept a lesser quantity or substitute, it shall be the responsibility of the Seller to furnish the quantity and kind of item ordered.
6. Indemnification: Buyer agrees to indemnify Seller against any and all loss as a result of discontinuance or obsolescence of any items not considered standard by Seller and stocked at the Buyer's specific written request. All requests for the stocking of nonstandard material will be made by the Buyer in writing and shall constitute Schedule C attached hereto and made part hereof. The quantity for which the Seller shall be indemnified is the total number of a particular item stocked at Buyer's request.
7. Contingencies: No liability shall result to either party from delays or nonperformance caused by circumstances beyond the reasonable control of the party affected.
8. Delivery:
   a. Stock shipments: F.O.B. delivered to the specific plant area specified by the Buyer.
   b. Direct shipments (if applicable): F.O.B. delivered with freight charges per manufacturer's terms and conditions.
9. Insurance: If deliveries hereunder are made in Seller's equipment, then Seller shall carry insurance of minimum limits as follows:

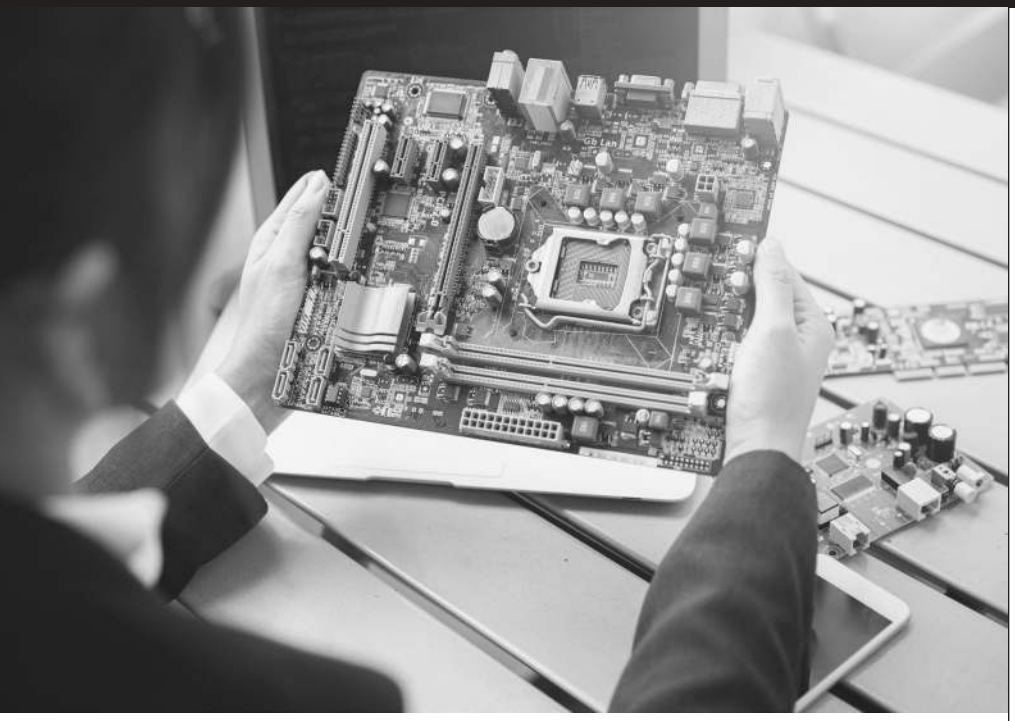
   Automotive Public Liability Bodily Injury (covering owned, hired, and all classes of nonowned vehicles) $100,000/$300,000 and Property Damage $25,000. Certificates indicating this insurance is in effect and a statement that the insurance companies will not cancel or reduce the coverage without giving Buyer ten days' prior written notice must be filed with Buyer before starting plant deliveries and shall be subject to Buyer's approval.
10. Patents: Seller warrants that the use or sale of the material delivered hereunder will not infringe any United States patent claim covering the material itself but does not warrant against infringement by reason of the use thereof in combination with other materials or in the operation of any process.
11. Fair Labor Standards Act: Seller warrants that all goods delivered within this contract will have been produced in compliance with the requirements of the Fair Labor Standards Act of 1938, as amended.
12. Assignment: This contract is not assignable or transferable by either party, either in whole or in part, without the prior written consent of the other party.
13. Entireties: This instrument constitutes the entire contract between the parties, and no modification or supplement shall be effective unless agreed to in writing by both parties.
14. Duration: This agreement shall become effective on ___ for a period of years subject to the right of either Buyer or Seller to terminate said agreement by not less than 30 days' prior written notice.

REFERENCE

Sigala, M. "E-Procurement Diffusion in the Supply Chain of Foodservice Operators: An Exploratory Study in Greece." *Journal of Information Technology & Tourism* 8, no. 2 (2006), pp. 79–90.

Supplier Selection and Evaluation

8



Axle, Inc. is a middle-market firm specializing in the design and manufacturing of front-end loaders for tri-axle dump trucks. The purchasing department spends approximately $75 million for materials and supplies. Last year, approximately one third of the $75 million was used to purchase 50 separate steel items from 20 different steel companies. Ten of the steel firms have been a supplier of the firm for many years. The purchasing manager has been asked by the executive committee to reduce the number of steel suppliers by 50%. What criteria should Axle use to consolidate the steel purchases?

INTRODUCTION

In today's competitive environment, progressive firms must be able to produce quality products at reasonable prices. Product quality is a direct result of the production workforce and suppliers. Buying organizations can no

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

8.1 State the reasons a corporation may decide to outsource production.

8.2 Identify sources businesses can use to make informed supplier decisions.

8.3 Explain the importance of a strategic match between the buyer and supplier.

8.4 Discuss the need for efficient supply chain management relationships.

8.5 Describe the approach to a supplier relationship management program.

8.6 Explain how to implement a supplier development program.

8.7 Explain how to implement a supplier evaluation program.

8.8 State the factors that should be considered when determining the number of suppliers to work with.

8.9 Compare how different industries select and evaluate suppliers.

longer afford to maintain a large supplier base. In today's competitive sourcing environment, buying firms select suppliers based on their capabilities and not purely on the competitive process. The current trend in sourcing is to reduce the supplier base. To select suppliers who continually outperform the competition, suppliers must be carefully analyzed and evaluated (Wetzstein, Hartman, Benton, & Feisel, 2018).

More manufacturing firms are increasing the percentage of parts they outsource versus those they produce internally. This has led to an increasingly important role for the purchasing function. Traditional purchasing professionals who act as little more than order placers are giving way to strategically involved analytical managers who control vital inputs to the production process. More and more power is being placed in the hands of professional purchasing managers because industry is beginning to realize the importance of defect-free parts and the value-added capabilities of suppliers.

THE BUY DECISION: OUTSOURCING

LO 8.1 State the reasons a corporation may decide to outsource production.

There are a variety of reasons organizations outsource product production and services. According to Deloitte, 31% of all IT services were outsourced in 2019. There has also been a growing increase in outsourcing from industries such as manufacturing, facilities management, and procurement. **Outsourcing**, which can be viewed as a delegation of production capabilities, can enable a firm to concentrate on its true core capabilities. Outsourcing can produce many benefits for a firm that would normally produce a part internally. Internal production of subassemblies and parts is actually a backward vertical integration policy. **Vertical integration** gives a firm more control over the part in question. However, the greater the percentage of internal parts an assembly firm produces, the greater its need to have competence in each of the areas involved. It is difficult for a manufacturer such as an automobile company to have competence in areas of production of all parts that go into producing and assembling a car. Therefore, outsourcing to suppliers reduces the pressure on firms to try to do everything.

Outsourcing Delegation of function or production capabilities.

Vertical integration The assimilation in one company of multiple stages of production normally operated by separate companies.

By concentrating on its core capability, a firm can direct its energies to the true value-adding steps that make it competitive. Likewise, suppliers can then develop their own core competence in the fields relevant to the production of the parts they make. Many successful Japanese automakers internally produce fewer parts and outsource more than do North American auto manufacturers. Of the total cost of materials, tools, and finished parts needed to produce a car, Toyota only produces approximately 27% internally while General Motors produces approximately 70%. By "delegating" or outsourcing, Toyota is left to concentrate on the core functional capabilities of its autos: the engine, transmission, electronics, and major body parts.

When a firm decides to buy, the question then becomes to whom to "delegate" this responsibility. Thus, the firm must select a supplier or suppliers for the part(s) in question. The supplier selection problem is much easier to describe than carry out. One purpose of this chapter is to shed light on selecting only the most compatible supplier for firms in specific industries. The buying firm may be highly skilled at (1) specifying product attributes, (2) forecasting expected requirements, and (3) ensuring the right quality at a reasonable price. However, unless the buying firm selects the right supplier, the prepurchase planning is meaningless. The selection of the correct supplier is perhaps the most important purchasing activity. The buying firm must spend extensive time analyzing and carefully selecting the correct supplier. Once the correct supplier is chosen, succeeding orders will, by definition,

meet quality, delivery, and price expectations. Of course, there should be periodic **supplier evaluations** to ensure continuous supplier performance achievement. In the next sections, we address the supplier sourcing process. Four specific industry examples are presented.

Supplier evaluations The procedure of evaluating a supplier's ability to perform the required quantity, quality, and scheduled requirements.

SOURCES OF SUPPLIER INFORMATION

LO 8.2 Identify sources businesses can use to make informed supplier decisions.

Searching for the appropriate supplier for a specific material or component part is becoming a strategic issue in itself. In the new fast-paced and volatile buying environment, the purchasing firm must know where to look for each item. Buyers should be experts on the industry and on specific raw materials or component parts. There are many sources available for the buyer to consider when seeking out potential suppliers.

The traditional buying source is the well-known **Thomas Register** (see www.thomasnet.com). The Thomas Register categorizes potential suppliers as manufacturers, distributors, manufacturer representatives, or services. Trade journals are also a valuable source of information regarding potential suppliers. Two such journals are *Purchasing World* and *Supply Management*. Salespersons are not only important resources about materials, they also can be an excellent source of free consulting information. Local chambers of commerce, trade shows, and city libraries are also excellent sources of supplier data. All of these sources of supplier information can be accessed by the Internet.

Thomas Register A buying source that categorizes potential suppliers as manufacturers, distributors, manufacturer representatives, or services.

STRATEGIC SOURCE SELECTION

LO 8.3 Explain the importance of a strategic match between the buyer and supplier.

Strategic sourcing emerged out of two needs. First, increased dependence on information technology based on the need to align buying cycles with production requirements. Second, as cost containment became a competitive strategy, managers realized major savings could be achieved by outsourcing noncore tasks. In addition, strategic sourcing gained increasing growth with globalization.

Each business unit and department should have a clear understanding of the strategy of the whole firm and have a departmental strategy that complements and aids the overall strategy execution of the firm. Purchasing, logistics, inventory management, and production control are all linked tightly together under the materials management umbrella. These functions must work as a cohesive strategic unit where each complements the other. It is from this perspective that supplier selection/reduction should take place (also see Chapter 2).

For example, if a firm's strategy is to be differentiated, then price will be secondary. Innovation, technology, and high quality will probably dominate the way the firm stays competitive. This places a need on the operation functions to be flexible and have the ability to change. Therefore, a supplier should be chosen that can adapt to the change needed by the operating functions of the firm. A **strategic match** is needed between buyer and supplier, as they can then work in harmony as far into the future as they are compatible. The selection of suppliers should not be based on performance of the past but the anticipated capabilities of the future.

Strategic match A win-win relationship resulting in positive benefits for both the buying and selling organization.

In order for good communication to exist between buyer and supplier, common ground should exist in management styles, control systems, quality philosophies, and technological abilities (e.g., in engineering, design, EDI, and RFID). Since outsourcing is a delegation of

responsibilities, it should be viewed as an extension of the original equipment manufacturer's (OEM) strategy (also see Chapter 7).

The primary objective of the buying firm's purchasing department is to provide for continuous operation of a business by ensuring the availability of goods and services. In a competitive environment, the purchasing function must ensure on-time delivery of the right goods at a reasonable price. There is a general consensus that quality, service, delivery time, and price are the key buying criteria for competitive firms. Implicit criteria such as managerial expertise, financial stability, and relative supplier location are also important in the supplier selection process.

Correct supplier selection will be an important factor in determining whether a buying firm is profitable. Firms must have a complete understanding of economic trends, innovations, and challenges in their industry.

SUPPLIER RELATIONSHIP MANAGEMENT

LO 8.4 Discuss the need for efficient supply chain management relationships.

Supplier relationship management (SRM) The management of strategic collaborative relationships between buying and selling organizations.

Transfer of value downstream Sharing the benefits of an efficient supply chain with supply chain members lower tiers.

Contract manufacturers A manufacturer that contracts with a firm for components or products; contract manufacturing is not the same as outsourcing.

Supplier relationship management (SRM) is defined as the management of strategic collaborative relationships between buying and selling organizations. The ultimate objective is to create supply chain value and minimize supply chain risk. The supply chain management process is based on the idea of efficient resource coordination and teamwork. Buyer and supplier relationships have become increasingly important for a number of reasons. There is a trend toward specialization away from manufacturing an entire product and to more contract manufacturing and purchasing. In some market segments, it is estimated that 80% or more of total product revenue often passes directly to suppliers as payment for labor, materials, and equipment. This significant **transfer of value downstream** emphasizes the importance and significance of supply chain relationship management. For any buying organization to stay competitive in today's aggressive market sectors, it is essential that it maintains strong relationships with its best **contract manufacturers** and suppliers.

When businesses purchase a large percentage of product value, the importance of supply chain relationship management cannot be underestimated. Buying firms experience a great deal of pressure from customers and competitors to keep their edge and stay in business by reducing costs, improving product, improving service quality, and enacting continuous improvement throughout the supply chain. At the same time, many buying firms also are reducing the number of their qualified suppliers. The costs of buying materials from a larger number of suppliers, while still managing a relationship with each, may be too great for a buying firm to absorb.

With the decreasing number of suppliers used by buying firms, it is more important than ever to maintain strong buyer–supplier relationships. Keeping these relationships healthy will secure a source of highly qualified supplier capabilities and materials that allow for the possibility of lower costs and higher quality as well as offer the promise of greater market share for the increasingly competitive markets. Buying firms shifting toward a smaller supply base cannot ignore the role that supplier relationship management (SRM) will play with the remaining supplier capabilities. Another reason that SRM is important is the increasing shortages of skilled supplier capabilities and resources. Because of increasing demand and shortages, many resources and commodity materials are becoming harder to acquire and in turn are becoming more expensive to purchase. With rising prices and increasingly scarce

materials, a buying firm must maintain strong relationships with the suppliers of these materials to guarantee they are the first-priority customer of their supplier; no buying firm can survive if it is unable to have a sustainable source of supply, even for scarce items.

Model of Supply Chain Relationship Management

One well-known model that explains supply chain relationship management includes four behavioral dimensions—the four Cs: counterproductive (lose-lose), competitive (win-lose), cooperative (win-win), and collaborative (win-win) relationships.

- *Counterproductive relationships* are those in which each organization (buying and supplying) is so focused on getting what is best for it that each puts the other at a disadvantage. This type of relationship is undesirable because it does not promote a positive rapport between buying and supplying firms involved, and neither organization achieves its goals. Counterproductive relationships also discourage future dealings between organizations and create instability in each organization's reputation. Counterproductive buyer–supplier relationships are not recommended. An example of a counterproductive relationship is buying a used car from a dishonest seller.
- *Competitive relationships*, also known as *transactional relationships*, are those relationships in which both buying and supplying firms strive to get the very best arrangement possible in their negotiations and fail to see the benefits of both organizations obtaining their goals and objectives. In transactional relationships, the buying and supplying firms will stop at nothing to make sure they come out on top and do not care about the other organization's well-being. Typically, the organization that is able to win in a competitive relationship has much more power than the losing organization. The more powerful organization sometimes places its focus on the *present*, not concerning itself with long-term negotiations on future business encounters. This type of relationship also will discourage an ongoing relationship to the detriment of both organizations. There are certain situations in which a competitive relationship is desirable. A competitive relationship is almost always required with *transactional/tier-three* suppliers and assures that the buying firm can lower prices to help keep its competitive edge in the market (e.g., commodities are transactional purchases unless there is a monopoly or shortage). It does not matter if the relationship is not strong enough to last because, by definition, transactional suppliers can be easily replaced at any time. An example of a competitive relationship is buying a new car from a dealership.
- *Cooperative relationships* recognize the potential value of both organizations getting what they want and maximize the potential of having a long-term relationship. Although it is a strong relationship, a cooperative alliance lacks the teamwork that is needed between the various buying and supplying firms to optimize the benefits for all members of the supply chain. Cooperative relationships are commonly found within a buying organization's *preferred/tier-two* service providers and suppliers list (for example, a buyer–seller relationship that consistently results in high quality, on-time delivery, and reasonable cost).

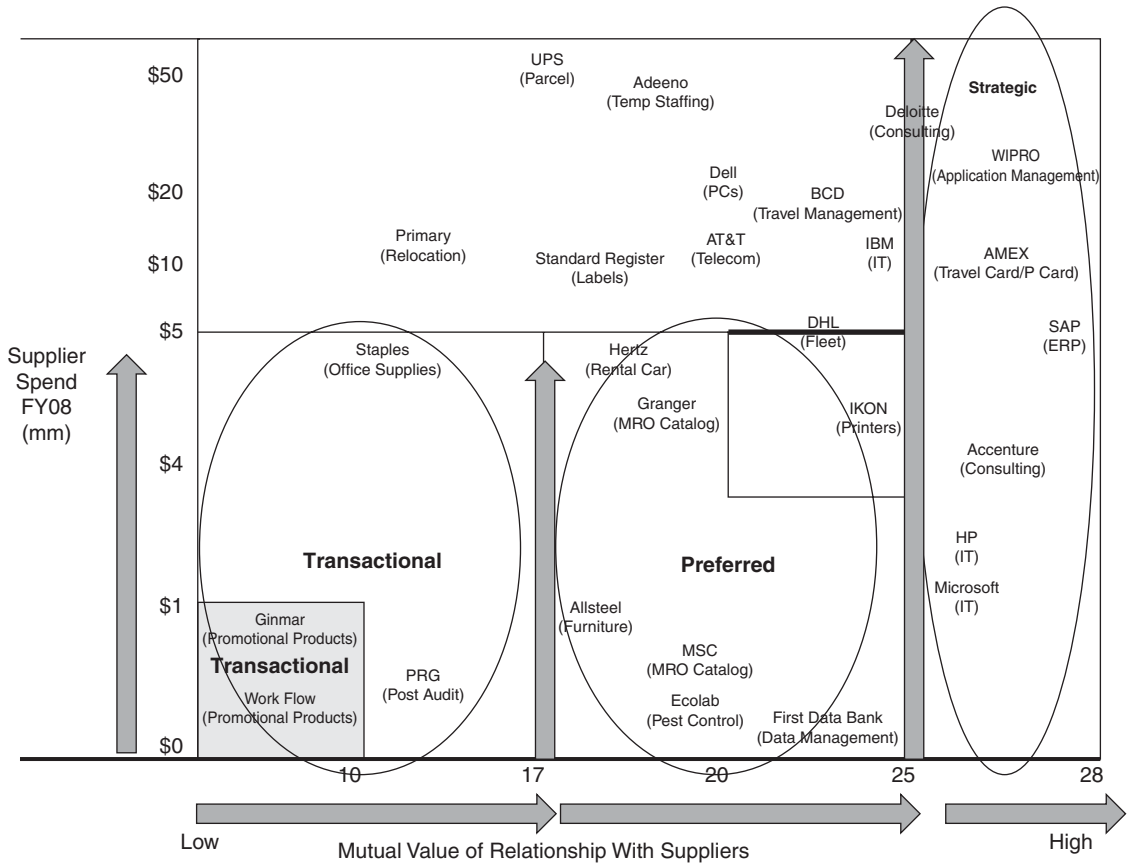
- *Collaborative relationships*, in comparison, are usually found with the buying firm's *strategic/tier-one* suppliers. They include the team component missing in a cooperative relationship. In collaboration, the two organizations truly realize the benefits of working together to optimize outcomes for both organizations. The two firms work together to develop a strategy to deliver a high-quality product or service on time and under budget. Strategic partners frequently share resources and information. As with any business arrangement, buying firms throughout the supply chain *must* avoid any antitrust violations including any appearance of price fixing or bid rigging (for example, buying and supplying organizations have greater trust and are more willing to coordinate their activities). Collaboration relationships usually result in levels of information sharing, coordination, and increased technology sharing.

SUPPLIER RELATIONSHIP MANAGEMENT PROGRAMS

LO 8.5 Describe the approach to a supplier relationship management program.

Many large buying firms are implementing SRM programs in their business plans to ensure they maintain their competitive edge. There are several different ideas on the exact process an SRM program should follow, but the general approach is the same.

FIGURE 8.1
Supplier Segmentation Model



Consider Scientific Management Systems, Inc., a large vertical manufacturing organization in the process of developing a supplier relationship program. Most SRM programs begin with some sort of ranking or categorization of potential suppliers. The process of supplier categorization is important for a number of reasons. This process forces the buying organization to communicate cross-functionally to develop some system for ranking the suppliers. Two main items considered in the categorization process are the *dollar amount* of the contract with an individual supplier and the *criticality* of the supplier to the buying firm's business strategy.

The rankings are aggregated to enable a ranking of all suppliers. The buying organization will then categorize the suppliers into one of three categories: *strategic*, *preferred*, or *transactional*. **Strategic suppliers** are those that are most important to the buying firm. They supply the buying firm with essential materials and capabilities that are not easily replaced. The buying firm will spend most of its efforts on maintaining and strengthening these relationships.

Preferred suppliers are those that are important to the buying firm, but alternative suppliers could be found with some effort. **Transactional suppliers** are those that provide the buying firm with items that are not critical to its core business and that can be easily replaced in a short time. Scientific Management Systems uses the labels of *strategic*, *preferred*, and *transactional* interchangeably with tier-one, tier-two, and tier-three suppliers. An example of an actual Fortune 100 pharmaceutical distributor's *supplier relationship segmentation model* is shown in Figure 8.1. Once the ranking system is developed, it then forces the various functions in the buying firm to evaluate which suppliers truly add value and reduce risk of failure.

Strategic suppliers The strategic supplier program is a unit within purchasing, stores, and auxiliary services. Its primary responsibility is negotiating high-valued contracts with key suppliers.

Preferred suppliers Those that are important to the buying firm, but alternative suppliers could be found with some effort.

Transactional suppliers Those that provide the buying firm with items that are not critical to its core business and that can be easily replaced in a short time.

SUPPLIER DEVELOPMENT PROGRAMS

LO 8.6 Explain how to implement a supplier development program.

It is well known that good standing relationships with suppliers can increase profitability and reduce overhead expenses. Therefore, relationships with suppliers must be developed in order to meet standards and contribute to continuous improvement goals. Specific communication strategies including supplier governance, supplier training and education, feedback, and frequent site visits can aid in developing suppliers. Once an investment in developing supply chain relationships is made, buying firms must actively manage these relationships. Strategic supply chain relationships, however, do not come without risks to the buying and supplying firms.

SUPPLIER EVALUATION PROGRAMS

LO 8.7 Explain how to implement a supplier evaluation program.

A buying organization can evaluate its suppliers in several ways. If suppliers do not meet quality, delivery, and scheduling standards, the buying organization may face delays and will lose money from not being able to meet critical scheduling and manufacturing demands. The company can evaluate a supplying firm's production methods and a supplier's quality performance. By evaluating the production methods and quality process of the supplier, the capabilities can be easily assessed. Performance-based evaluations assess the company after its product or service has been delivered.

Criteria for Supplier Evaluation

There are two main categories of supplier evaluations: process-based evaluations and performance-based evaluations. The **process-based evaluation** is an assessment of the supplier's

Process-based evaluation An assessment of the supplier's production or service process.

production or service process. Typically, the buyer will conduct an audit at the supplier's site to assess the level of capability in the supplier's systems. Process flow charts can be developed to identify the non-value-added activities that should be eliminated to improve the business efficiency. In addition, large buying organizations increasingly are demanding that their suppliers become certified through third-party organizations, such as ISO 9001:2018 certification or Malcolm Baldrige National Quality Awards (also see Chapter 1).

Performance-based evaluation An assessment of the supplier's actual performance on a variety of criteria, such as delivery reliability, cost, and quality defect rate.

The **performance-based evaluation** is an assessment of the supplier's actual performance on a variety of criteria, such as delivery reliability, cost, and quality defect rate. It is a more tactical assessment and measures the day-to-day performance of the supplying firm; hence, it is an after-the-fact evaluation. The performance-based evaluation is more common than the process-based evaluation, perhaps since objective data are readily available and easier to measure. Benefits of objective measurement schemes are that they reduce perceptual bias and provide a means for benchmarking a supplier's performance. Following are three common performance-based supplier evaluation systems.

Three Common Supplier Evaluation Systems

The three general types of supplier evaluation systems in use today are the categorical method, the cost-ratio method, and the linear averaging method. The guiding factors in determining which system is best are ease of implementation and overall reliability of the system. It must be pointed out that the interpretation of the results from any of these three systems is a matter of the buyer's judgment.

Categorical Method

The categorical method involves categorizing each supplier's performance in specific areas as defined by a list of relevant performance variables. The buyer develops a list of performance factors for each supplier and keeps track of each area by assigning a "grade" in simple terms, such as "good," "neutral," and "unsatisfactory." At frequent meetings between the buying organization and the supplier, the buyer will then inform the supplier of its performance (see Table 8.1).

The categorical method is a simple and informal system in the sense that detailed performance achievements or shortcomings are not measured. Instead, it is mostly used as an evaluation tool between top managers in the buying organization and the selling organization, permitting the discussion of past performance, future expectations, and long-term plans.

The advantages associated with implementing this sort of an evaluation program are that it can be implemented almost immediately and is the least expensive of the three evaluation systems discussed here. The method's major disadvantage is its dependence on the judgment

TABLE 8.1
Performance Characteristics for the Categorical Method

Supplier	Cost	Product Quality	Speed	Total
A	Good (+)	Unsatisfactory (-)	Neutral (0)	(0)
B	Neutral (0)	Good (+)	Good (+)	(++)
C	Neutral (0)	Unsatisfactory (-)	Neutral (0)	(-)

of its users. The system largely depends on the memories of personnel to explain what "unsatisfactory" or "good" means. With this method, there are no concrete supporting data.

In the goods-producing sector, establishing performance factors and measures is a relatively simple task for management because some type of quantitative system can be developed to gauge improvement. The service area is perhaps the most difficult area to measure. When measuring service businesses, data must be collected on the quality of technical assistance, supplier attitude, supplier response time to requests for assistance, and support staff qualification. It is normal, therefore, to have a relatively simple rating scheme for services, such as outstanding, acceptable, and poor, along with explanations regarding specific incidents to explain the specific ratings.

When using any category-based evaluation system, experience is essential. As an example, a simple pass/fail approach to supplier rating will work when a company is reducing its supplier base but must be replaced after the supplier base is more manageable. In other words, the initial improvements are easier and less expensive than future evaluation methods.

Cost-Ratio Method

The cost-ratio method evaluates supplier performance by using standard cost analysis. The total cost of each purchase is calculated as its selling price plus the buyer's internal operating costs associated with the quality, delivery, and service elements of the purchase. Calculations involve a four-step approach.

Step 1. Determine the internal costs associated with quality, delivery, and service.

Step 2. Convert each to a cost ratio, which expresses the cost as a percentage of the value of the purchase. An example of a quality cost ratio is shown in Table 8.2.

TABLE 8.2
Performance Characteristics for the Cost-Ratio Method

Supplier: AA	
Elements	**Costs**
Plant visits	$200
Sample approval	$25
Incoming inspection	$75
Reworking costs	$225
Paperwork inaccuracies	$100
Lost time due to rejected parts	$375
Total additional quality costs	$1,000
Total value of purchase	$100,000
Quality-cost ratio (total quality cost/total purchase)	**1%**

TABLE 8.3
Cost Comparison Using Cost-Ratio Method of Supplier Rating

Company	Quality Cost Ratio	Delivery Cost Ratio	Service Cost Ratio	Total Penalty	Quoted Price/ Unit	Net Adjusted
AA	1%	3%	-1%	3%	$86.25	$88.84
BB	2%	2%	3%	7%	$83.24	$89.07
CC	3%	1%	6%	10%	$85.10	$93.61
DD	2%	1%	2%	5%	$85.00	$89.25

Step 3. Sum the three individual cost ratios (quality, delivery, and service) to obtain an overall cost ratio.

Step 4. The overall cost ratio is applied to the supplier's quoted unit price to obtain the net adjusted cost figures (see Table 8.3).

The net adjusted cost figure is used as the basis for performance comparison among other suppliers. When applying this evaluation method, all costs of conducting business with the supplier are assessed as a penalty. The best supplier is selected as the one with the lowest net adjusted cost.

The advantage associated with the cost-ratio method is that the results are cost-oriented. However, the associated costs must be known. Therefore, the cost of implementing this method may be expensive when compared to the categorical method. Moreover, this method does not take into account other aspects of supplier performance.

A hybrid of the cost-ratio method is the "total cost-of-ownership rating," developed by the director of corporate purchasing at Sun Microsystems. It includes five performance factors: quality (maximum of 30 points), delivery (25), technology (20), price (15), and service (10). A perfect supplier would receive a score of 1.00. This is calculated by deducting the number of points received (100 if perfect) from 100, dividing by 100, and adding 1. The idea is to give a simple numeric rating to the so-called hidden cost of ownership—the additional product-lifetime cost to Sun. A score of 1.20, for instance, means that for every dollar Sun spends with that supplier, it spends another 20 cents on everything from line downtime to added service costs.

Linear Averaging

The linear averaging method is the most commonly used evaluation method. Specific quantitative performance factors are used to evaluate supplier performance. The most commonly used factors in goods purchases are quality, service (delivery), and price, although any one of the factors named may be given more weight than the others. Quality is most important for a manufacturer of complex components such as electronics. Price might be given equal or greater weight in an evaluation system used by the manufacturer of highly competitive "throwaway" items like party novelties. An example of the linear averaging method follows:

Step 1. Assign appropriate weights to each performance factor, such that the total weights of each factor add up to 100. For example, quality might be assigned a weight of 50, service a weight of 35, and price a weight of 15. The assignment of these

weights is a matter of judgment and top management preferences. These weights are subsequently used as multipliers for individual ratings on each of the three performance factors.

Step 2. After the weights have been assigned, the individual performance factor ratings are determined. This is done by summing the scores for each factor.

Step 3. Multiply each performance factor rating by its respective weight as a percentage. Continuing the example, a quality rating of 95 would be multiplied by 0.50, if quality had a weight of 50.

Step 4. Finally, the results from Step 3 are added to give a numerical rating for each supplier.

The advantage of this type of system is that it is relatively easy to implement once all the performance factors and their weights have been determined. Another advantage is that this system provides the buyer with a great deal of flexibility in determining the performance factors to be measured. Example 8.1 consists of only three factors (quality, service, and price), but any number of factors can be used. For different product classes, different factors, weights, and measures can be used to reflect the relative importance of each item to the buying organization. Finally, these types of systems produce reliable data and are relatively inexpensive to implement.

The Strategic Supplier Performance Review Process

The buying firm should have a process for managing performance and giving feedback to strategic suppliers. This process is typically accomplished by asking the supplying firm for a

Example 8.1

LINEAR AVERAGING

Buyer A wishes to rate its vendors on quality, service, and price and has assigned each a weighting factor of 50, 35, and 15, respectively. For this example, quality is rated as a direct percentage of the number of acceptable lots received in relation to total lots received. The service rating is a direct percentage of the lots delivered on time in relation to total lots received. In rating price, the lowest price obtained from any supplier is used as the base price, and prices from other suppliers are rated as a ratio of this figure. Two suppliers would thus be rated as follows:

	Supplier 1	Supplier 2
Quality (weight = 50)		
Acceptable lots	50	35
Total lots received	58	40
Quality rating	**86.2**	**87.5**
Service (weight = 35)		
On-time deliveries	52	38
Total lots received	58	40
Service rating	**89.7**	**95.0**
Price (weight = 15)		
Lowest price	$75	$75
Price submitted	$75	$82
Price rating	**100**	**91.5**
Total performance rating	**89.8***	**90.7****

***89.8 (5 x 86.2) + (0.35 x 89.7) + (0.15 x 100)**

****90.7 (5 x 87.5) + (0.35 x 95.0) + (0.15 x 91.5)**

In this situation, Supplier 2 is the more satisfactory supplier.

performance self-assessment and then communicating to the supplying firm exactly how the buying firm rates its performance. Most often there is some sort of reward and punishment system put in place by the buying firm to further encourage excellent performance.

Supplier performance review A set of expectations and measurements for controlling long-term relationships with existing strategic suppliers.

An overview can be beneficial in developing a clear idea of the **supplier performance review** process. A performance review is a set of expectations and measurements for controlling long-term relationships with existing strategic suppliers. It includes consistent measurements for establishing positive relationships with new suppliers and evaluating current performance of existing strategic suppliers according to the expectations of the buying firm. The review process must have a standard template that is used as a guideline for informing a customized review process with criteria specific to each strategic supplier. The performance review template should include a personal meeting with the functional manager. Having the functional manager in the performance review of a strategic supplier is beneficial for the buying firm and fosters cross-functional communication. By getting input from the person directly responsible for each strategic supplier, a more complete review of performance is possible.

The general review process should take approximately 2 workdays to complete depending on the level of complexity of the specific strategic supplier. The first step is to schedule a review process for each individual strategic supplier; the review date is usually established when the contract is signed. Approximately 5 days before the review date, a buyer-developed questionnaire specific to the buyer's needs and those of the strategic supplier is sent to the strategic supplier. The strategic supplier is then required to complete the questionnaire and return it to the buying firm no later than 2 days prior to the meeting. After an internal review is completed, a final analysis of the relationship expectations is communicated to the strategic supplier. Within the next few days, meetings are held between the buying firm and the strategic supplier where all of the action items are recorded. The final step is the distribution of the minutes from the meetings between the buying firm and the strategic supplier and the official publication of action items (see Figure 8.2).

The buying firm should have various review categories used to fully assess its strategic suppliers. Quality is a very important review category. The buying firm should require its strategic suppliers to meet or exceed its performance standards and proactively initiate quality process improvements. Customer service should be expected to be proactive and flexible, and delivery performance needs to be optimized. The most important attributes should be high quality and on-time delivery. Technology and innovation are also important to stay ahead of or at pace with competition and help keep the buying firm at the top of its field. The buying firm needs to have strategic suppliers who are open about their total costs. Cost reduction and continuous process improvement are necessary to keep costs down and create trust with strategic suppliers. The last category is the ethical characteristics of the strategic supplier. Every strategic supplier also should have formal environmental, health, operational, and safety programs. In addition, they should put forth the effort to reduce, reuse, and recycle when possible. These categories, as well as others, should be used in the development of the questionnaire for each supplier.

The SRM Scoring System

The scoring system for each strategic supplier should be done on a scale from 0.0 to 4.0, where 4.0 is the highest possible score, meaning that there are five ratings ranging from exceptional to unacceptable. The weaker the score, the more often the strategic supplier

FIGURE 8.2
Meeting Report for Strategic Suppliers

SMS, INC. **MINUTES OF** **MEETING** **REPORT**	Supplier No. _____ Supplier Name. _____ Project Location _____ Date _____ Page 1 of _____ Compiled by _____

Meeting Subject _____

Meeting Location _____ Date _____ Time _____

Name	Title	Representing	Comments

Item No.	Minutes/Description	Action by	Action Required Date

Remarks: _____

_____

Distribution: _____

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needs to be evaluated. When a supplier rates between 2.5 and 4.0 (exceptional and very good subcontractors/suppliers), there are annual evaluations. A good supplier should rate between 1.5 and 2.49 and needs to be evaluated semiannually. A marginal strategic supplier receives a rating of 1.0–1.49 and needs to be evaluated every quarter. When a supplier is unacceptable, it is given a rating between 0.0 and 0.99, which means it is necessary to develop a new source.

SINGLE VERSUS MULTIPLE SOURCES

LO 8.8 State the factors that should be considered when determining the number of suppliers to work with.

Much debate has taken place concerning the number of suppliers a firm should use. One side of the debate is the multiple-sources side. This involves the use of two or more suppliers. The other side of the debate is the single-source policy, in which only one supplier is used to supply a particular part.

The goal of both policies is to provide the buyer with the best value for a supplied part. Many attributes contribute to the value the buyer receives. They include risk, quality, unit price, total cost, delivery, reliability, and service (design capabilities, productivity improvements, and R&D).

Multiple Sourcing

The main arguments for multiple sourcing are competition and ensured supply. It is commonly believed that competition between suppliers for a similar part will drive costs lower as suppliers compete against each other for more of the OEM's business. This sense of competition is the very root of American thought as competition is the basis for capitalism and is the backbone of Western economic theory.

Multiple sources also can guarantee an undisrupted supply of parts. If something should go wrong with one supplier, such as a strike or a major breakdown or natural disaster, the other supplier(s) can pick up the slack to deliver all the needed parts without a disruption.

Multiple sourcing also can provide other benefits such as improved market intelligence and improved supplier appraisal effectiveness. Contact with many suppliers allows a firm to keep abreast of new developments and new technologies as they emerge across the field. In addition, greater contact with suppliers increases the effectiveness of evaluating a supplier's ability and progress by comparing cost and production data from supplier to supplier.

Single Sourcing

The major arguments in favor of single sourcing are that with the certainty of large volumes the supplier can enjoy lower costs per unit and increased cooperation and communication to produce win-win relationships between buyer and seller. Naming a certain supplier as the single source and providing it with a long-term contract (3 to 5 years) greatly reduces the uncertainty that the supplier will lose business to another competitor. With this contract guarantee, the supplier is more willing to invest in new equipment or change its business/operating methods to accommodate the buyer.

Single sources should be able to provide lower costs per unit compared to multiple sources by reducing the duplication of operations in areas such as setup. Spreading fixed costs across a larger volume also should result in an accelerated learning curve.

Cooperation and communication can increase between buyer and seller with a single-source agreement due to fewer people involved when compared to multiple sourcing. Engineers and production people from both firms can work together to improve product quality and productivity. One caveat to single sourcing is to consider an **80/20 single sourcing approach**. Specifically, Supplier A and Supplier B supply 80% and 20% of the requirements, respectively.

80/20 single sourcing approach Supplier A and Supplier B supply 80% and 20% of the requirements, respectively.

Disadvantages of Single and Multiple Sourcing

The advantages of multiple sourcing can be viewed as the disadvantages of single sourcing and vice versa. The best scenario would be one that can obtain the advantages of both. This might be done by applying significant pressure to single-source suppliers or by providing significant certainty to suppliers in a multiple-sourcing environment. This may be accomplished through the use of contract length. Short-term contracts regardless of single or multiple suppliers can be used as a source of punishment. In some instances, long-term contracts can be viewed as a reward.

Long-term contracts can provide the stability needed to produce single-source results while still using more than one supplier. Given enough volume, two suppliers may be able to achieve the economies of scale to produce a part at a per-unit price comparable to that of one supplier. When spreading volume over fixed costs, the per-unit savings experience diminishing returns. If the volume is great enough, two firms may eventually get the returns diminished enough so they are comparable in per-unit price to one firm. The advantage may rest in the learning curve, as a single source will be able to improve at a faster rate.

An additional consideration that may prove a disadvantage for single sourcing is labor unrest. The single-source movement became popular during the 1990s. The 1980s were a period of labor stability as strikes were not a major issue. The federal government under the Reagan administration sent clear antistrike/labor signals that reduced the power of the labor movement (e.g., firing the air-traffic controllers). What is to prevent future labor unrest that could unravel single-source relationships and bring assembly lines to a halt? This was the case as strikes crippled General Motors plants in 2019. Progressive and participative management style may be the answer, but management must effectively move beyond lip service to prevent labor unrest.

Long-Term Issues With Sourcing

Single-sourcing advocates may want to address the following long-term impacts. In the long run, if every firm reduces its supplier base, there will be fewer suppliers, and overall supplier competition will decrease. Supplier consolidation will give suppliers more power in the long run.

Also, a supplier may be able to forward-integrate and market the very subassemblies it sells to the OEM in the aftermarket, which is a very lucrative field. This warrants using the Porter (1985) model to assess the supplier's capability to do this prior to single sourcing.

Finally, many more "white collar" tasks are being done by single sources in areas such as engineering and design. So-called black-box supply contracts occur when OEMs assign a finished component to the supplier and it is the supplier's responsibility to design and produce it because all the manufacturer wants is the final product. It is these types of situations that may enable suppliers to become so specialized and obtain so much expertise that the

producer cannot effectively compete with its suppliers. OEMs must be careful not to let too much of the value-added portion of their product be delegated to suppliers or the OEM's power will be reduced.

Japanese Reality

Many "pop" management techniques have emerged over the last 40 years by emulating the successes of Japanese manufacturers, particularly in automobile production. Many managers believe that "if it works in Japan, it can work here." That may be true, but one of the perceptions possibly leading to the popularity of single sourcing in the United States is the belief that all Japanese firms work closely with one supplier. Therefore, the common American response has been that if Japan uses single sourcing, we should too. In fact, over 98% of Ford's outsourced parts are supplied by single-source suppliers.

This perception of Japanese manufacturers is true for high-tech items that require large R&D expenditures or complex parts that require major equipment investments. However, this is not the case with simpler parts. To make sure everyone tries hard (assuming they mean through competitive forces), the assemblers usually divide their parts order between two or three members of their supplier group. The assemblers don't take this step to keep prices down; rather, they do it to prevent anyone letting down on quality or delivery reliability. If there is a problem with one of the suppliers, volume percentages temporarily shift to others as a form of punishment.

One can therefore conclude that Japanese manufacturers provide enough stability to two or three suppliers to achieve the advantages of single sourcing. It should be noted that many Japanese automakers use suppliers that produce more than just one part for them. Therefore, the investment in increased communication, cooperation, and coordination with a major supplier can be spread across many parts.

Cross-Sourcing

The single-sourcing/multiple-sourcing issue does not have to be viewed as a "black or white" decision. A hybrid approach known as cross-sourcing can be used. With this method, the supplier base is expanded without increasing the actual number of suppliers. For example, if both Supplier A and Supplier B can produce parts 1, 2, 3, 4, and 5, the advantages of both single and multiple sourcing can be achieved if Supplier A produces all of parts 1, 3, and 5, and Supplier B produces all of 2 and 4. If anything happens to Supplier A, Supplier B can pick up the slack as it has the capability to produce 1, 3, and 5 as well. Neither supplier suffers because overall volume remains the same. The reverse also can be done if a buyer wants to increase competition among suppliers.

Supplier Reduction

Regardless of one's final analysis of the single/multiple sourcing debate, it is recommended to reduce the overall supply base. If the perceived benefits outweigh the risks, after careful analysis of both short-term and long-term needs, a single source may be appropriate. However, for operations that would be financially damaged when a supply stoppage occurs, then the use or development of a second source is wise.

Assume it is desirable to reduce the number of suppliers. The question now is which to reduce? The grade and hurdle methods are used to guide the supplier reduction analysis.

Grade

"Grade" methods are based on a score or grade given to the supplier by the buyer for some attribute. The suppliers' performances in the past are kept on record, and the suppliers receive a "report card" as to how well they are doing compared to other suppliers. The most common attributes are quality, price, and delivery, but many additional attributes can be added such as frequency of delivery; regardless, the method remains the same—for each attribute and purchase transaction, the supplier is given a grade. These attributes can be weighted equally or used to emphasize what is more important to the buyer firm.

When implementing a policy of supplier reduction, use this information, which is usually computerized, to rank the suppliers to choose the best one(s). One of the drawbacks of this method is that, many times, qualitative information cannot accurately be incorporated into the system—for example, a design change or traffic congestion may have caused a shipment to be delayed, and thus a late delivery was not the supplier's fault. Another drawback of the grade method is that supplier performance is the only thing being used to resolve the cause of the problems.

One major problem with grade methods is that they assume the best performance of the past will be the best performance in the future. In a way, it is by forecasting that suppliers will be able to best meet the supply needs even though the OEM's needs may be different in the future. Computerized supplier performance reports (grade methods) may be of better use if futuristic criteria are used and the criteria are comprehensive and exhaustive.

Hurdle

The second group of methods used to reduce the number of suppliers a firm uses is referred to as "hurdle" methods. In this type of situation, suppliers are required to "jump" over higher and higher hurdles to win the buyer's business. Usually this is done through some sort of supplier certification program.

Certification

Supplier certification programs are useful tools to evaluate the quality capabilities of a supplier. Since quality is one of the biggest concerns to many OEMs, this is a good way to control supplied part quality. Basically, certification involves the setting of criteria regarding quality levels as demonstrated through the use of statistical process control (SPC) capability studies of a supplier's equipment, supplier recordkeeping abilities, and so forth.

If a supplier meets some but not all of the criteria, it may reach a "preferred" status and will be rewarded increased business by the manufacturer. If a supplier meets all the criteria and has demonstrated that it can sustain these levels, then it may be granted "select" status and be awarded a long-term supply contract.

By using these methods, buyers can reduce their supply base by only rewarding business to those suppliers who can become certified or by awarding the suppliers who become certified first with a bigger slice of the pie. Some of the suppliers will not be able to become certified and thus the supply base will be reduced.

The certification criteria can be changed and updated as recertification may be required. Thus, the hurdle can be raised higher and higher until there are only one or a few suppliers left. In combination with quality certification are the price and productivity hurdles. OEMs can add these criteria to make it more difficult to be a select supplier.

Ford Motor Company has used this method by creating the Q1 (quality is job one) certification program. New business is only awarded to those suppliers who have demonstrated quality and productivity improvements to obtain Q1 status. Suppliers awarded long-term contracts with Ford are then expected to reduce their unit price 5% each year. Similar programs have been developed by General Motors in its "Targets for Excellence" standards and by IBM with its six-sigma program.

Certification programs are usually only as good as their designers make them. The attributes that determine certification must be well thought out and realistic. For example, requiring a 5% decrease in price annually may force suppliers to look for short-term cost reductions that may hurt long-term investments, which could make a partnership with a single source stronger.

Part of the single-source philosophy is that through cooperation and input from the manufacturer, suppliers will be able to reduce their costs for a particular part. However, a Boston University survey of the major suppliers of the North American auto industry reported that assemblers had given them little assistance in reducing costs and adopting new techniques.

When designing a certification program, careful attention should be paid to the selection of criteria. Good certification should include issues regarding equipment capability, quality assurance, financial health of the supplier, production scheduling methods, value analysis abilities, and cost accounting methods.

INDUSTRY EXAMPLES

LO 8.9 Compare how different industries select and evaluate suppliers.

Consider the apparel, chemical, electronics, and construction industries. A supplier with the lowest per-unit price may not have the best quality or delivery rating of various suppliers. A strategy seeking such suppliers may be acceptable in the apparel industry, where the highest emphasis is placed on price or price markup, but would be unacceptable in the chemical industry, where the highest priority is purity of the chemicals (i.e., quality). Each industry must analyze the various associated criteria trade-offs when selecting a supplier.

In the four sections that follow, we take a closer look at supplier selection and evaluation criteria for the apparel, chemical, electronics, and construction industries.

Apparel Industry

Organizational buying can be broken down into two categories: *retail buying* and *industrial buying*. There are distinct differences between them. An important distinction is that the retail buyer is unique in serving as both a purchasing agent and a marketing manager. Successful retail buying depends on the ability to select suppliers who meet the perceived needs and wants of the firm and its customers.

The most important difference between industrial buying and retail buying is in the buyers' responsibility for meeting the profit objectives of the firm. While industrial buyers are responsible for controlling costs, retail buyers are responsible for both controlling costs and generating revenue through their purchases. This suggests that markup (the difference between the wholesale cost of a supplier's merchandise and the consumer's price of a supplier's merchandise) may be more appropriate than price in the study of supplier selection among retail buyers. Retail buyers need to not only consider what suppliers charge but how much profit per unit can be made in reselling the goods and in what volumes.

While industrial buyers purchase raw materials and component parts for use in production, retail buyers purchase finished goods for resale to the consumer. Consequently, the right goods for industrial buyers are those necessary to support the production process, while the right goods for retail buyers are likely to be those the buyer expects to sell satisfactorily. Retail buyers might then be expected to use criteria such as selling history and merchandise fashionability in their supplier selection decisions.

Retail buying has always used the selection of merchandise as an important buying decision. However, the increasing size of retail organizations and corresponding homogenization of merchandise assortments suggest that increasingly more important retail buying decisions are supplier selection and evaluation. The most common criteria used when selecting retail vendors are delivery (usually reliabilities), quality of merchandise, and price markup (percentage above plan versus percentage below plan). The most important criterion is price markup, followed by delivery and final quality.

Price markup The difference between the selling price of a good or service and the cost; can be expressed as a percentage or fixed amount.

Price markup is clearly the most important criterion used when selecting a vendor in the apparel industry. Unlike industrial buying decisions, which are often made within a "buying center," retail buying decisions are usually made autonomously by the retail buyer. This, coupled with the fact that the wholesale cost of merchandise is often not negotiable, leads buyers to view sales as a profit-related variable that they can influence by choosing vendors with strong selling histories. Markup has a direct effect on gross margin and thus has implications for profit, which is the major long-range objective of many firms. The best suppliers "stand out like a sore thumb." Retailers can then pick and choose from these vendors to obtain the best price markup possible. Good relations are also a key issue at the end of a buying season when merchandise is marked down in price. The buyer and vendor must work closely together to decide on a markdown that is fair to both parties.

Ensuring the availability of goods is an essential buying function in any organization. While poor delivery on the part of vendors is a problem for all retail buyers, it is of most concern to apparel buyers because of the seasonality of fashion merchandise. As an example, the clothing chain Express sets itself apart from its competition because it has the ability to get new fashion merchandise delivered to its stores 3 to 4 months earlier than most. This allows the company to be a leader in getting new fashions to its customers and results in increased revenues. On the other hand, Macy's has developed a vendor matrix that allows it short lead times. Macy's does not rely on early delivery times to get new fashions out on the showroom floor first as does Express but, instead, wants to see if the fashion is going to be a success. If this is the case, Macy's will then contact the appropriate vendor to manufacture the new fashion and have the merchandise in its stores within a week.

Value or quality of merchandise is an obvious choice of vendor selection criteria. Buyers must purchase goods from their suppliers that meet their customers' needs and wants. Quality is a very important factor to retail customers. Often in the retail industry various buyers obtain similar prices and delivery dates. What distinguishes one buyer from the next is the quality of the merchandise. If consumers can buy a better-quality item for the same price as one of lesser quality, they will do so. Macy's reports that it is able to obtain moderate- to high-quality merchandise 80% of the time. Express, on the other hand, requires all of its merchandise to meet its high-quality standards. Express's customers expect a high-quality product, and this expectation allows it to charge a higher price.

Supplier evaluation in the apparel industry is a continuing task. Each time a shipment of merchandise arrives in the stores, the goods are examined for defects and compliance with

specifications (e.g., color, size, and form). If, for example, Supplier X continually sends unacceptable merchandise to Buyer A, then it would be customary for Buyer A to stop giving Supplier X orders to fill. Often then, Buyer A would talk about the bad experiences encountered with Supplier X, and simply by word of mouth, buyers would stop using Supplier X. This is the reason that "good vendors stand out like a sore thumb." Retail suppliers therefore must strive to maintain the faith of the buyers by offering acceptable-quality goods, showing little delinquency of order deliveries, and being willing to negotiate price markup percentage.

Finally, online apparel retailers are the fastest-growing e-commerce market. Online apparel sales increased from 30.6% in 2017 to 34.6% in 2019. In February 2020, Macy's announced that it would close 125 stores. Luxury retail stores like Macy's have been unable to adjust in the online age.

Chemical Industry

Industrial buying in the chemical industry mostly deals with bulk chemicals for chemical production and synthesis. Quality is the number one criterion in supplier selection. Reliability and dependability of the delivery ranked second, while price considerations ranked third.

Purchasing managers send requests for quotes (RFQs) to prequalified suppliers. Maintaining quality is by far the most important competitive advantage of companies in the chemical industry. During the bidding process, samples of the chemicals are obtained for quality testing. The chemicals must meet the buying firm's complete specifications. For example, samples of the same chemical and purity may have different tints. Even if the purity specification is met, the buying firm also must require consistency with the existing product line. Another important aspect of quality control is incoming inspection, to make sure the desired amounts are delivered. This should be done by weighing the products as they come into the warehouse.

At Pfizer, quality testing is considered the number one criterion. Samples are obtained from potential suppliers, and a variety of tests are done to ensure that purity and identification of unique characteristics of the specific chemical are met. Reliable quality of specific specialty chemicals is what makes a company competitive in the chemical industry. When considering the quality of the specific chemicals, historical quality performance also is evaluated in the selection process. If suppliers do not meet quality standards consistently, a firm's product may be delayed, thus leaving the buying firm unable to meet customer demand.

Delivery performance is also important in the chemical industry. The lead time for the commodity must be well established so that planning horizons for the production schedule may be made with a high degree of certainty.

Throughout the purchasing process, it is important for all functional areas in the corporation to work together to find a supplier compatible with all the firm's needs. A trade-off regarding the desired qualities in a supplier must be made to select the best one. For the shipping and receiving department, a supplier who does not meet the delivery schedule usually causes severe operational problems. Random sampling of the raw material inventory stocked in the warehouses also should be performed to further test the quality of the chemicals.

When considering the price of chemicals, bids are evaluated and ranked according to the firms' financial strength, quality, and historical performance records. If an active bidding firm does not pass these tests, two options exist.

All of the companies lack certain fundamentals, and the buyer must work with the supplier with the best overall record to meet the desired needs of the firm. In this stage, both

the supplier and the buyer should work together to meet mutual agreements. For some specialty chemicals, a limited number of suppliers exist; therefore, these suppliers are willing to work closely with any firm that needs their products. It is also likely that because such a small number of suppliers exist for these chemicals, sourcing for these chemicals is engaged in both international and domestic markets. This is usually not a major concern for Pfizer because the policy is to stock the warehouse and to deliver from there to the individual plants requesting raw materials for the next production run. International sourcing problems may occur due to shipping delays, customs, and the excessive amount of paperwork involved with importing raw materials.

Periodic unannounced plant visits also are performed to ensure that suppliers are following any mutually established procedures. This is an excellent method for collecting data to evaluate supplier performance. Usually, forms consisting of standard checks to be performed in the company audit are used by the purchasing department to rate suppliers. This information is then evaluated to see if overall improvements are being made in the firm. If the variance is favorable, or if there is no variance, the purchasing department may favor that particular supplier. In instances where the supplier's audit does not go well, inquiries are made to determine what is being done to alleviate the problems to ensure better overall performance.

Electronics Industry

Industrial buying in the electronics industry is extremely competitive. Some companies place higher emphasis on pricing and delivery. Companies also vary in their methods of purchasing. For example, Dynalab prefers to deal with a single source per unit, while Best Buy uses many suppliers to meet its needs for any given item.

Due to the intense competition in the electronics industry, suppliers of electronic equipment are forced to comply with standard specifications. Buyers do not have to concern themselves with checking the quality of every batch of goods because they know that suppliers understand this inherent objective. Likewise, timely delivery is not a large problem due to the massive amounts of inventory held in the plants. Thus, late deliveries do not severely affect the production process of the firm, as the company can simply use the surplus or buffer stock until the order is filled. Because the majority of electronic parts are small and inexpensive, large amounts of inventory may be held economically.

Supplier selection at Best Buy is based solely on price. When Best Buy sends out an RFQ, suppliers that lack a good reputation are ignored. Thus, the quality of the supplier chosen to bid is assumed to be high. Delivery time is not a major factor due to the fact that the firm does not operate on a just-in-time basis. Instead, electronics companies usually order large quantities of goods and then put these goods into inventory. Once the product is received, an acceptable quality level (AQL) sample check is performed before the goods are transferred to stock. On the few occasions that samples do not conform to quality standards, the entire lot is sent back to the supplier. However, the likelihood of this happening is minimal. Supplier evaluation is therefore primarily based on previous performance criteria, not defects or delivery time.

Supplier selection also is based on price. The only instance in which delivery time is considered important is for a special project with certain time restrictions. In this unique case, the firm would purchase directly from the factory to bypass the extra time involved when dealing with a distributor. Many electronics firms attempt to single source to meet their purchasing requirements. This simply means that although the supplier might not be the lowest bidder

on all parts, it is the lowest bidder on a total cost basis. It is easier to develop and manage one supplier than to manage four or five. The preference of most electronic firms is to deal with one supplier rather than with many suppliers. Single sourcing allows buyers to gain several advantages. First, they are able to make maximum use of their buying power. They are able to concentrate all requirements for a certain item with a single supplier and thereby get the largest possible quantity discount. Second, with single sourcing, less administrative work is required of the buyer's organization as orders, reports, and payments are issued to only one supplier. Single sourcing also allows suppliers to offer special price concessions if they can make 100% of a given item. Finally, single sourcing gives suppliers the incentive to aid in methods improvement.

Selection of a supplier for a new commodity is a different process. The Thomas Register is used to obtain potential suppliers for new commodities. Once a supplier is decided on, a single part is ordered and checked for quality and specifications, and then a batch is ordered and inspected for percentage of defects. If the batch meets the requirements, then no further testing is done on the remaining orders. If the batch does not meet the requirements, the buying firm will usually work with the supplier to solve the problems causing the batches to fail the checks. Suppliers are very interested in improving their performance.

In today's market, an electronics supplier must have a quality product to survive. Thus, electronics firms do not test the quality of the electronics suppliers. Seventeen years ago, electronics firms tested each unit due to poor quality, but now, because of Chinese, Japanese, and other foreign competition, quality has become a given for each product or the supplier simply will not survive in the electronics supplier market.

Construction Industry

In the construction industry, material quality, delivery dependability, and price again appear to be the most critical criteria (see Benton & McHenry, 2009). However, the degree of importance that construction firms place on the three criteria varies.

The supplier selection process begins by choosing potential suppliers for each material type needed for a specific project. The selection process is usually based solely on past performance. Once a pool of potential sources is formed, RFQs are sent out, negotiations are conducted, and specific suppliers are selected.

High-quality materials are expected from every potential supplier. If a supplier has shown the ability to supply a quality product in the past, it is assumed that the supplier will continue to do so. In most cases, there are no formal measures taken to ensure that high-quality materials have been delivered. Visual material inspection is used, and any piece of material not visibly damaged is accepted and used. However, materials such as steel beams or concrete require more formal inspection to ensure they conform to specifications. In the case of steel materials, plant visits may be made by a representative of the buying firm during testing procedures to ensure that the architect's specifications are being met. In addition, a representative of the supplier will sometimes be present at the construction site to ensure that the materials are being properly used. As an example, concrete samples are sometimes tested to confirm that they are of the desired consistency. Although quality is an important aspect to the buyer, it may not play a large role in actually selecting one supplier over another. Quality is rarely a problem in the construction industry, simply because the buying firm provides the supplier with specifications, and the supplier must comply. If a supplier cannot provide adequate quality, it will not receive consideration for future business from the contractor. Therefore, after

the potential suppliers have been selected, considerations of delivery dependability and price may play a more important role in actually selecting one supplier over another.

Delivery dependability is obviously vital in today's fast-track construction industry, where construction is often begun before the architects' final designs are completed. If delivery deadlines are missed, the result can be costly to both the owner and the contractor. In the construction industry, time really is money. If a project is not completed by its deadline, the loss of potential profits increases with each day past the due date. In this industry, suppliers must be able to deliver materials to the contractor (buyer) when promised. If one company can supply a contractor (buyer) considerably faster than another supplier, the faster company will have an advantage. Delivery considerations are the most important criterion used in selecting suppliers for the construction industry.

Price also has a significant effect on the selection process. Price, however, cannot always overshadow all other criteria. The trick is to strike a balance between price and the other factors considered in the process. Premiums often may be required for rush deliveries. The company must weigh the desire for expected deliveries with the resulting higher prices. Through negotiation, the buyer and supplier must reach a price agreement satisfactory to both parties.

While quality, delivery-speed dependability, and price may play the most vital role in selecting a supplier, they are not the only considerations. Depending on the project, and the specific types of required materials, other factors may play an even more important role. As an example, a supplier must be financially stable to assure the buyer it will be around to fulfill the negotiated agreement. Also, warranties may play an important role when buying roofing materials, wooden doors, and cabinets. Finally, advantages in the areas of customer service or supplier location also may sway a buyer in the direction of a particular supplier.

SUMMARY

LO 8.1 State the reasons a corporation may decide to outsource production.

Outsourcing can produce many benefits for a firm that would normally produce a part internally. The supplier selection problem is much easier to describe than carry out. The primary purpose of the supplier selection decision is to shed light on selecting only the most compatible supplier for firms in specific industries. The buying firm may be highly skilled at (1) specifying product attributes, (2) forecasting expected requirements, and (3) ensuring the right quality at a reasonable price.

LO 8.2 Identify sources businesses can use to make informed supplier decisions.

Searching for the appropriate supplier for a specific material or component part is becoming a strategic issue in itself. In the new fast-paced and volatile buying environment, the purchasing firm must know where to look for each item. Buyers should be experts on the industry and on specific raw materials or component parts. The traditional buying source is the well-known Thomas Register.

LO 8.3 Explain the importance of a strategic match between the buyer and supplier.

A "strategic match" is needed between buyer and supplier, as they can then work in harmony as far into the future as they are compatible. Each business unit and department should have a clear understanding of the strategy of the whole firm and have a departmental strategy that complements and aids the overall strategy execution of the firm. Purchasing, logistics, inventory management, and production control are all linked tightly together under the materials management umbrella.

LO 8.4 Discuss the need for efficient supply chain management relationships.

The supply chain management process is based on the idea of efficient resource coordination and

teamwork. Buyer and supplier relationships have become increasingly important. There is a trend toward specialization away from manufacturing an entire product and to more contract manufacturing and purchasing. This significant *transfer of value downstream* emphasizes the importance and significance of supply chain relationship management. For any buying organization to stay competitive in today's aggressive market sectors, it is essential that it maintains strong relationships with its best contract manufacturers and suppliers.

LO 8.5 Describe the approach to a supplier relationship management program.

Supplier relationship management (SRM) is defined as the management of strategic collaborative relationships between buying and selling organizations. The ultimate objective is to create supply chain value and the minimization of supply chain risk. Many large buying firms are implementing SRM programs in their business plans to ensure they maintain their competitive edge. There are several ideas on the exact process an SRM program should follow, but the general approach is the same. Consider Scientific Management Systems, Inc., a large vertical manufacturing organization in the process of developing a supplier relationship program.
One well-known model that explains supply chain relationship management includes four behavioral dimensions—the four Cs: counterproductive (lose-lose), competitive (win-lose), cooperative (win-win), and collaborative (win-win) relationships.

LO 8.6 Explain how to implement a supplier development program.

Relationships with suppliers must be developed to meet standards and contribute to continuous improvement goals. Once an investment in developing supply chain relationships is made, buying firms must actively manage these relationships.

LO 8.7 Explain how to implement a supplier evaluation program.

A buying organization can evaluate its suppliers in several ways. If suppliers do not meet quality, delivery, and scheduling standards, the buying organization may face delays and will lose money from not being able to meet critical scheduling and manufacturing demands. Therefore, relationships with suppliers must be developed in order to meet standards and contribute to continuous improvement goals. Specific communication strategies including supplier governance, supplier training and education, feedback, and frequent site visits can aid in developing suppliers.

LO 8.8 State the factors that should be considered when determining the number of suppliers to work with.

Much debate has taken place concerning the number of suppliers a firm should use. One side of the debate is the multiple-sources side. This involves the use of two or more suppliers. The other side of the debate is the single-source policy, in which only one supplier is used to supply a particular part.

The goal of both policies is to provide the buyer with the best value for a supplied part. Many attributes contribute to the value the buyer receives. They include risk, quality, unit price, total cost, delivery, reliability, and service (design capabilities, productivity improvements, and R&D).

LO 8.9 Compare how different industries select and evaluate suppliers.

The apparel, chemical, electronics, and construction industries were evaluated in terms of their differences. Specifically, a strategy seeking such suppliers may be acceptable in the apparel industry, where the highest emphasis is placed on price or price markup, but would be unacceptable in the chemical industry, where the highest priority is purity of the chemicals (i.e., quality). Each industry must analyze the various associated criteria trade-offs when selecting a supplier.

KEY TERMS

80/20 single sourcing approach 179
Contract manufacturers 168
Outsourcing 166
Performance-based evaluation 172
Preferred suppliers 171
Price markup 183
Process-based evaluation 171
Strategic match 167
Strategic suppliers 171

DISCUSSION QUESTIONS

1. What are some of the sources of supplier information?
2. Discuss three common supplier evaluation systems.
3. What are the advantages of single and multiple sourcing? What is the trend?
4. What is meant by cross-sourcing?
5. Discuss the recent trend of supplier reduction.
6. Discuss how supplier selection and evaluation strategies vary across different industries.

SUGGESTED CASES

Case 9: Columbus Auto Parts

Case 16: The Kemper Engine Plant

Case 23: Pendleton Construction, Inc.

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9 Strategic Outsourcing

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

9.1 Describe why organizations outsource manufacturing and services business processes.

9.2 Identify the hidden cost of strategic outsourcing.

9.3 Identify the differences between core and noncore competencies.

9.4 State the trends of strategic outsourcing.

9.5 Explain the elements of strategic outsourcing.

The vice president of operations for CASE, Inc., is concerned about the low R22 solenoids inventory. There is currently a 20-day supply of R22 solenoids. A 90-day supply is the normal inventory level. CASE has not received a shipment in 2 months. Last week when the buyer discussed the problem with LGK, it was revealed that the contract price would be doubled and the current contract with CASE is null and void. LGK is located in Shanghai, China.

The buyer also found out in his conversation with LGK that the solenoid industry has been experiencing significant shortages. The demand has been larger than expected based on the increased demand from China. Chinese auto manufacturers have been specifying the R22 solenoids for their new electric-powered cars. According to the LGK salesman, if electric cars become popular, LGK is expected to allocate more of its capacity to support the Chinese automotive industry.

INTRODUCTION

As you learned in Chapter 8, outsourcing can be defined as the complete transfer of a business process that has been traditionally operated and managed internally to an independently owned external service provider. A

complete transfer means the people, facilities, equipment, technology, and other assets are no longer maintained internally once the business process is outsourced. Outsourcing is sometimes thought to be similar to subcontracting, joint venturing, and contract manufacturing. Contracting is the purchasing of goods or services to facilitate a business process owned by the buyer. The outsourcing point of departure from these concepts is the complete transfer of all associated internal business process activities. When considering outsourcing, firms are evaluating whether to reverse a prior decision to "make." In other words, outsourcing reshapes or expands a firm's boundaries.

In a large scale study, executives categorized their outsourcing activities (Handley & Benton, 2009). Table 9.1 illustrates the diverse set of outsourced activities reported on. Not surprisingly, information technology outsourcing (ITO) represented the largest number of responses at 25.8%. Approximately 35% of the responses represented the outsourcing of some type of manufacturing activity, with the remainder being **business process outsourcing (BPO)**. The foundation for BPO is the manufacturing industry, with hiring other suppliers (providers) to handle specific processes, such as the supply functions unrelated to the core competencies required to make their end products.

Business process outsourcing (BPO) Hiring other suppliers (providers) to handle specific processes.

Outsourcing can be conceptualized as a process rather than simply an event. This process begins with the development of a *strategic and financial business case* for outsourcing. The crafting of the business case is followed by implementing the external sourcing model and, ultimately, managing the relationship with the provider. This view is summarized in Figure 9.1 and is consistent with the definition of the outsourcing process offered by the International Association of Outsourcing Professionals (IAOP, 2019).

The strategic case for outsourcing focuses on whether the outsourced product or service is a core or noncore activity. If the outsourced activity is a core competitive product or service, it should not be outsourced. The financial case for outsourcing focuses on whether the outsourced product or service will generate a savings of at least 30% after all of the relevant costs are satisfied.

TABLE 9.1
Categories of Outsourced Activity Reported

Category of Outsourced Activity	Frequency	Percentage
Business process—information technology or systems	51	25.7%
Other—business process	38	19.2%
Manufacturing of end items	33	16.7%
Manufacturing of component parts	24	12.1%
Other—manufacturing	13	6.6%
Business process—human resources	11	5.6%
Logistics services	11	5.6%
Call center or customer service center	9	4.5%
Business process—accounting or finance	8	4.0%
Total	198	100.0%

Source: Adapted from Handley and Benton (2009).

In 2019, global business process outsourcing in the United States accounted for approximately $86 billion (IAOP, 2019). A recent report from global consulting firm Booz Allen Hamilton posits the expectation that U.S. business process outsourcing will continue to grow

FIGURE 9.1
Outsourcing Process

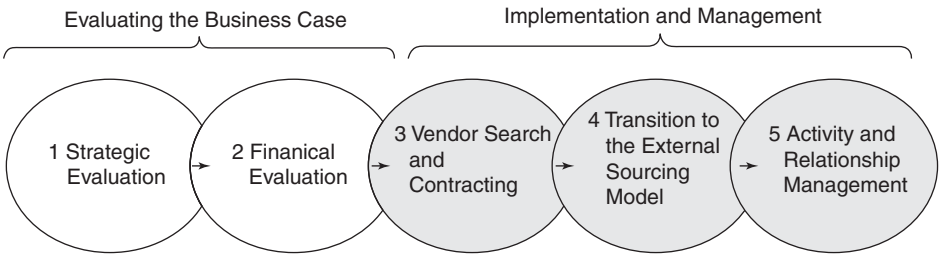


FIGURE 9.2
Predictions for the 2020 Outsourcing Environment
Reprinted with permission of the National Outsourcing Association.

Outsourcing in 2020 is an industry-wide campaign that aims to investigate how outsourcing will change as a practice over the next 5 years. The National Outsourcing Association surveyed 134 organizations. Its key findings are given here.

- 70% of buyers plan to increase their use of outsourcing. Only 10% plan to decrease their outsourcing slightly; none plan to decrease the amount they outsource significantly.
- 83% of service providers expect the outsourcing industry to grow, with 37% expecting it to grow significantly. Just 4% expect the outsourcing industry to get smaller.
- Overall, organizations said they outsourced primarily for the following reasons: cost savings (35% cited this as the prime driver for outsourcing), improving the customer experience (23%), and transitioning from legacy IT to as-a-service models (17%). This differs from the traditional prime reasons why companies outsource: cost savings, increasing operational flexibility, and accessing new skills.
- Overall, respondents said they are most interested in offshoring cloud-based technologies and process transformation.
- 83% of all respondents believed robotic process automation (RPA) will be of greater significance in the next decade; 80% said the same of artificial intelligence (AI).
- 44% of service providers said AI will be more of a game-changer than RPA. Just 7% on the buy side agreed.
- 61% of buyers thought back-sourcing will be less significant in 2020, with 57% of service providers saying the same. About 59% of buyers thought reshoring will be less significant in 2020, while 61% of providers said the same of offshoring.
- There is strong expectation on both sides that the following changes to contracting will occur:
  1. Contract values will be based on outcomes.
  2. Service providers will be contracted as service integrators sharing risk.
  3. Procurement will become a more important part of the contracting process.

at a rate of approximately 12% per year in the near term. A report by the IAOP suggests that 25% to 34% of the "typical executive's budget is outsourced." There is a significant amount of attention reported by industry and the popular press. According to a Deloitte Consulting study, 64% of respondents indicated they had brought outsourced services back in-house (Di Leo, 2019). Bringing an outsourced manufacturing function back in-house is not a trivial endeavor. After a period of time the skills within the firm for these manufacturing functions will degrade due to atrophy. A more recent Deloitte (2018) outsourcing survey of more than 500 executives from leading organizations indicated that outsourcing solutions—led by cloud and automation—are fundamentally transforming traditional outsourcing process. Most of the Deloitte survey respondents agreed they should replace their traditional outsourcing strategy by implementing a continuous cost improvement technology-driven outsourcing process. Fifty percent of respondents identified "hidden costs" as the primary problem encountered with outsourcing, while 44% of the respondents did not realize cost savings. They also found that only 10% of the firms were highly satisfied with the costs they were saving, and nearly 50% failed to achieve cost savings expectations. Moreover, Dun and Bradstreet found that 20% to 25% of all outsourcing relationships *fail* within 2 years, and approximately 50% fail within 5 years. Finally, another study reported that, based on the experience of Booz Allen Hamilton, approximately one in three outsourcing efforts fails to achieve outsourcing expectations. These anecdotal findings suggest there is a troubling gap between expectations and reality; however, outsourcing is here to stay. It has become the key driver for globalization. The Internet has made outsourcing an important competitive weapon; it cannot be dismissed as a passing fad. Perhaps outsourcing is one of the most important business concepts in the past 70 years. Predictions for the 2020 outsourcing environment are given in Figure 9.2.

WHY DO ORGANIZATIONS OUTSOURCE BUSINESS PROCESSES?

LO 9.1 Describe why organizations outsource manufacturing and services business processes.

It is virtually impossible to generalize why organizations outsource various business processes. The final outsourcing decision depends on whether the CEO, CFO, or CIO initiates the outsourcing proposal. Whichever executive initiates the outsourcing proposal, a reduction in direct operating costs is usually the primary driver. The cost reduction must be significantly lower than the current direct operating costs for an outsourcing proposal to be attractive. Some of the generic strategic benefits of outsourcing are listed here.

1. *Cost minimization* is accomplished by reducing direct operating costs, eliminating overhead costs, and transforming fixed costs into variable costs.
2. *Refocusing the organization to its core competencies* is accomplished by focusing on what the organization does best and/or transforming the business to focus on new products and services.
3. *Improvement in operating performance* is accomplished by increasing quality, increasing productivity, and obtaining new capabilities technologies from external sources.
4. *Increased market share and revenue* is accomplished by assessing the providers' network and accelerating expansion into new markets.

Some of the specific benefits of outsourcing are listed here.

1. Reduce and control operating costs
2. Improve quality
3. Change company focus
4. Acquire external capabilities
5. Refocus scarce resources for alternative uses
6. Reduce cycle time
7. Obtain cash infusion
8. Reduce risks
9. Gain flexibility
10. Turn fixed costs into variable costs

While a contract is required to legally protect one's interests, an extensive strategic assessment and a true commitment to a cooperative relationship with the service provider are both necessary to realize expected outsourcing benefits. These insights offer valuable guidance to outsourcing practitioners in terms of where and how sourcing resources should be applied. Outsourcing initiatives must create value. The type of management and relationship skills and capabilities must be developed through training and/or recruitment within the outsourcing organizations. The hidden costs of outsourcing are given in the next section.

THE HIDDEN COSTS OF OUTSOURCING

LO 9.2 Identify the hidden cost of strategic outsourcing.

Today, many organizations turn to outsourcing to expand their reach, engage specialists, or eliminate noncore capabilities. While there is benefit to strategic outsourcing, organizations should be aware that there are often hidden costs behind the expected benefits. In the majority of cases, the financial benefits will be significantly lower than expected.

Quality Costs

Cost of quality Costs related to (1) preventative, (2) appraisal, (3) internal failure, and (4) external failure.

The **cost of quality** is an essential consideration in sourcing decisions. The costs associated with ensuring quality are often categorized as (1) preventative, (2) appraisal, (3) internal failure, and (4) external failure. If sourcing internally, firms must estimate the costs of defect prevention (i.e., designing quality into products and processes), the costs of quality appraisal (e.g., inspections, audits, monitoring mechanisms), the costs of internal failure (e.g., scrap, rework, internal downtime), and the costs of external failure (i.e., failure as perceived by the external customer). All of these costs exist with external sourcing as well. Persistent internal quality issues at the external source will ultimately impact the buying firm. The buying firm will need to ensure that proper mechanisms are in place to make sure it is capable of detecting quality failures by an external source. This may be more difficult than with internal sourcing because if sourcing externally, the buying firm may not have maintained sufficient internal capabilities to even appropriately assess the quality of a product or service provided by the external source.

Costs of Strategic Supplier Relationship Management

It has long been recognized in both the strategy and operations literature that the most effective external sourcing relationships involve considerable management time and coordination. Unfortunately, this comes at an expense. Not all external sourcing relationships are created equal, and those involving commodity products or services may not require extensive relationship building and coordination. The external sourcing of strategic products and services is on the other end of the spectrum. In these situations, relationship building and coordination activities are extensive. Thus, it is critical that firms considering outsourcing also evaluate the type and depth of the relationship required to effectively manage the exchange. According to the Deloitte outsourcing study, 62% of respondents cited requiring more management time than expected. It is also suggested that managing the supply relationship costs at least 3% and sometimes more than 10% of the annual contract value. On average, the IT outsourcing engagements studied resulted in an annual supplier management expense that equaled 8% of the contract value. Many of the costs associated with managing the external sourcing relationship are manifested in the labor expense of purchasing personnel. For instance, Toyota spends more than 7,200 man-days of face-to-face contact with suppliers each year. Other costs associated with managing the relationship include travel, IT infrastructure and management, and supplier development programs (e.g., training and performance evaluation systems).

Internal Coordination Costs

While internal coordination costs are unique to external sourcing alternatives, they must be contrasted against the internal coordination and overhead costs associated with internally sourcing a product or service. One can think of internal coordination costs as those overhead expenses incurred solely due to the decision to internally source a product or service. Presumably, sourcing internally induces higher levels of many overhead administrative functions such as payroll, benefits management, utility expenses, IT expenses, and so forth. The relationship between higher levels of vertical integration and an increase in bureaucratic costs has been noted in the extant academic literature. Some firms have cast the decision to vertically integrate (i.e., source internally) versus the decision to externally source as a comparison between the cost of bureaucracy and the cost of external coordination. However, according to the Deloitte study, 57% of respondents were unable to free up the anticipated level of internal resources after outsourcing. In comparing traditional internal sourcing with external sourcing options, firms need to have a thorough understanding of these marginal overhead expenses and how they would be incrementally impacted by outsourcing a particular business activity.

Costs Related to Implementation of External Sourcing Model

An often-underestimated expense incurred when switching sources (internal or external) is that associated with the transition itself. This cost category could include supplier search, evaluation and contracting, the transfer of physical assets, domestic and international travel during startup, and training of the new source to ensure a smooth transition and seamless integration. The typical transitions between the buying and supplying organizations took more than 10 months to complete. During the transition period, firms incur additional costs related to internal staff providing additional support and duplicate resources. There is usually lower efficiency and effectiveness at the beginning of the contract. Moreover, Dun and

Bradstreet found that 20% to 25% of all outsourcing relationships fail within 2 years, and nearly half fail within 5 years. This implies that the likelihood of incurring these expenses again, or experiencing costs associated with reinternalizing an outsourced activity, is relatively high. Another critical financial consideration with outsourcing is the impact on the internal workforce. Some of the often "hidden costs" of outsourcing include training internal employees to become relationship managers rather than technical managers. The hidden costs also include retention bonuses, severance packages, employee turnover, and management time required to thwart labor disputes. Furthermore, the majority believed their welfare was *not* a major consideration in outsourcing. These observations underscore the importance of considering the management and impact of internal staff when making outsourcing decisions.

Costs of Product/Service Design and Development

One of the most influential factors in vertical integration decisions is the coordination requirements. Perhaps nowhere is this more evident than when considering new product or service development. There appears to be a significant interplay between the architecture of the product or service and the cost of coordination. The cost of coordination has been captured in the extant literature as the number of engineering hours required to bring a new product to market. It has been suggested in the literature that tightly coupled or integrated product designs require higher levels of coordination and, therefore, may not be appropriate for external sourcing. These findings are consistent with another set of literature that describes the difficulty and cost with which knowledge is shared between firms, particularly when this knowledge is tacit and less easily codified. Thus, it is imperative that firms develop a deep understanding of the coordination cost implications of various sourcing alternatives. This consideration may not be separable from key product and process architecture decisions.

Governmental and Political Expenses

Particularly if considering international sourcing alternatives, it is important that the decision-makers develop a complete understanding of the costs involved with ensuring compliance with governmental laws, regulations, and even local business customs. Specifically, these costs could include but are not limited to legal expenses incurred to learn about a foreign location's laws and regulations, lobbying efforts, travel, taxation, tariffs, local content obligations, quota systems, and others. Tariff rates in developed countries are typically less than 10% but can be much higher for lesser-developed nations and for certain products such as agriculture (see Chapter 10). These environmental parameters may be highly dynamic, requiring analysts to be "on the ground" and well connected to develop a deep understanding of the evolving environment. Some multinational corporations with large international exposures have large departments dedicated to assessing and managing political risks around the globe.

Costs Related to Supply Chain Risk Management

Intellectual property A created work or invention protected under copyright or patent.

Outsourcing risks include breaches in **intellectual property**, provider shirking, and opportunistic renegotiation. The combination of contractual incompleteness, asset specificity, and uncertainty gives rise to these risks when firms pursue external sourcing. Outsourcing organizations must have a clear understanding of true supplier intentions.

The idea of **risk management** should underlie all of the previously discussed cost categories. However, some costs are more directly tied to the management of risk in the supply chain. Broadly, risk can be defined as a measure of the probability and severity of adverse effects. One can divide risk management into four iterative phases: (1) risk assessment, (2) risk mitigation, (3) risk monitoring, and (4) contingency planning. Each of these phases has associated costs that vary depending on the specific sourcing decision.

Risk management The identification and evaluation of risks followed by the control of the probability or impact of unfortunate events.

Risk Assessment

Risk assessment involves answering three questions. (1) What adverse events could happen? (2) What is the probability of these events happening? (3) What is the financial impact if these events occur?

Risk Mitigation

Risk mitigation involves a detailed analysis of what can be done to reduce or eliminate the probability and severity of these adverse events while also considering the trade-offs involved. Managers must learn to tailor appropriate risk mitigation strategies to a particular situation. It is crucial to fully appreciate these possible financial uncertainties when considering outsourcing opportunities, for they could fundamentally impact the attractiveness of alternatives.

Risk mitigation Involves a detailed analysis of what can be done to reduce or eliminate the probability and severity of adverse events while also considering the trade-offs involved.

Risk Monitoring

Risk monitoring involves continuously evaluating supply chain conditions so that potential issues may be avoided or at least lessened by being more proactive. Best practices for monitoring include regular supplier financial assessments, use of supplier scorecards, use of advanced tracking technology such as RFID, increased supply chain visibility at second- and third-tier sources, as well as other practices.

Contingency Planning

The final phase is contingency planning. More than likely it will be impossible to eliminate all risks associated with a sourcing alternative, and, thus, contingency plans need to be put into place that detail early warning detection systems, internal and external actions upon recognition, and so forth. This comprehensive risk management approach will introduce costs that are different for various sourcing alternatives because the different options will carry with them different types and sizes of risks. Some specific costs associated with risk management could include insurance, dedicated risk management personnel, financial hedging, and operations hedging.

Miscellaneous Financial Considerations

A final consideration for evaluating the hidden costs of each sourcing alternative is learning and the appropriation of its benefits. The idea that firms tend to improve their cost position with cumulative volume and engineering time has been well established. A commonly cited source of financial benefit from outsourcing is the supplier's better economies of scale. External specialists often enjoy more efficient use of assets from being able to pool the less than perfectly correlated demands of multiple customers. Also, external suppliers can aggregate the demands of their multiple customers, which allows them to offer immediate cost

Example 9.1

SIMPLE OUTSOURCING EXAMPLE

Consider that Company A in Hopkinsville, Kentucky, has 10 employees that produce 1,000 brake assemblies per month per employee. At a wage rate of $15 per hour, the total labor cost per year is $300,000. Last week, Company A decided to outsource the 100,000 brake assemblies of production to Company B in China where the wage rate is $5 per hour, for a total annual labor cost of $100,000. The savings from the outsourcing example is $200,000 ($300,000 - $100,000). Of course the $200,000 savings will be offset by indirect and hidden costs.

The outsourcing cost analysis can be broken down into five basic steps:

- Step 1. Clearly define the business process your organization would like to outsource.
- Step 2. Calculate the in-house costs that could be avoided by outsourcing.
- Step 3. Calculate the total costs of outsourcing.
- Step 4. Subtract the costs of outsourcing from in-house costs to determine savings.
- Step 5. Subtract the hidden costs from Step 4 to determine the actual savings.

Opportunistic behavior The behavior of relationship motivated by the maximization of economic self-interest and occasioned loss of the other partners.

Total quality management Based on the principle that every employee must be committed to maintaining high standards of work in every aspect of a company's operations.

Incremental savings A systematic reduction or elimination of the cost of a recurring expense (e.g., paying on a monthly school loan).

benefits and to travel more quickly down the learning curve than can a firm with its individual demand alone. This is particularly true in industries with relatively standardized processes such as telecommunications equipment and consumer electronics. However, the buying firm also needs to consider what portion of the cost improvement it will be able to appropriate if it decides to outsource. This may be determined by competitive conditions in the supply market, power structures, and the overall threat of **opportunistic behavior** by the external supplier. These considerations have been found to have the potential to greatly impact the sourcing decision. It is critical that firms also consider their internal ability to improve, by means of innovative work, practices such as **total quality management**, lean production, and others. If a firm can generate nearly equal financial improvement through internal efforts as would be realized with outsourcing, then the business case may need to be called into question. According to a Deloitte study, many organizations could realize **incremental savings** on the order of 20% to 30% of direct labor from implementing innovative programs such as lean production. It is the author's experience that if the incremental savings is less than 30% the outsourcing activity should not go forward.

This section served to develop a comprehensive overview of the multitude of factors that can materially impact the financial viability of outsourcing yet are often overlooked in developing the business case for outsourcing.

CORE COMPETENCIES

LO 9.3 Identify the differences between core and noncore competencies.

Resource-based view A model view of the company as the primary approach for achieving a competitive advantage in a competitive environment.

Core competencies The collective learning in an organization.

A concept similar to the **resource-based view** of the firm is that of core competencies. **Core competencies** are the collective learning in an organization. The core competency concept is especially concerned with how to coordinate diverse production skills and integrate multiple streams of technology. Organizations continuously innovate in order to attract customers and increase revenues and market share with products and services. Core competencies are unique combinations of thought, focus, and implementation methodologies. Most organizations have

numerous capabilities. The organization must have a set of core competencies that ensure survival in a competitive marketplace. Core competencies are only built and learned over the long term. Alternatively, outsourcing can provide short-term competitive benefits but does not contribute significantly to developing "people-embodied" skills for a sustainable advantage. This implies that upon outsourcing, a firm is accepting a position of competitive parity for the activity in question. Organizations should concentrate on the development of a few core competencies and strategically outsource noncore activities. Outsourcing core activities is the beginning of the end of the existence for any organization. A noncore product or service is outside of business operations that are the primary revenue source of the business. Noncore products or services are incidental activities, while *core* items are considered central to operations.

Thus, the concept of core competencies along with the resource-based view of the organization provides the basis for the assertion that in considering outsourcing, the decision-making team must have a thorough understanding of core and noncore capabilities and how they relate to an organization's competitive advantage.

OUTSOURCING TRENDS

LO 9.4 State the trends of strategic outsourcing.

Outsourcing is not immune to the effects of economic volatility; however, in an economic downturn, internal and external costs will become the primary basis for considering the outsourcing business case.

At the time of this writing, there is a trade war between the two largest economies, the United States and China. However, the outsourcing market represents a dichotomy: On the downside, organizations' cost-cutting outsourcing strategies may negatively impact market growth, but the upside is that outsourcing will be adopted by more organizations to help them meet their competitive challenges. In a financially challenged economic environment, the knowledgeable buyer and provider will have a competitive advantage. The potential for outsourcing to address immediate cost pressures and long-term recovery goals will be unprecedented. However, only organizations that are diligent about understanding and avoiding the pitfalls of cost-focused outsourcing and that apply total business-outcome–focused outsourcing will be successful. Many outsourcing buyers must continuously reevaluate their contracts to improve efficiency and costs. This will affect provider selection and retention, how services are or will be delivered, delivery location, and contract pricing. Beyond the drivers of efficiency and cost, however, many organizations also will experience core business changes as a result of repercussions of a worldwide economic crisis.

For organizations that are outsourcing, contract terms may be altered in response to corporate change: Some will downsize, others will expand, acquisition and divestiture will impact others, and still others will cease to exist. Many organizations that are not outsourcing will consider it or move to aggressively outsource their IT or business processes to focus on their *core business*. Outsourcing buyers and providers must be attentive to contract issues to ensure a certain level of flexibility, since business change is inevitable.

Approximately 76% of announced outsourcing contracts represented new deals; the remaining percentage was a combination of contract extensions, expansions, or renewals. Almost one quarter of these contracts were a continuation of outsourcing with an incumbent provider. Key providers are basically betting their future on forming enduring, long-lasting relationships. In uncertain economic times, outsourcing relationships can prove (and test) the durability of relationships and the outsourcing value proposition.

ELEMENTS OF STRATEGIC OUTSOURCING

LO 9.5 Explain the elements of strategic outsourcing.

The following are the suggested steps to successful outsourcing:

1. Strategic evaluation
2. Financial evaluation
3. Supplier selection and contracting
4. Transition to external sourcing model
5. Managing relationships

These steps are based on the model given in Figure 9.1. These steps can and should be modified to fit the specific organization and outsourcing objectives. As can be seen from Figure 9.1, these steps are highly interrelated. The nature of the various steps is important in order to achieve continuous improvement and communication between the required outsourcing activities. Concurrent relationships also reduce the implementation cycle time. It is important to assign different team members to implement each of the steps. It is also important to assign members to more than one step in the process to enhance communication and information flows. Figure 9.3 illustrates the concurrency concept.

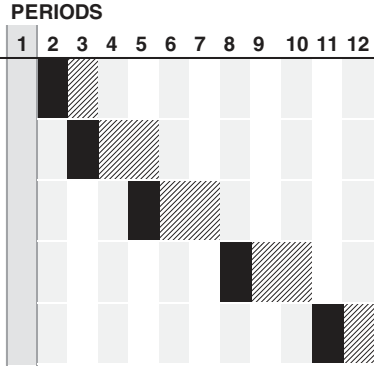
Make-versus-buy
Determination of the product or service to provide as well as determining the in-house capability for producing the product or service.

Strategic Evaluation

As outsourcing is closely related to the traditional make-or-buy decision, a discussion of the **make-versus-buy** decision will be helpful in analyzing what may or may not be good strategic candidates for outsourcing. The first step in the make-or-buy decision is to understand the strategic importance (value) of the activity or system.

FIGURE 9.3
The Strategic Outsourcing Process

ACTIVITY	PLAN START	PLAN DURATION	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
1. Strategic Evaluation	2	2	2	2	25%
2. Financial Evluation	3	3	3	3	15%
3. Supplier search and contracting	5	3	5	3	20%
4. Transaction to external sourcing model	8	3	8	3	20%
5. Managing Relationships	11	3	11	3	20%



Initially, outsourcing decisions predominantly involved standardized processes, commoditized products, and activities of extremely low strategic value. However, firms are increasingly considering more strategic capabilities for outsourcing, making the evaluation much more complex. Managers must be discouraged from making outsourcing decisions piecemeal but rather are encouraged to make them as part of a comprehensive sourcing strategy.

Make Versus Buy

It is no easy task for management to decide to make, lease, or buy component parts and services. The decision to outsource has led to a need for strategic partnerships. As can be seen, the make-versus-buy decision is strategic, not merely a routine operational decision. The make-versus-buy decision actually consists of a series of interrelated decisions that evolve over time. The make-versus-buy decision must first determine what product or service is under consideration. The firm must then consider the in-house capability for producing the product or service. Figure 9.4 presents an overview of key issues related to the make-versus-buy decision.

Financial Evaluation

Along with performing a complete strategic evaluation of a potential outsourcing effort, it is also critical to ensure that outsourcing makes short- and long-term financial sense. It should be noted that the strategic and financial categories are not necessarily mutually exclusive and independent constructs but rather may be significantly interrelated. Furthermore, one may notice that some of the considerations are only pertinent in certain circumstances. For instance, many of the costs are only relevant when considering international sourcing alternatives or are only pertinent when considering the outsourcing of a manufacturing activity as opposed to a business process such as accounting, human resources, information technology, and so forth.

FIGURE 9.4
Make-Versus-Buy Decision

Key Make-Versus-Buy Mistakes

1. In most cases, businesses are not proficient at identifying their core capabilities. They rationalize in-house decisions based on capacity capabilities.
2. They wait too late to assess the value of consultants or strategic partners.
3. They do not recognize that the product or service is approaching maturity.
4. There are always new competitors with new technology attacking the market.

Key Make-Versus-Buy Success Factors

1. Perform a realistic assessment of the capabilities and expertise of each member of the in-house team. If the core competencies exist, what happens if a key member leaves the team? Can the member be easily replaced?
2. Evaluate alternative strategic partnership arrangements and select the appropriate partner.
3. Share information with all functional areas and request their input.

Supplier Selection and Contract Development

Potential outsourcing suppliers must be identified and investigated. One way to identify and investigate a potential supplier is for the buying firm to compile supplier profiles for each potential supplier. (See profile examples in Figures 9.5, 9.6, and 9.7.) While the process of compiling these profiles should be owned by the outsourcing project team, the content of

FIGURE 9.5
Strategic Supplier Profile: BASF Corporation

Key Management Contacts

Dr. Martin Brudermüller, Chief Executive Officer

In 2011, he served as the chief technology officer and was later promoted to chair of the board and CEO in 2018. He also served in Corporate Legal, Compliance, Tax and Insurance; Corporate Development; Corporate Communications and Government Relations; Corporate Human Resources; and Corporate Investor Relations.

Dr. Hans-Ulrich Engel, Vice Chairman of the Board of Executive Directors

Chief Financial Officer Corporate Finance; Global Procurement; Global Business Services; Global Digital Services

Contact Information

BASF Corporation

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Company Overview

- BASF Aktiengesellchaft (BASF) was incorporated as a stock corporation in Germany in 1952. The company's original name was Badische Anilin-und Soda-Fabrik, formed in 1865.
- Headquartered in New Jersey is the North American affiliate of BASF AG, Ludwigshafen, Germany.
- BASF employs more than 15,500 in North America.
- It is the world's leading chemical company with a portfolio ranging from chemicals, plastics, performance products, agricultural products, and fine chemicals to crude oil and natural gas.
- The agricultural products and nutrition segment is organized into two divisions: agricultural products and fine chemicals.
- The agricultural products are used by farmers to improve crop yields and crop quality and by other customers for uses in areas such as public health, structural/urban pest control, turf and ornamental plants, and vegetation management and forestry.

Strengths

- It is one of the world's largest chemical companies, with a presence in over 200 countries at 150 production sites worldwide.
- In Ludwigshafen, the company operates the world's largest integrated chemical site.
- The concept of *Verbund*: BASF takes an innovative approach to vertical integration, using byproducts of chemical reactions, which in many cases would be disposed of.
- This concept enables BASF to have significant cost advantage and energy savings, which pushes the company's margins higher than industry averages.

- BASF has a good credit rating, especially compared to it's competitors. The ratings awarded by Standard & Poor's (A/A-/outlook stable) and Scope Ratings (A/S1/outlook stable) were most recently confirmed on July 11, 2019, and August 14, 2019, respectively.

Weaknesses

The global industrial economy continued to cool in the third quarter of 2019. The escalating trade conflict between the United States and China and the uncertainty surrounding Brexit exacerbated the existing economic downturn. This has particularly affected Europe's export-oriented countries, as well as the United States. Industrial growth continued in China, albeit at a slower pace. Production in the global automotive industry again declined compared with the already low level at the end of the first half of the year. The price of oil decreased despite an intensification of the geopolitical conflicts in the Middle East. The U.S. dollar continued to appreciate against the euro. Other weaknesses are Global Procurement, Global Business Services, and Global Digital Services.

Compared with the Half-Year Financial Report, BASF has therefore adjusted its assessment of the global economic environment in 2019 as follows (assumptions from the Half-Year Financial Report 2019 in parentheses):

- Growth in gross domestic product: 2.5% (2.5%)
- Growth in industrial production: 1.5% (1.5%)
- Growth in chemical production: 1.5% (1.5%)
- Average euro/dollar exchange rate of $1.15 per euro ($1.15 per euro)
- Average Brent blend oil price for the year of $65 per barrel ($70 per barrel)

Opportunities

In August 2019, BASF, Solvay, and Domo Chemicals agreed that Domo will acquire the European PA6.6 business from Solvay. This transaction closed in December 2019 and remains subject to the approval of the relevant competition authorities. BASF will acquire the global, non-European PA6.6 business from Solvay. In addition, BASF will acquire the 50% share in Butachimie's adipodinitrile (ADN) production. The transaction between BASF and Solvay is also targeted to close by the end of 2019, assuming the relevant competition authorities approve the transaction between Domo and Solvay and grant their final approval. The purchase price to be paid by BASF on a cash and debt-free basis is €1.3 billion. Solvay's businesses to be acquired by BASF generated sales of around €1.0 billion in 2018.

Threats

As a consequence of the considerably weaker-than-expected business development in the second quarter of 2019 and the slowdown in global economic growth and industrial production, mainly due to the trade conflicts, on July 8, 2019, BASF adjusted the sales and earnings forecast for the BASF Group made in the BASF Report 2018. We do not expect to see any recovery in global economic activity in the fourth quarter either.

Industry Competition

- Bayer AG
- Dow Chemical Company

BASF's Primary Products

(*Agricultural Division*)

Herbicides, fungicides, insecticides

Key Figures

- EBIDT: -34%
- The company recorded revenues of €46,566 million during the fiscal year ended December 2019, a decrease of 1% from 2018.

See annual report available online at www.BASF.com.

FIGURE 9.6

Strategic Supplier Profile: Bayer AG

Werner Baumann became chairman of the Board of Management (CEO) of Bayer AG on May 1, 2016. Effective January 1, 2010, Baumann was chief financial officer of Bayer AG. From October 1, 2014, until his appointment as chairman of the Board of Management, he was chief strategy and portfolio officer and also responsible for the Europe, Middle East, and Africa region. Between April and the end of December 2015, Baumann was additionally chairman of the Board of Management of Bayer HealthCare AG.

Werner Wenning has been chairman of the Supervisory Board of Bayer AG since October 1, 2012. He was elected to this office by the members of the Supervisory Board on September 14, 2012, as successor to Dr. Manfred Schneider. Wenning was chairman of the Board of Management of Bayer AG from April 2002 until September 30, 2010.

- He joined Bayer in Leverkusen as a commercial trainee in 1966.
- From 1970 to 1975, he established and managed the finance and accounting department of Bayer Industrial, Peru.
- He served as the managing director and administrative head of the Peruvian company of the group from 1978 to 1983.
- He also served as the head of the staff department of the health care sector from 1983 to 1986.
- From 1992 to 1996, he was the managing director of Bayer Hispania Industrial and the senior Bayer representative for Spain.
- He was the head of corporate planning and controlling in Leverkusen in 1996.
- He joined the group's Board of Management in 1997.
- He has been the chairman of the Board of Management of Bayer since 2002.

Company Overview

- Bayer was established in 1863 by Friedrich Bayer and Johann Friedrich Weskott as a dyeworks group.
- Bayer is a German chemical and pharmaceutical group. It primarily operates in Europe and North America. It is headquartered in Leverkusen, Germany, and employs about 106,000 people.
- Bayer is the holding company of the Bayer Group, which includes approximately 280 consolidated subsidiaries worldwide.
- The business operations of the group are organized into three divisions: health care, material science, and crop science.
- The crop science division comprises the crop protection subdivision and environmental science and bioscience subdivision. Bayer's crop protection segment distributes chemical crop protection products for the control of insects, weeds, and fungi (plant diseases). Its major products include insecticides, fungicides, herbicides, and seed treatment.

Strengths

- The life sciences business are the core businesses.
- The company intends to improve cost structures.
- The planned efficiency and structural measures are set to include a reduction in internal research and development capacities at the pharmaceuticals segment, with the freed-up resources set to be directed toward strengthening investment in collaborative research models and external innovations.

Weaknesses

In June 2019, the Supervisory Board of Bayer AG decided on measures in connection with the glyphosate litigations. Among them are the establishment of a new Supervisory Board committee to monitor the current litigations, including trial and mediation activities, and consult with the Board of Management and make recommendations on the litigation strategy. In addition, a U.S. lawyer and product liability litigation expert has been retained to advise the Supervisory Board on matters related to the glyphosate litigations on an ongoing basis.

Opportunities

In the consumer health market segment, the company adapted the organizational structure and reduced costs to succeed in a rapidly changing market environment. In the crop science market segment, the focus is on integrating the acquired business and enhancing the resulting sales and cost synergies. The aforementioned efficiency and structural measures also entail the planned reduction of approximately 12,000 jobs. The changes in the segments and the efforts to streamline the portfolio were complemented by extensive adjustments within the company, particularly in the corporate and supporting functions, business services, and the country platforms.

Threats

The business activity is subject to extensive regulations that may change. For example, further restrictions could be imposed on the sale and use of various crop protection products, or the pricing of pharmaceutical products could be more strictly regulated. Residues of agrochemical products in the environment could also be subject to more stringent regulation. In addition, decisions could also affect agricultural imports from other parts of the world and therefore the company's business in those regions. Moreover, regulatory changes may generally give rise to uncertainty regarding the company's future patent protection. They can also lead to higher product development costs and times or even necessitate adjustments to the product portfolio, which may in turn negatively impact the firm's reputation.

Industry Competition

- BASF Aktiengesellschaft
- Syngenta AG

Significant Supplier Changes

Bayer's Primary Products

Crop science:

Fungicides, herbicides, insecticides, seed treatment

Key Figures

- The group recorded revenues of €39,586 million during the fiscal year ended December 2018, an increase of 10% over 2017.
- EBITD was €3,915 in 2018.

See annual report available online at www.bayer.com.

Source: Bayer Corporate Report

FIGURE 9.7

Strategic Supplier Profile: Dow Chemical

Jim Fitterling is the chief executive officer.

Mr. Fitterling has played a key role in the company's transformation, from lower-margin, commodity businesses to one more deeply focused on higher-growth, consumer demand–driven markets that value innovation, with the goal of creating the most innovative, customer-centric, inclusive, and sustainable materials science company in the world.

Fitterling was named chief executive officer-elect of Dow in March 2018, prior to becoming CEO in July 2018. Before that he served as president and chief operating officer of Dow. From September 2017 through March 2019, he also served as chief operating officer for the Materials Science Division of DowDuPont, an $86 billion holding company comprised of the Dow Chemical Company and DuPont, created with the intent to form independent, publicly traded companies in materials science, agriculture, and specialty products sectors. On April 1, 2019, Dow separated from DowDuPont.

Howard Ungerleider is president and chief financial officer.

In his role, he serves as a member of Dow's most senior executive committee that sets the strategic direction, defines priorities, establishes corporate policy, and manages governance and enterprise-level decisions for

(*Continued*)

(Continued)

the company. He has executive oversight for Dow Finance, Public Affairs, Government Affairs, Information Technology & Business Services, Purchasing, and Integrated Supply Chain.

From September 2017 until April 2019, Ungerleider also served as chief financial officer of DowDuPont, an $86 billion holding company comprised of the Dow Chemical Company and DuPont, created with the intent to subsequently form three independent, publicly traded companies in materials science, agriculture, and specialty products sectors. On April 1, 2019, Dow separated from DowDuPont.

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Company Overview

- The Dow Chemical Company (Dow) is a science and technology company, manufacturing chemicals, specialty chemicals, and polymers. The company operates in over 170 countries. It is headquartered in Midland, Michigan.
- Dow is a global science and technology-based company that provides chemical, plastic, and agricultural products and services to various consumer markets. Dow serves customers in over 175 countries and a range of markets, including food, transportation, health and medicine, personal and home care, and building and construction, among others. The company has 156 manufacturing sites in 37 countries and supplies over 3,200 products.
- Dow operates through six divisions: performance plastics, performance chemicals, agricultural sciences, plastics, chemicals, and hydrocarbons and energy.
- The company's agricultural sciences division develops, manufactures, and markets products for crop production, weed, insect and plant disease management, and industrial and commercial pest management.

Strengths

- Dow has global operations. It is the largest chemical company in the United States and the second largest in the world after BASF in terms of sales. It has 156 manufacturing sites in 37 countries worldwide. The company markets its products in over 175 countries worldwide.
- The company has a diversified product portfolio. It manufactures over 3,200 products.
- Dow has strong R&D capability.

Net sales for 2018 were $60.3 billion, up 9% from $55.5 billion in 2017, driven by higher sales volume, reflecting additional capacity from U.S. Gulf Coast growth projects and increased supply from Sadara Chemical Company ("Sadara"), increased local price, and the favorable impact of currency.

Weaknesses

- The performance of the agricultural sciences division has been slow. The profitability of the chemicals division, despite growth in revenues, has declined.

Opportunities

In January 2019, Dow became a founding member of the Alliance to End Plastic Waste (AEPW), an initiative to accelerate efforts to drive innovation, provide much-needed resources, and take decisive action to put an end to plastic waste in the environment.

- New ventures in the world's fastest-growing economy would strengthen Dow's global market position.

Threats

Economic conditions around the world, and in certain industries in which the company does business, also impact sales price and volume. As a result, market uncertainty or an economic downturn in the geographic regions or industries in which Dow sells its products could reduce demand for these products and result in decreased sales volume, which could have a negative impact on the company's results of operations.

- Certain of the claims and lawsuits facing the company purport to be class actions and seek damages in very large amounts. All such claims are contested.

- The global nature of Dow's business requires active participation in the foreign exchange markets. The company has assets, liabilities, and cash flows in currencies other than the U.S. dollar. The primary objective of the company's foreign currency risk management is to optimize the U.S. dollar value of net assets and cash flows.

Industry Competition

- BASF Aktiengesellschaft
- Bayer AG
- E. I. DuPont de Nemours & Company

Significant Supplier Changes

Primary Products

Agricultural sciences:

Herbicides, fungicides, insecticides, gas fumigant

Key Figures

The company recorded revenues of $85,877,307 during the fiscal year ended December 2018, an increase of 15.3% over 2017. Net income was $90 million; Op. EBIT of $1.1 billion.

See annual report available online at www.DOW.com.

Source: Dow Chemical Corporate Report

the profiles should be shared and evaluated by all related business functions within the buying firm. Functional evaluation of the content will ensure that all impacted areas within the buying firm will have input into the outsourcing process. This method also ensures that the outsourcing project team is knowledgeable about all potential suppliers and aware of how they are rated by each function within the buying firm. In addition to the supplier profiles, the buying organization should clearly establish expectations for the potential suppliers and discuss the **scope of work** and the appropriate pricing for the outsourcing activity.

Scope of work The division of work to be performed under a contract or subcontract in the completion of a project, typically broken out into specific tasks with deadlines.

Strategic Supplier Profiles

For each strategic supplier, a key contact within the buying firm must be established to ensure that the relationship is being properly managed. This person is the individual within the buying firm whom others in the buying organization should contact for information about specific strategic suppliers. It is possible that each functional manager within the buying firm will be an "owner" for a specific strategic supplier relationship.

Relationships with strategic suppliers need to be closely managed. One way to keep up on supplier relationships is for a buying organization to compile supplier profiles for each strategic supplier. These profiles should include items such as key management contacts, a company overview, SWOT (strengths, weaknesses, opportunities, threats) analysis, Porter's five key financial figures, information on current contracts, owners of the relationship within the firm, and an organizational chart (Porter, 1985). Ownership of the process by the supply manager/purchasing department makes certain that there is only one source of strategic supplier profiles for the entire firm. In addition to the strategic supplier profiles, the buying firm should clearly establish expectations for the strategic suppliers and discuss future product and supplier development plans; this is typically done with an annual review period.

Contract Development

An outsourcing alliance is an agreement between the buying organization and the provider organization to pursue a set of agreed-on objectives needed while remaining independent organizations.

The outsourcing alliance must arrive at an enforceable contract. The contract is the key to effective governance of the relationship between the two independent firms. The language of the contract must include *at a minimum* the following components:

- A clearly defined scope of work and elements of the processes to be supplied
- An agreed-on approximate price for each aspect of what is being supplied
- An understanding of an acceptable level of flexibility as circumstances and requirements change
- Consideration of a short-term contract with provisions for extensions and renegotiations
- Ground rules that encourage relationship and alliance maintenance
- Determination of a means for measuring performance for each aspect of the agreement

Unfortunately, it is often observed, particularly in unpredictable environments, that it is nearly impossible, or at least impractical, to construct a contract that fully addresses all possible states of nature and contingencies. When a system design is complex (many tightly coupled or technologically novel components), the ability to effectively contract with an independent provider (supplier) becomes untenable.

When a precise and legally binding contract is lacking, certain parties to the agreement may be enticed to act in a manner that is potentially counter to the objectives of the other party. One such risk is that of **opportunistic renegotiation**, especially when one party has made relationship-specific investments. The outsourcing supplier may shirk its responsibilities even if the contract is complete. This is due to incentive misalignment coupled with difficulty in measuring or monitoring the supplier's performance or efforts. While **contractual incompleteness** and misaligned interests can make maintaining a healthy relationship challenging, it has been recognized that spending the extra time to make sure the contract is precisely developed up front can save substantial costs and time down the road. The contract should be treated like a prenuptial agreement by both parties. Outsourcing arrangements form alliances, not legal partnerships. Thus, while having a perfectly complete contract may not be feasible, making it as inclusive as possible is critical. This often involves using a cross-functional team that includes external experts, experienced employees, and members of senior management.

Opportunistic renegotiation Occurs in the presence of high switching costs, economic lock-in, and strategic dependence upon a single supplier.

Contractual incompleteness A contract is incomplete if either its value-sharing scheme or its actions are not completely specified.

Perhaps the most widely suggested means of improving goal alignment is to have clear, easy-to-understand roles and responsibilities. A critical part of this is having a contract with precise performance or service level agreements along with penalty and reward clauses. This fundamentally must begin with a clear understanding of existing performance and that which is possible, which often requires benchmarking.

It is important to make the contract as complete as possible, yet due to the uncertainty that surrounds most outsourcing efforts as well as the lack of clairvoyance by decision-makers, contracts also must be flexible. To enhance flexibility, a shorter contract is suggested. Further, many stipulate to clearly outline a dispute resolution process for those situations when actual operating conditions deviate significantly from contract provisions. Reversibility clauses in the contract are sometimes used to spell out the transfer of human and physical resources

should the relationship come to an end. These clauses are argued to ease supplier switching or reinternalizing efforts.

A final contractual element posited to improve outsourcing efforts is the treatment of transferred employees. In addition to **reversibility clauses**, it also has been suggested that contracts should include clauses that protect transferred employees or stipulate guidelines as to their treatment. These clauses can include items such as rules for employee retention, benefits, transfer to other accounts, and so on. It is the objective of these employee-related contractual items to minimize the service impact to the organization as well as enhance the perception of procedural equity in the eyes of the impacted associates.

Reversibility clauses
A reversible decision in an agreement.

While hardly any contract can be airtight in its precision, following the prescriptions outlined in this section can ensure the contract is as effective as possible. Recognizing the reality of contractual incompleteness, however, highlights the need for effective relationship management. For a more comprehensive discussion of contracts, see Chapter 3.

Transition to External Sourcing Model

The success of the outsourcing initiative depends heavily on the implementation effort beginning with the contract execution to the transfer of the agreed-upon activities and resources. The buying and selling organizations must follow the specific roles outlined in the contract. The buying organization also must appoint a relationship manager. The relationship manager and the suppliers must merge their independent plans into one consensus plan. The consensus transition plan must include, at a minimum, the following:

- *Communication criteria*. How should the external initiatives be communicated to the affected and unaffected employees?
- *Personnel criteria*. What packages will be offered to affected and unaffected employees?
- *Transition criteria*. When will the activities and resources be moved to the supplying organization?

Communication Criteria

The goal of effective communication is to avoid misinformation and to control the rumor mill. Prior to developing the outsourcing project team, the CEO should explain the outsourcing decision to all employees. The initial announcement to the employees should be thorough and convincing. After the contract has been signed, the CEO should meet with the affected employees. The announcement to the affected employees should

- state that the contract has been signed and awarded to the supplying firm,
- discuss how severance packages will be offered to affected employees, and
- feature an extensive question-and-answer session.

Personnel Criteria

Outsourcing often has a profound effect on employees. This observation underscores the importance of considering the management and impact to internal staff when making outsourcing decisions.

Effective management of employee-related concerns is crucial when outsourcing, particularly considering the often negative perceptions many employees have about outsourcing. Being laid off as a result of outsourcing has clear economic and emotional implications for employees and the organizations that must manage these situations. However, being transferred to the service provider also has consequences that must be addressed. Transferring employees increases the level of uncertainty that surrounds their career prospects with their new employer. Transferring employees to the supplier can have an adverse impact on transferred employee morale, productivity, and turnover. This not only has direct cost implications but also can negatively affect the provider's ability to provide high-quality service. The results indicated that employees who were highly satisfied and involved (perception that one's job represents a portion of who one is) pre-outsourcing expressed a statistically significant decrease in satisfaction after being transferred to the external provider. Additionally, those who were highly involved pre-outsourcing expressed a significantly higher intent to exit the external provider. This could manifest itself in higher turnover at the external service provider and perhaps difficulty in providing efficient and effective services.

By observing their peers being transferred or laid off, remaining employees may call into question the organization's commitment to them and their risk of being impacted in a similar manner in the future. Employees perceive that their existing psychological contract with their employer has been fundamentally altered, which can lead to a drop in their commitment to the organization, a reduction in job satisfaction, and lower productivity.

While it is clear that there are significant personnel implications of outsourcing given the frequent occurrence of downsizing (i.e., layoffs) and employee transfer, this direct relationship has been relatively neglected in the business literature.

A fundamental element of creating the perception of procedural and interpersonal justice is communication. Specifically, organizations need to communicate early and clearly to employees about why the decision has been made. This aspect of procedural and interpersonal justice has received wide empirical support as it relates to layoffs or downsizing decisions.

A second element that impacts the perceived equity of a decision is the involvement or "voice" of all interested parties. It is important to make sure that all stakeholders feel as though their interests were represented and considered in making the decision.

It is crucial to treat employees (both survivors and those directly impacted) with respect and dignity during the decision-making and implementation process. Some have noted that smooth outsourcing efforts have made explicit attempts to assist impacted employees and to protect those who are transferred to the provider or supplier.

Finally, it has been recognized that providing the retained team with new skills so they may be effective in their new role is important. Retained employees need to be trained to enhance their "lateral" skills such as relationship management, negotiation, and consensus building. Failing to appreciate these concerns and proactively manage them will have an adverse impact on the outsourcing engagement.

Transition Criteria

The activities are implemented either sequentially or concurrently. Some of the highlights for implementation follow:

1. An organization meeting should be conducted for employees moving from the buying firm to the supplier's organization.

2. A meeting with the buying firm's manager whose activities are being outsourced should be conducted onsite at the new location.

3. A plan should be generated to address the issues involved in transferring significant physical assets. There should be a specific third-party agreement in the contract to accomplish the physical movement and acquisition of the equipment.

The transition process will never be flawless. A high level of professionalism is required for a successful relationship between the alliance parties.

Relationship Management

To effectively cultivate the relationship, the buying organization should be active in monitoring and evaluating performance and solving problems. The original contract establishes the performance measures, deliverables, due dates, and expected supplier requirements. Performance measurement is the cornerstone of the buyer–supplier relationship. Without measurement, there is no control. Without control, there can be no relationship to manage. The buyer and supplier relationship managers should develop and execute the reporting system established in the contract. The performance report should be designed to compare the actual performance to the contractual standards. An example report is given in Table 9.2.

Traditional thinking about the most appropriate form of governance has cast the decision as somewhat of a dichotomous choice between hierarchy (i.e., internal sourcing) and market (i.e., external sources). Prior works have developed the image of market governance as an arm's-length relationship between the buyer and the supplier organization. However, in the past few decades, due largely to the observation of Japanese-style supply chain relationships, we have come to see that many organizations effectively pursue a governance form that is neither purely hierarchical nor a purely arm's-length market mechanism. This hybrid governance form recognizes the inherent limitations, as well as the advantages, of both of these extreme forms. It seeks to realize the control, goal alignment, and improved coordination associated with retaining an activity internally, while also benefiting from the potentially superior skills and cost position of specialized, external organizations. In this environment, the relationship is more of a long-term, collaborative relationship rather than a short-term, focused opportunistic arrangement. In an evaluation of the automotive industry, trust and goodwill over a prolonged period and the investment in *co*-specialized assets led to a reduction in transaction costs. Further, the greater social capital leads to improved dissemination of information and reduced motivation for opportunistic behavior. **Social capital** is the sum of

Social capital The sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit.

TABLE 9.2
Sample Performance Report: September 25, 2020

Performance Measures	Weight	Performance Standard	2020 Actual	2020 Variance	2019 Actual	2019 Variance	2018 Actual	2018 Variance
Number of outputs	0.1	10,000	10,000	0.00%	9,910	-0.09%	9,820	-0.82%
Number of errors	0.4	10	45	-140.00%	15	-20.00%	70	-240.00%
Number of on-time deliveries	0.2	50	49	-0.40%	43	-2.80%	39	-4.40%
Number of days-cycle time	0.2	5	4	4.00%	6	-4.00%	8	-12.00%
Number of output per employee	0.1	100	105	0.50%	93	-0.70%	82	-1.80%

Source: The National Outsourcing Association

the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit. Collaborative relationships can improve learning and control opportunism (see Handley & Benton, 2013).

Thus, it appears that through the development of mutually beneficial long-term relationships with service providers, firms can, to a large extent, mitigate many of the traditional concerns with external sourcing while still realizing many of the proclaimed benefits.

For these long-term relationships to work, it initially requires a strong commitment from both parties. Although these longer-term relationships can bear significant benefits for the customer and service provider, the road will not always be a smooth one. Without commitment from both leadership teams, it would be easy to regress into traditional adversarial thinking. The sharing of timely, rich, and often proprietary information is required for building trust between the organizations. Information sharing also allows for more effective planning and execution. Information exchange in these deep relationships goes beyond simple transactional information exchange to include sharing demand forecasts, detailed cost information, new product plans, strategic changes, and other information.

Closely related to rich information exchange is the idea that true buyer–supplier partnerships work collaboratively in many areas. While the idea of information sharing may connote one party providing information to the other, collaboration entails joint effort by the organizations. Ultimately, people and organizations tend to act in their own best interests. Thus, it is imperative for the outsourcing alliances that the parties tie their destinies together. Equitable distribution of pain and gain will ultimately lead to enhanced partnership performance. Along with having a contract that defines performance incentives by means of penalty and reward structures, the relationship also must be able to work through unforeseen conditions in a productive manner. Put differently, it is necessary for the outsourcing alliances to have a constructive and flexible change management and dispute resolution process. A final key element of an effective buyer–supplier relationship is the performance evaluation. There is a strong statistical relationship between a collaborative communication strategy for supplier performance evaluations and the strength of the buyer–supplier relationship, which subsequently influences the supplier's commitment and performance. In the recent Benton, Prahinski, and Fan (2020) study, collaborative bilateral communication was characterized as being formal and providing opportunities for feedback and indirect influence (e.g., evaluation, certification, recognition, training). It appears clear that effective buyer–supplier relationships should include a formalized procedure for communicating the buyer's expectations and evaluating the supplier's performance.

SUMMARY

LO 9.1 Describe why organizations outsource manufacturing and services business processes.

Some of the generic strategic benefits of outsourcing are the following:

1. *Cost minimization* is accomplished by reducing direct operating costs, eliminating overhead costs, and transforming fixed costs into variable costs.
2. *Refocusing the organization to its core competencies* is accomplished by focusing on what the organization does best and/or transforming the business to focus on new products and services.
3. *Improvement in operating performance* is accomplished by increasing quality, increasing productivity, and obtaining new capabilities technologies from external sources.

4. *Increased market share and revenue* is accomplished by assessing the providers' network and accelerating expansion into new markets.

LO 9.2 Identify the hidden cost of strategic outsourcing.

While there is benefit to strategic outsourcing, organizations should be aware that there are often hidden costs behind the expected benefits. In the majority of cases, the financial benefits will be significantly lower than expected. Some of the hidden costs of outsourcing are (1) the cost of quality, (2) costs of strategic supplier relationship management, (3) internal coordination costs, (4) costs related to implementation of external sourcing model, (5) costs of product/service design and development, (6) governmental and political expenses, (7) costs related to supply chain risk management, and (8) miscellaneous financial considerations.

LO 9.3 Identify the differences between core and noncore competencies.

A noncore product or service is outside of business operations that are the primary revenue source of the business. Noncore products or services are incidental activities, while core items are considered central to operations.

The concept of core competencies along with the resource-based view of the organization provides the basis for the assertion that in considering outsourcing, the decision-making team must have a thorough understanding of core and noncore capabilities and how they relate to an organization's competitive advantage.

LO 9.4 State the trends of strategic outsourcing.

At the time of this writing, there is a trade war between the two largest economies, the United States and China. However, the outsourcing market represents a dichotomy: On the downside, organizations' cost-cutting outsourcing strategies may negatively impact market growth, but the upside is that outsourcing will be adopted by more organizations to help them meet their competitive challenges. In a financially challenged economic environment, the knowledgeable buyer and provider will have a competitive advantage. The potential for outsourcing to address immediate cost pressures as well as long-term recovery goals will be unprecedented.

LO 9.5 Explain the elements of strategic outsourcing.

The following are the suggested steps to successful outsourcing:

1. Strategic evaluation
2. Financial evaluation
3. Supplier selection and contracting
4. Transition to external sourcing model
5. Managing relationships

These steps can and should be modified to fit the specific organization and outsourcing objectives. The steps are highly interrelated.

KEY TERMS

Business process outsourcing (BPO) 191
Contractual incompleteness 208
Core competencies 198
Cost of quality 194
Incremental savings 198
Intellectual property 196
Make-versus-buy 200
Opportunistic behavior 198
Opportunistic renegotiation 208
Resource-based view 198
Reversibility clauses 209
Risk management 197
Risk mitigation 197
Scope of work 207
Social capital 211
Total quality management 198

DISCUSSION QUESTIONS

1. What is outsourcing?
2. What is meant by make versus buy? What are the key make-versus-buy success factors?
3. Why do firms outsource business processes?
4. How is outsourcing similar to, or different from, contracting, make-versus-buy, and joint venturing?

5. What are some of the strategic benefits of outsourcing?
6. Discuss in detail three hidden costs of outsourcing.
7. How does supply chain risk management relate to outsourcing?
8. Discuss in detail what is meant by "core competence."
9. What are the elements of strategic outsourcing?

SUGGESTED CASES

Case 9: Columbus Auto Parts

Case 20: Microfuse, Inc. (B)

Case 29: Worldwide Auto Manufacturers, Inc.

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Global Sourcing

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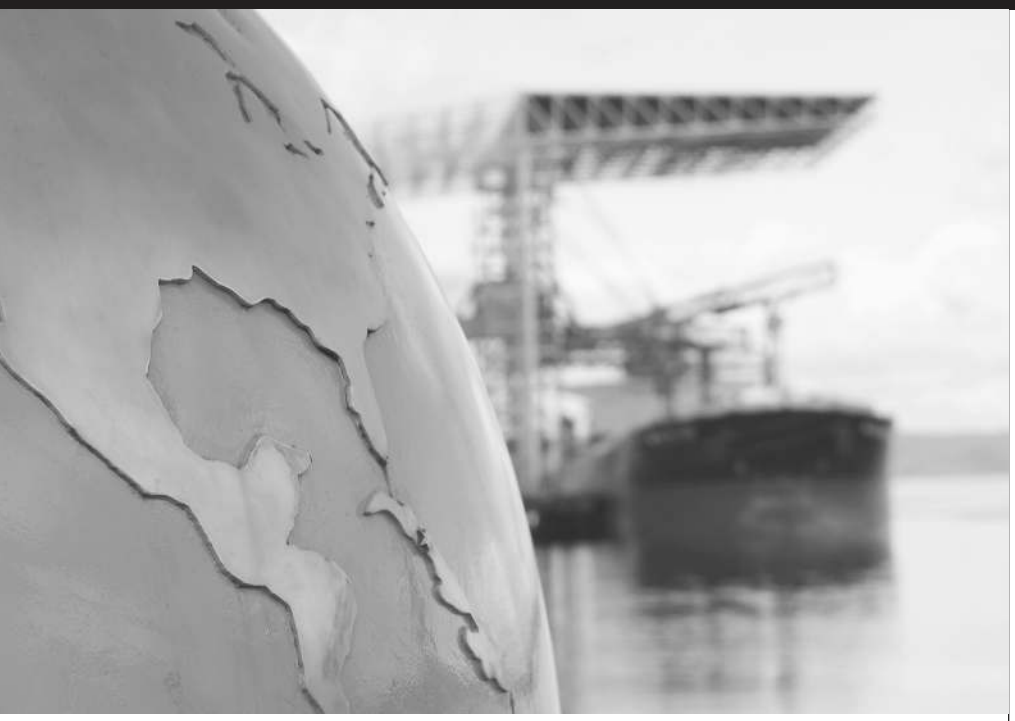

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Powell Industries just received its patent for a solar vehicle tracking device. The tracking device was designed to be placed in dump trucks. During the operation of the trucks an electronic signal is monitored by the dispatcher. Internet research indicated that AAKT provided the best FOB price and is a well-established firm with a good credit and performance track record. The only downside is that AAKT is located in Shenzhen, China.

Powell Industries has never sourced globally. The buyer Megan Thomas is concerned about the terms of the production and delivery cost. What should Megan do first?

INTRODUCTION

The total level of global purchases has increased significantly for the top 20 U.S. trading partners. Recent foreign purchases of manufactured goods and services are shown in Tables 10.1 and 10.2.

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

10.1 Identify the costs associated with global sourcing and provide an example of each.

10.2 Explain the impact the exchange rate can have on overall costs.

10.3 Discuss the challenges experienced in global sourcing in terms of ethics, lead times, and communication.

10.4 State the qualitative and quantitative factors impacting risk assessment in the strategic planning for global sourcing.

10.5 Define protectionism and its impact on global sourcing.

10.6 Describe negotiation techniques for various cultures.

10.7 Explain opportunism and provide an example of poaching and shirking.

10.8 Identify the procedures necessary for importing goods to the United States.

10.9 Describe how to effectively use foreign trade zones.

TABLE 10.1

2018 Top U.S. Trade Partners. Ranked by 2018 U.S.Total Export Value for Goods (in millions of U.S. dollars)

		Exports						Imports					
Rank	Country	2017	2018	% Change	May 2017	May 2018	% Change	2017	2018	% Change	May 2017	May 2018	% Change
1	Canada	282,473	299,769	6.1%	24,904	27,062	8.7%	299,090	318,824	6.6%	26,289	28,223	7.4%
2	Mexico	243,508	265,443	9.0%	19,907	23,005	15.6%	312,809	346,101	10.6%	27,037	29,432	8.9%
3	China	129,798	120,148	-7.4%	9,880	10,428	5.5%	505,220	539,676	6.8%	41,761	43,966	5.3%
4	Japan	67,585	75,229	11.3%	5,144	6,123	19.0%	136,418	142,425	4.4%	10,951	11,661	6.5%
5	United Kingdom	56,257	66,313	17.9%	5,040	5,729	13.7%	53,282	60,783	14.1%	4,620	5,084	10.1%
6	Germany	53,961	57,753	7.0%	4,527	5,126	13.2%	117,548	125,849	7.1%	9,482	10,801	13.9%
7	Korea, South	48,350	56,507	16.9%	4,523	4,925	8.9%	71,416	74,264	4.0%	5,958	6,630	11.3%
8	Netherlands	41,475	48,703	17.4%	3,547	3,777	6.5%	17,808	24,504	37.6%	1,426	1,789	25.5%
9	Brazil	37,331	39,560	6.0%	3,243	3,242	0.0%	29,450	31,104	5.6%	2,464	2,338	-5.1%
10	Hong Kong	39,855	37,310	-6.4%	2,560	2,852	11.4%	7,372	6,286	-14.7%	740	578	-21.8%
11	France	33,595	36,617	9.0%	2,557	3,227	26.2%	48,912	52,432	7.2%	4,216	4,434	5.2%
12	India	25,648	33,503	30.6%	2,062	2,625	27.3%	48,550	54,349	11.9%	4,498	5,091	13.2%
13	Singapore	29,649	32,747	10.5%	2,346	3,300	40.7%	19,368	26,612	37.4%	1,726	2,499	44.8%
14	Belgium	29,924	31,427	5.0%	2,472	2,861	15.8%	14,980	17,182	14.7%	1,330	1,693	27.3%
15	Taiwan	25,736	30,560	18.7%	1,907	2,417	26.7%	42,426	45,756	7.9%	3,643	3,791	4.1%
16	Australia	24,518	25,310	3.2%	2,088	2,128	1.9%	10,049	10,124	0.7%	846	862	1.9%
17	Italy	18,391	22,798	24.0%	1,477	2,095	41.8%	49,888	54,744	9.7%	4,103	4,873	18.8%
18	Switzerland	21,695	22,172	2.2%	1,752	1,948	11.2%	35,974	41,092	14.2%	3,460	3,608	4.3%
19	United Arab Emirates	20,079	19,511	-2.8%	1,560	1,734	11.2%	4,243	5,002	17.9%	395	393	-0.5%
20	Chile	13,633	15,377	12.8%	1,012	1,557	53.8%	10,550	11,387	7.9%	771	965	25.2%
21	Colombia	13,375	15,158	13.3%	1,124	1,325	17.9%	13,552	13,783	1.7%	1,291	1,374	6.5%
22	Israel	12,548	13,707	9.2%	933	1,148	23.1%	21,945	21,771	-0.8%	2,389	2,593	8.6%
23	Saudi Arabia	16,355	13,601	-16.8%	1,689	1,629	-3.6%	18,871	24,062	27.5%	1,954	1,791	-8.3%

24	Spain	11,071	13,086	18.2%	1,046	1,122	7.3%	15,672	17,210	9.8%	1,381	1,460	5.7%
25	Malaysia	12,873	13,012	1.1%	1,263	1,051	-16.8%	37,370	39,356	5.3%	3,263	3,632	11.3%
26	Thailand	11,023	12,448	12.9%	859	983	14.3%	31,116	31,873	2.4%	2,562	2,706	5.6%
27	Ireland	10,708	10,725	0.2%	811	968	19.3%	48,861	57,454	17.6%	4,289	4,246	-1.0%
28	Turkey	9,772	10,261	5.0%	1,040	888	-14.7%	9,387	10,334	10.1%	838	844	0.8%
29	Argentina	9,602	9,927	3.4%	892	947	6.2%	4,785	4,833	1.0%	415	433	4.4%
30	Peru	8,668	9,724	12.2%	651	790	21.4%	7,282	7,888	8.3%	456	583	27.8%
-	European Union	283,256	318,376	12.4%	23,759	27,970	17.7%	4,34,902	4,87,037	12.0%	36,516	41,066	12.5%
Top 30 Total		1,359,452	1,458,407	7.3%	112,816	127,015	12.6%	2,044,194	2,217,060	8.5%	174,554	188,374	7.9%
U.S. International Tradein Goods		1,553,589	1,674,330	7.8%	126,887	144,552	13.9%	2,358,789	2,561,667	8.6%	193,815	211,222	9.0%
Top 30% Share		87.5%	87.1%		88.9%	87.9%		86.7%	86.5%		90.1%	89.2%	
U.S. International Trade in Services		798,957	826,980	3.5%	65,336	68,789	5.3%	543,880	567,322	4.3%	45,093	46,471	3.1%
U.S. Total Trade		2,352,546	2,501,310	6.3%	192,223	213,341	11.0%	2,902,669	3,128,989	7.8%	238,908	257,692	7.9%

Source: US Department of Commerce, Census Bureau, Foreign Trade Division

Notes: Totals for international trade are presented on a balance of payments basis.

TABLE 10.2

2018 Top U.S. Trade Partners Ranked by Total Import Value for Goods (in Millions of U.S. Dollars)

		Imports						Exports					
Rank	Country	2017	2018	% Change	May 2017	May 2018	% Change	2017	2018	% Change	May 2017	May 2018	% Change
1	China	505,220	539,676	6.8%	41,761	43,966	5.3%	129,798	120,148	-7.4%	9,880	10,428	5.5%
2	Mexico	312,809	346,101	10.6%	27,037	29,432	8.9%	243,508	265,443	9.0%	19,907	23,005	15.6%
3	Canada	299,090	318,824	6.6%	26,289	28,223	7.4%	282,473	299,769	6.1%	24,904	27,062	8.7%
4	Japan	136,418	142,425	4.4%	10,951	11,661	6.5%	67,585	75,229	11.3%	5,144	6,123	19.0%
5	Germany	117,548	125,849	7.1%	9,482	10,801	13.9%	53,961	57,753	7.0%	4,527	5,126	13.2%
6	South Korea	71,416	74,264	4.0%	5,958	6,630	11.3%	48,350	56,507	16.9%	4,523	4,925	8.9%
7	United Kingdom	53,282	60,783	14.1%	4,620	5,084	10.1%	56,257	66,313	17.9%	5,040	5,729	13.7%
8	Ireland	48,861	57,454	17.6%	4,289	4,246	-1.0%	10,708	10,725	0.2%	811	968	19.3%
9	Italy	49,888	54,744	9.7%	4,103	4,873	18.8%	18,391	22,798	24.0%	1,477	2,095	41.8%
10	India	48,550	54,349	11.9%	4,498	5,091	13.2%	25,648	33,503	30.6%	2,062	2,625	27.3%
11	France	48,912	52,432	7.2%	4,216	4,434	5.2%	33,595	36,617	9.0%	2,557	3,227	26.2%
12	Vietnam	46,477	49,174	5.8%	4,278	3,992	-6.7%	8,134	9,675	18.9%	788	924	17.3%
13	Taiwan	42,426	45,756	7.9%	3,643	3,791	4.1%	25,736	30,560	18.7%	1,907	2,417	26.7%
14	Switzerland	35,974	41,092	14.2%	3,460	3,608	4.3%	21,695	22,172	2.2%	1,752	1,948	11.2%
15	Malaysia	37,370	39,356	5.3%	3,263	3,632	11.3%	12,873	13,012	1.1%	1,263	1,051	-16.8%
16	Thailand	31,116	31,873	2.4%	2,562	2,706	5.6%	11,023	12,448	12.9%	859	983	14.3%
17	Brazil	29,450	31,104	5.6%	2,464	2,338	-5.1%	37,331	39,560	6.0%	3,243	3,242	0.0%
18	Singapore	19,368	26,612	37.4%	1,726	2,499	44.8%	29,649	32,747	10.5%	2,346	3,300	40.7%
19	Netherlands	17,808	24,504	37.6%	1,426	1,789	25.5%	41,475	48,703	17.4%	3,547	3,777	6.5%
20	Saudi Arabia	18,871	24,062	27.5%	1,954	1,791	-8.3%	16,355	13,601	-16.8%	1,689	1,629	-3.6%
21	Israel	21,945	21,771	-0.8%	2,389	2,593	8.6%	12,548	13,707	9.2%	933	1,148	23.1%
22	Russia	17,058	20,875	22.4%	1,416	1,984	40.1%	7,003	6,659	-4.9%	479	578	20.6%
23	Indonesia	20,206	20,842	3.1%	1,854	1,836	-1.0%	6,863	8,172	19.1%	430	634	47.4%

24	Spain	15,672	17,210	9.8%	1,381	1,460	5.7%	11,071	13,086	18.2%	1,046	1,122	7.3%
25	Belgium	14,980	17,182	14.7%	1,330	1,693	27.3%	29,924	31,427	5.0%	2,472	2,861	15.8%
26	Colombia	13,552	13,783	1.7%	1,291	1,374	6.5%	13,375	15,158	13.3%	1,124	1,325	17.9%
27	Austria	11,727	13,429	14.5%	1,042	1,054	1.2%	4,275	3,564	-16.6%	197	444	125.4%
28	Venezuela	12,344	13,172	6.7%	1,224	914	-25.4%	4,127	6,120	48.3%	340	498	46.3%
29	Philippines	11,623	12,597	8.4%	1,052	1,008	-4.1%	8,450	8,720	3.2%	595	722	21.2%
30	Iraq	10,754	11,872	10.4%	904	1,158	28.0%	1,205	1,312	8.9%	90	110	21.4%
-	European Union	434,902	487,037	12.0%	36,516	41,066	12.5%	283,256	318,376	12.4%	23,759	27,970	17.7%
Top 30 Total		2,120,714	2,303,167	8.6%	181,865	195,662	7.6%	1,273,383	1,375,207	8.0%	105,933	120,028	13.3%
U.S. International Trade in Goods		2,358,789	2,561,667	8.6%	193,815	211,222	9.0%	1,553,589	1,674,330	7.8%	126,887	144,552	13.9%
Top 30% Share		89.9%	89.9%		93.8%	92.6%		82.0%	82.1%		83.5%	83.0%	
U.S. International Trade in Services		543,880	567,322	4.3%	45,093	46,471	3.1%	798,957	826,980	3.5%	65,336	68,789	5.3%
U.S. Total Trade		2,902,669	3,128,989	7.8%	238,908	257,692	7.9%	2,352,546	2,501,310	6.3%	192,223	213,341	11.0%

Source: U.S. Department of Commerce, Census Bureau, Foreign Trade Division.

Notes: Totals for international trade are presented on a balance-of-payments basis.

The largest exporter to the United States is China. In 2019, the United States imported $418,575 billion in goods from China. This is a 27% decrease in imports from 2018. Many large manufacturing and retail companies have set up purchasing centers in China to drive their global supply chains. Walmart, Microsoft, Motorola, and General Electric are some of the largest companies that have established purchasing centers in China. If a company is competitive in the furniture, toy, appliances, and consumer electronics industries, there is a high probability that the products were made in China. Chinese price quotes are also used as leverage to create lower prices against price quotes from domestic suppliers.

Purchasing departments play a major role in keeping material costs down. Many firms rely on global sourcing to remain competitive and survive in today's competitive markets. Often this strategy is taken as an initiative by a firm to achieve an advantage over its competition, or else it is a reaction to other firms who already use global sourcing.

As an example, outsourcing is currently perceived as key to automotive suppliers' survival and is being driven by consumers in the price-pressured global market. Even as different buying organizations take different positions on the overall merit of global outsourcing, the reports and discussions nevertheless have one theme in common. The focus has been on a single aspect of outsourcing: the migration of jobs and, in particular, the outsourcing of white-collar jobs. A few countries, notably India and China, are often targeted as those displacing American workers by offering cheap labor. The intense attention on the outflow of work to overseas locations has generated fear about which jobs or professions will be outsourced next.

COSTS OF GLOBAL SOURCING

LO 10.1 Identify the costs associated with global sourcing and provide an example of each.

The costs of global sourcing include some of the same costs found in domestic sourcing; there are also costs that are different. It is easiest to group these costs into the following categories: administrative, foreign, and common.

Administrative Costs

Administrative costs of foreign sourcing include identification, qualification, program development, travel, broker fees, and others not directly involved with the product. Some of these costs are common to both the domestic and international aspects of sourcing. Some examples of administrative costs are executive salaries and bonuses, professional fees for accounting and legal, and office supplies. Administrative costs are not specific to any business function such as production and sales.

Foreign Costs

Exclusively foreign costs are those that would not be incurred if a domestic source were found. Examples of these costs are duty charges, customs fees, import fees, and currency exchange costs. Ocean and air freight could be mentioned, but these are part of the transportation costs of a good that would be incurred from any source. Another example of a foreign cost is the base salary of your employee in a foreign country; this is approximately 3 times higher. At the same time, hiring locals can be considerably cheaper, but recruiting costs are usually expensive. Many of these exclusively foreign costs are established by governments and are very difficult to avoid.

Common Costs

Finally, there are costs common to both global and domestic sourcing. Direct labor and materials costs, lead-time costs, transportation costs, and inventory costs are a part of both domestic and offshore sourcing. Transportation costs, inventory costs, and lead-time costs tend to be higher when sourcing globally. On the other hand, labor and materials costs are often lower for firms in developing countries.

These costs must be covered when making all sourcing decisions. Direct costs (labor and materials) are what make foreign products attractive. Exclusive foreign costs and administrative costs tend to be fixed and are more often absorbed in the final sale of the product.

CURRENCY EXCHANGE RATES

LO 10.2 Explain the impact the exchange rate can have on overall costs.

One of the most important variables to consider is the exchange rate of currencies. The **currency exchange rate** is the value of one nation's currency versus the currency of another nation or economic zone. For example, how many U.S. dollars does it take to buy one Chinese yuan? Depending on the performance and strength of the dollar, goods can cost American firms different amounts from what is expected. Since predicting the fluctuation in currency markets is extremely difficult, foreign purchases may actually cost more or less than expected depending on the length of the contract. When the dollar is weak, the final cost of goods tends to be relatively more than originally agreed upon. When the dollar has a strong performance over the life of a contract, a firm can realize savings through the exchange rates. The effective exchange rate index composite for July 31, 2019, is presented in Table 10.3. The indicators are based on the relative normalized unit labor costs, relative value-added deflators, relative wholesale prices, and relative export unit values for the manufacturing segment.

Currency exchange rate The value of one nation's currency versus the currency of another nation or economic zone.

Agreeing to terms of payments in U.S. dollars can eliminate risks for American firms. A second way is to use a risk-sharing contract, where payment fluctuates with exchange rates. This is usually a win-win situation for both firms.

TABLE 10.3
Exchange Rate Indexes

Top USD Exchange Rates

Add / Change Currency ...

	03	USD	EUR	GBP	CAD	INR	MXN	AUD	CNY	MYR
	1 USD	1.00000	0.89133	0.79413	1.34145	69.8132	19.1595	1.45528	6.92516	4.16747
	Inverse:	1.00000	1.12191	0.25924	0.74546	0.01432	0.05219	0.68715	0.14440	0.23995
	1 EUR	1.12191	1.00000	0.89095	1.50499	78.3243	21.4953	1.63270	7.76942	4.67554
	Inverse:	0.89133	1.00000	1.12240	0.66446	0.01277	0.04652	0.61248	0.12871	0.21388
	1 GBP	1.25924	1.12240	1.00000	1.68920	87.9112	24.1263	1.83254	8.72041	5.24783
	Inverse:	0.79413	0.89095	1.00000	0.59200	0.01138	0.04145	0.54569	0.11467	0.19055

2019-16-14 21:16 UTC
All figures are live mid-market rates, which are not available to consumers and are for informational purposes only. To see the rates we quote for money transfer, please use our money transfer service.

Cross rates are listed in order of popularity.

ORGANIZATIONAL AND BEHAVIORAL ISSUES

LO 10.3 Discuss the challenges experienced in global sourcing in terms of ethics, lead times, and communication.

Firms can run into problems when global sourcing is introduced into their organizations. The resistance of the firm's buyers to learn to evaluate global sources is the reason for most of the problems. An attitude of "if it can't be bought here in the USA, it can't be bought anywhere" can be seen with some purchasing departments. Many buyers simply do not want to learn about the other countries with whom they will be dealing. There are many ethical considerations that you must learn in order to be successful. This is one reason many companies hire brokers to do their sourcing.

Major ethics scandals in the recent past include Nike's child labor scandal in the 1990s, Starbucks' unfair trade scandal in the early 2000s, and Apple's employee suicide scandal in the late 2000s. Sun Danyon was accused of stealing a closely guarded iPhone prototype while working in the logistics department, however, he denied stealing the prototype. He later complained to friends that he had been beaten and humiliated by the factory's security team. The security team later claimed he had jumped to his death from the 12th floor of an apartment building.

In each of these cases, the U.S. firm's overseas supplier(s) treated workers in ways that are unacceptable to many U.S. consumers. Those who work in global sourcing are responsible for preventing similar problems from harming their firms. For example, firms can conduct audits that focus on working conditions and human rights, adopt ethical sourcing codes of conduct, and engage with NGOs that focus on the key issues in their industry.

A separate potential problem is bribery and corruption. In some countries, offering and soliciting bribes is common. U.S. businesspeople can be charged in U.S. courts for bribing foreign public officials. Purchasing staff may be offered bribes by potential suppliers. They may also observe suspicious activities by their own firms. In 2019, Walmart agreed to pay $282 million to settle a U.S. bribery investigation related to payments that its Brazilian subsidiary made to secure government permits. The payments were recorded as payments to a construction company, when in reality they were payments to a local government official (CBS News, 2019). Walmart said the $282 million was part of a "global settlement" and ended all-related investigations into the retailer and its overseas businesses. According to the judge, Walmart was accused of profiting from rapid international expansion but in doing so chose not to take necessary steps to avoid corruption.

For companies that purchase agricultural products, environmental issues like deforestation can be the most important ethical issues in global sourcing. Nestlé has committed to eliminating deforestation from its supply chain by the end of 2020. To do this, Nestlé focuses on raw ingredients (e.g., soy), looks at all the products that come from the ingredient (e.g., chocolate bars made with dairy products produced from cows fed on soy), then works to understand where the ingredients came from. Meeting commitments like Nestlé's is especially difficult because of long supply chains and the legal conversion of natural vegetation to cropland (Southey, 2019).

Lead times and delivery times can create problems also. Longer lead times can increase inventory needs and drive up carrying costs. The extended lead time also might push back the date at which a firm is able to introduce new products to the market. Consider the following lead time example. Let's say a company makes and sells dolls. It has Walmart as a customer.

Walmart wants to buy 10,000 dolls to put in its stores in October for the Christmas season. It takes 2 weeks to get the doll components and a week to assemble 10,000 dolls, so the doll company has a lead time of about a month. That means it must get the order from Walmart no later than September 1 in order to make the delivery on time.

Another problem companies face in global sourcing is communication. Quality, price, delivery, flexibility, and service are considered in making sourcing and purchasing decisions. Both the buyer and seller must have a clear understanding of what these sourcing decisions mean. Many times there are delays and confusion in translations. Today, there is increased Internet usage, resulting in the elimination of delays and confusion.

GLOBAL SOURCING AS A STRATEGIC SOURCING OPTION

LO 10.4 State the qualitative and quantitative factors impacting risk assessment in the strategic planning for global sourcing.

Global sourcing is the trend of the future. Supply management is becoming very important to the survival of both American and offshore firms. In certain industries, using foreign suppliers can reduce costs, thus making a company more competitive. Firms in the apparel and electronics industries that do not use global sourcing could find themselves out of business when competing with firms that source globally. Global sourcing is in no way meant to completely replace domestic sources; however, it is a way to meet a competitor's challenge and achieve better value for goods all over the world. Global sourcing is extremely complicated from a quantitative and qualitative viewpoint. The total cost of sourcing is perhaps the most important variable. Of course, the costs vary from firm to firm since the appropriate qualitative components of offshore sourcing must be considered. For instance, the associated qualitative risk profiles of (1) the impact of national interest, (2) the ethical consequences of "sweatshop" labor, and (3) hazardous working conditions in some foreign countries must be evaluated. The quantitative costs are (1) exchange rate uncertainties, (2) direct costs of importation (transportation costs, transaction costs), and (3) indirect importation costs (use of fixed assets, pipeline inventories, managerial time, engineering support). Moreover, the general uncertainty associated with the business cycle makes offshore sourcing a risky proposition.

The **purchase risk perception (PRP)** is based on the perceived associated risk with alternative countries. Buying professionals who evaluate the offshore sourcing option must ultimately rely on their best judgment in estimating the risk/reward associated with various offshore suppliers. Table 10.4 is an example of the attributes of sourcing options for an electrical appliance manufacturer.

Purchase risk perception (PRP) The potential for failures of a purchasing process designed to purchase goods and services.

The advantages of sourcing offshore must be weighed against the associated risk. This may seem easy enough to accomplish, but there are some not-so-obvious costs that must be considered. The decision process is further complicated by additional uncertainty associated with offshore sourcing. The buying professional considering offshore sourcing must be prepared to fully analyze both the qualitative and quantitative factors. In this section, an example quotation is evaluated.

The first step in the evaluation process is the determination of accurate freight and duty costs. The actual transportation costs can be as high as 25% of the item value. Some

TABLE 10.4
Attributes of Sourcing: Options Faced by a Typical Buying Firm

	Offshore Option 1	Offshore Option 2	Domestic Option	Mexico Maquiladora Option
Positive attributes	• Politically stable • Pro-business government • Proven supplier • Ease of continuing sourcing supply • No tooling charges • Overall cost lower than domestic option	• Politically stable • Pro-business government • Good quality • Lowest-cost source	• Politically stable • Direct management control • Proven in-house ability • No exchange rate fluctuation • Lower transport costs • No duty • Shorter lead time • Less pipeline inventory	• Lower labor costs • Increasingly favorable exchange rate • Lower transport costs than Taiwan • Low duty costs • Less pipeline inventories
Negative attributes	Threat of trade retaliation from United States • Uneven-quality supplier • Less favorable exchange rate • Higher pipeline levels • Longer lead times than domestic option • Transaction costs • Duty costs • Impact on U.S. economy	Threat of trade retaliation from United States • Uneven-quality supplier • Less favorable exchange rate • Higher pipeline levels • Longer lead times than domestic option • Transaction costs • Duty costs • Impact on U.S. economy	• High labor and tooling costs • Higher costs than foreign sources	• Unknown political stability • Variable government stance toward business • High tooling costs • Unknown reliability • Inexperienced workforce • Transaction costs • Impact on U.S. economy

products require specialized packing and expensive air transportation. The duty fee for various products may vary from country to country. As an example, the duty for importation of electronic components into the United States is 5.3%. Consider the situation where the foreign supplier offers you component X at a 25% cost reduction. Further assume that your competitors are currently buying high-quality products from similar suppliers in the same country (see Table 10.5).

TABLE 10.5
Quote Evaluation

Component X	
Current price	$2,000 per unit
Annual usage	1,000 units
Offshore quote	$1,500 per item
Analysis	
Estimated annual purchase cost	$1,500,000
Estimated freight additions	$150,000 10% increase
Estimated duty	$75,000 5%
Total costs	$1,725,000
Actual cost reduction 13.75%	13.75%

While a 13.75% cost reduction is significant, it may not be large enough to offset other direct and indirect costs associated with offshore sourcing. The additional freight and duties are the first of many hurdles that must be overcome. Moreover, there are a number of other qualitative and quantitative issues that must be resolved. Some of these issues are distance, communication, time value of money, quality issues, pipeline inventory problems, staffing issues, and competition.

1. *Distance.* The distance between the buying and selling firm is significant in terms of time zones and physical location. Internet capabilities usually provide a partial solution. However, face-to-face contact is preferred for some sensitive issues. IBM requires the buyer to visit each supplier on a routine basis. Trips offshore are more expensive and time consuming.
2. *Communication.* Communication can be described as the glue that holds together a sourcing relationship. Without effective communication, global transactions between buying and selling firms would be futile. In addition to being absolutely necessary for the completion of the transaction, communication may also reduce or eliminate uncertainty within the relationship.
3. *Time value of money.* Since most offshore deals require the use of a "letter of credit," the buying firm loses the use of funds when the letter is established. Suppose the shipments arrive 2 weeks after the letter of credit is established. For a $1.5 million purchase, the buying firm bears a $30,000 (0.01 [opportunity cost %] x 1.5 million x 2 weeks) opportunity cost expense.
4. *Quality issues.* The buying firm must spend the necessary time to correctly specify and articulate quality expectations. Then evaluation makes sure that the sample is from a legitimate production run. Prototypes/lab samples should not be analyzed. Remember, the buying firm is interested in the actual production on the entire batch. In some cases, the buying firm should inspect statistical process control charts to assess projected defect rates and the inspection

methods. The buyer should renegotiate the agreement ultimately if the production process is out of control. These quality issues can easily increase costs of offshore sourcing.

5. *Pipeline inventory.* Pipeline inventory issues will always occur when a third party (the shipper) is involved. The problems become pronounced when offshore sourcing is used. Consequently, pipeline inventory problems can sometimes be next to impossible to resolve. It is almost impossible to put specific costs on problems associated with pipeline inventory. The pipeline inventory costs are truly a hidden cost that must be considered when evaluating offshore quotes.
6. *Staffing.* If a buying firm is to be effective with an offshore sourcing strategy, it must either hire experts or develop specialists that are assigned to offshore suppliers. Ideally, these individuals must have experience in purchasing management, quality control, and basic accounting. This cost also must be considered in the evaluation process.
7. *The impact of increased competition.* The above direct and indirect costs tend to add unexpected costs to purchased items. However, the significant benefits associated with offshore sourcing enable the buying firm to gain leverage over domestic suppliers. Domestic firms are well aware that some firms are considering offshore firms in their long-term strategies. By merely evaluating the potential of offshore sourcing, domestic suppliers will be motivated to provide better-quality products at lower costs.

The costs and benefits just presented are by no means exhaustive. The purpose here is to illustrate the need for careful analysis of offshore sourcing decisions. The discussion is validated by the empirical evidence given in the paragraphs that follow.

Businesses that expect to reap huge savings from outsourcing will be disappointed, according to a recent survey of more than 5,000 corporate executives around the globe. Low-skill labor is becoming less important as a factor of production. Contrary to popular perception, only about 18% of global goods trade is now driven by labor-cost arbitrage (defined as exports from countries whose GDP per capita is one fifth or less than that of the importing country).

In a 2005 outsourcing report, Landis, Mishra, and Porrello found that the cost savings from offshore outsourcing was not the 35% to 40% that many corporations assumed they would gain when they decided to go overseas, said Phillip Hatch, Ventoro president. Hatch stated that one of the key reasons why outsourcing programs fail is because customers have unrealistic expectations about cost savings. Savings averaged slightly less than 10% for the offshore outsourcing projects reviewed. Contrary to the promise of massive labor savings, the survey found that 46% of the cost savings was generated from process improvement resulting from the outsourcing project and 45% from the quality of the system or service provided.

A more recent report found that "low-skill labor is becoming less important as a factor of production. Contrary to popular perception, only about 18 percent of global goods trade is now driven by labor-cost arbitrage" (McKinsey & Company, 2019). An example of a global sourcing policy is given in the appendix. Also see Chapter 9 for a more comprehensive discussion of strategic outsourcing.

PROTECTIONISM

LO 10.5 Define protectionism and its impact on global sourcing.

In today's competitive supply-chain–driven world, the ability to find a sustainable and economically viable source of goods and services is essential to every going concern. Many countries and territories around the world are actively striving for the role as a world source for goods and services. The level of **protectionism** and negotiation styles is addressed for selected countries.

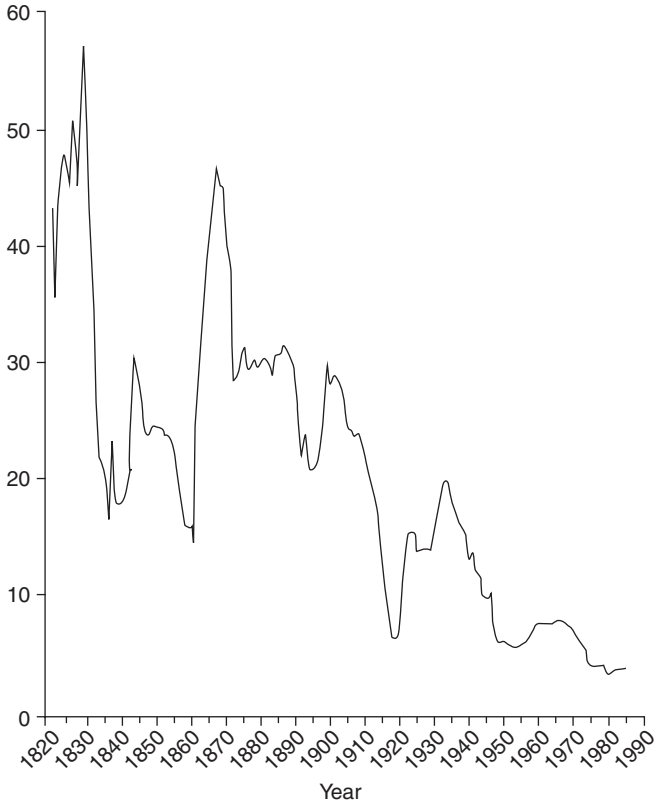
Protectionism The practice of taxing imports as a means of shielding a country's domestic industries from foreign competition.

Protectionism in the United States

Most of us like to think of the United States as free and open, unlike our stingy neighbors across the Atlantic with their walls of protectionism. However, the average U.S. tariff rate in 2017 was 3.4%, while the average rate for the European Union was 2.4%. For many decades, the United States has shown a distinct trend of decreasing tariff rates for goods coming to this country (see Figure 10.1).

Average tariff rates are less than 20% in most countries, although they are often quite a bit higher for agricultural commodities (see Table 10.6). On average, less-developed countries maintain higher tariff barriers, but for many countries that joined the WTO relatively recently, tariffs were reduced substantially to gain entry.

FIGURE 10.1
Average U.S. Tariff Rate, 1821–1985



Source: US Department of Commerce, Bureau of Economic Analysis, Industry Economic Accounts, March 1989; American Economic Review, March 1989.

TABLE 10.6

Average Tariff Rates for the G20 Countries and Selected Threshold Countries (2017)

Average Tariff Rate (%)		
Country/Territory	**2007**	**2017**
Argentina	12.0	13.7
Australia	3.5	2.5
Brazil	12.2	13.4
Canada	5.5	4.0
Chile	6.0	6.0
China	9.6	9.8
European Union	5.2	5.1
India	14.5	13.8
Indonesia	6.9	8.1
Japan	5.1	4.0
Korea	12.2	13.7
Malawi	13.5	12.4
Mexico	12.6	6.9
Morocco	23.0	11.4
Norway	8.1	6.2
Pakistan	14.7	12.1
Russia	11.0	6.7
Saudi Arabia	5.0	5.9
Singapore	0.0	0.0
South Africa	7.8	7.6
Turkey	10.0	10.9
United Arab Emirates	5.0	4.8
United States	3.5	3.4
Vietnam	16.8	9.6

Source: World Trade Organization.

In the United States, average tariff rates have fluctuated, sometimes significantly, during the past 175 years. In part, this reflects shifting attitudes regarding the appropriateness of free trade versus protectionist policies. Tariff rates also were usually raised when the country was at war, since additional tariff revenue would be needed to finance wartime expenses.

Many industries and products are currently protected by legislation. Although the legal aspects of international sourcing are beyond the scope of this chapter, two examples are given. The United States and the European Union have a long-running dispute over aircraft subsidies given to Boeing and Airbus, respectively. Each side objects to the state-sponsored support the other gives to its aircraft manufacturer. The WTO has upheld these objections, confirming that the subsidies distort market competition and essentially giving permission to the United States and European Union to retaliate against one another with tariffs.

The United States and China engaged in an escalating trade dispute beginning in 2018, imposing tariffs on products ranging from handbags and railway equipment (U.S. tariffs on Chinese products) to beef and construction equipment (Chinese tariffs on U.S. products). This resulted in changes to global trade patterns, with both countries shifting demand to third-party countries. China began buying more of its soybeans from Brazil, and the United States began buying more of its cell phones from Vietnam.

Tariffs are not the only form of protectionist policy. Nontariff barriers to trade can include quotas, local content requirements, public procurement practices, domestic subsidies and industry bailouts, licensing and packaging requirements, administrative and bureaucratic delays at the border, and other creative actions. Two examples of how nontariff barriers are used are given:

1. U.S. exporters of poultry parts are unable to access the Egyptian market and have raised their concerns with the WTO. U.S. exporters say they have demonstrated compliance with Egypt's Halal and food safety requirements, but Egypt says its authorities are facing difficulties in verifying compliance with Halal requirements, including identifying the source of all imported parts and sourcing partners.
2. A long-running trade dispute over U.S. imports of Vietnamese catfish has involved several nontariff tactics including requiring that the Asian imports not be labeled as catfish, applying hefty antidumping duties, and implementing a strict new inspection process.

IMPORTANCE OF NEGOTIATIONS

LO 10.6 Describe negotiation techniques for various cultures.

When negotiating a purchase agreement, there are certain general attributes in dealing with various offshore suppliers. We attempt to explain the nuances of negotiating with the people of various EU countries and China.

United Kingdom

The United Kingdom's GDP was $2.825 trillion in 2018. Its monetary unit is the pound sterling. Major trading partners include the United States, Germany, China, France, and other countries in the European Union. The United Kingdom's major exports globally include

manufactured goods, fuels, chemicals, and food and beverages. Its largest export categories to the United States are vehicles, machinery, pharmaceuticals, and fuels. The United States received $60.8 billion in imported goods from the United Kingdom in 2018. The volume of trade in services between these two countries is larger than the volume of trade in goods, with major categories including financial services, travel, transportation, and intellectual property.

On June 23, 2016, a majority of voters in the United Kingdom supported leaving the European Union. The details of how 'Brexit' will unfold remain uncertain. North American firms with UK operations have expressed concern over the following factors: loss of access to EU markets, level of UK economic growth, tariffs on imports, tariffs on exports, restrictions on labor mobility, customs compliance costs, diverging regulation, border delays, and the level of UK political risk (EY's UK Attractiveness Survey, 2018).

It can't be assumed that English and American businesses operate in the same manner. English executives may appear polite and friendly, but they can be tough and ruthless when appropriate.

The English are motivated by other things besides money, such as free time, status of their work, and other intangibles. English businesspeople tend to be deliberate yet oftentimes less prepared than the people with whom they are negotiating. At the same time, they are open and forthright. They tend not to play games. However, they will scrutinize the terms and conditions of the agreement. This trait can be attributed to their risk averseness.

In some instances, English businesspersons sometimes patronize people with whom they negotiate. However, they are often impressed by education and degrees. If you've got it, flaunt it.

Firms in the United Kingdom tend to be overstaffed, which can delay the decision-making process. Some American buyers have been successful in developing a final package proposal in advance and presenting it to an English businessperson on a "take it or leave it" basis. This usually speeds up negotiations significantly.

The Federal Republic of Germany

Germany's GDP was $3.95 trillion in 2018. Its monetary unit is the euro. Major trading partners include the United States, France, Netherlands, China, other European Union countries, and Switzerland. Germany is one of the world's largest and most technologically advanced producers of iron, steel, coal, cement, chemicals, machinery, vehicles, machine tools, electronics, food and beverages, shipbuilding, and textiles. Its largest export categories to the United States are vehicles, pharmaceuticals, and vehicle parts. The United States received $125.9 billion in imported goods from Germany in 2018. The European Union countries combined would rank as the second largest supplier of imported goods to the United States (in 2018), and Germany is the largest of these by far, with more than double the value of the runner-up. In Germany, climate change and sustainability are important topics in business. The Green Party is a major player within Germany's multiparty political system.

Most of the executives you encounter will have attended a university, and 50% hold doctorates. The title "Dr." commands instant respect. Germans tend to be specialists in one industry with multiple company experiences. Due to technical expertise, German negotiators are extremely cautious. The opponent should be well prepared on technical details.

The German negotiator will always have an ultimate goal in mind, but he or she will be slow in revealing it. Once it is revealed, the negotiations should move forward quickly. Germans are very concerned about the precision of written contracts. It's not that they do not trust the opponent; it is that they are precise and know the cost of mistakes and misunderstandings. In general, German business executives are honest and straightforward.

Avoid being humorous at the negotiating table. Germans are usually serious and honest in business dealings. If you are fluent in the German language, you are ahead of the game. Germans have a habit of talking strategy and caucusing in German right in the negotiating room, even when they know the opponent understands the language. Decisions are made by committees and thus are slow to be made. Breaks in the negotiating proceedings will probably be required so German negotiating teams can gain approval for some proposal.

Managers in Germany are more like Americans than most other European managers, evidenced by their desire to clear things up before the weekend or the end of the day. They do not leave things hanging. With this in mind, you can see why it is productive to introduce new important issues near the deadline. Germans tend to be risk averse. This behavior makes them willing to seek a compromise rather than risk having a confrontation or controversy.

Mexico

Mexico's GDP was $1.228 trillion in 2018. Its monetary unit is the peso. The United States is Mexico's biggest trading partner, by far, for both imports and exports. Mexico also exports to Canada, and imports from China and Japan. U.S. students are likely familiar with Mexico's membership in NAFTA (North American Free Trade Agreement) and USMCA (United States–Mexico–Canada Agreement); they may not be aware that Mexico has free trade agreements with 46 countries. Mexico's largest export categories to the United States are vehicles, electrical machinery, machinery, mineral fuels, and optical and medical instruments. The United States received $346.5 billion in imported goods from Mexico in 2018.

Americans doing business in Mexico will notice that both personal relationships and hierarchies matter more there than they do back home. Your counterpart will probably be seeking a long-term, stable business relationship and is therefore interested in feeling out your character and capabilities, not just reaching an agreement on the topic at hand.

Always start with some leeway, so that you can "give in" on something, allowing everyone to save face and claim victory.

Canada

Canada's GDP was $1.71 trillion in 2018. Its monetary unit is the Canadian dollar (CAD). The United States and Canada enjoy the world's most comprehensive bilateral trade and investment relationship, with goods and services trade worth more than $700 billion in 2018. Canada is also the largest foreign supplier of energy to the United States, including oil, natural gas, electricity, and uranium. Canada's largest export categories to the United States are mineral fuels, vehicles, machinery, and plastics. After the United States, Canada's next largest trading partner for both imports and exports is China.

Canadians have a lot in common with Americans, and the same strategies that work in the United States tend to also work in Canada. One important difference is that about one quarter of Canada is francophone, or primarily French-speaking. Americans doing business in Quebec should make an effort to use a few French words (e.g., "Bonjour" for hello). The gesture will be appreciated and help you start off on the right foot.

China

Based on purchasing power parity, China is now the largest economy in the world. Its GDP, based on the official exchange rate, was $13.37 trillion in 2018 (see Table 10.7). China's

TABLE 10.7
China's GDP

China's GDP	(2010 est.)	(2017 est.)
GDP (purchasing power parity)	US$9.872 trillion	US$23.21 trillion
GDP global rank	3	1
GDP, real growth rate	10.30%	6.90%
GDP, per capita	US$7,400	US$16,700
Labor force	819.5 million	806.7 million
Population below the poverty line	2.80%	3.3% (2016 est.)

Source: CIA World Fact Book, accessed 2011 (for 2010 data) and 2019 (for 2017 data) https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html

Note: 2010 values are in 2010 dollars; 2017 values are in 2017 dollars.

currency is the renminbi, which is denominated in yuan. This might seem confusing at first, but the difference is like talking about USD, the currency, and dollars, the units. China's largest export categories to the United States are electrical machinery, machinery, furniture and bedding, toys and sports equipment, and plastics. The United States received $418.75 billion in goods from China in 2019. China's other major trading partners include Hong Kong, Japan, and South Korea.

Many Western companies that do business in China have raised concerns about intellectual property infringements. China's current economic plans emphasize increasing innovation and boosting domestic consumption.

Americans doing business in China should consider hiring a good translator, ideally someone who can help with the cultural context as well as the language. The negotiation process may be slow at first. The Chinese like to know who they are dealing with before the real business discussions begin. Negotiations may also iterate, with discussions looping back to issues that you thought had already been agreed to and closed. Make sure you leave enough time to conduct your business and make decisions.

GLOBAL PROVIDER OPPORTUNISM

LO 10.7 Explain opportunism and provide an example of poaching and shirking.

Opportunism Taking advantage of situations and people without evaluating the consequences.

Shirking The extent to which the service provider is inclined to deliberately underperform or withhold resources should the customer be unable to detect such action.

There are two germane forms of **opportunism** associated with outsourcing: shirking and poaching. **Shirking** represents the extent to which the service provider is inclined to deliberately underperform or withhold resources should the customer be unable to detect such action. Shirking is often associated with the problem of moral hazard and is frequently cited as a typical form of passive yet intentional opportunism. As an example, the primary goal of a professional football player is to receive a multiyear long-term contract. Once the contract is awarded and guaranteed, the player purposely does not perform to the best of his ability in the next year. This is shirking.

Poaching is the extent to which the service provider is inclined to use information gained through its relationship with the customer for its own, perhaps unauthorized, benefit should the customer be unable to detect such action. An example of poaching is when the

professional football player is approached by a competing sports agent who offers the player a new automobile if the player signs and becomes his client. Player poaching is an accepted practice in the NFL. However, poaching will destroy win-win business relationships.

Poaching The extent to which the service provider is inclined to use information gained through its relationship with the customer for its own, perhaps unauthorized, benefit should the customer be unable to detect such action.

Shirking and poaching are specific forms of provider opportunism that can play a value-destroying role in global outsourcing relationships. Handley and Benton (2012) found that service provider shirking and poaching are in fact significant risks of global outsourcing. Statistical evidence from a large-scale empirical study indicated that buyer relationship–specific investments and the use of mediated power are associated with an increased risk of outsourcing provider shirking. Conversely, provider relationship–specific investments and buyer nonmediated power had a negative influence on the risk of provider shirking. Outsourcing firm reliance on nonmediated power was also found to be related to a decreased tendency for provider poaching, while mediated power increased this risk. In sum, these results suggest that outsourcing engagements characterized by higher levels of provider relationship–specific investments and buyer influence derived from nonmediated rather than mediated power bases face a lower risk of provider opportunism. These conditions not only diminish the risks of outsourcing but also demand lower investments in monitoring and formal control mechanisms. All else equal, this results in a more favorable risk-reward relationship for the outsourcing organization. This analysis demonstrated the value of looking at specific forms of opportunism rather than simply opportunism in general. Only by distinguishing between shirking and poaching were the differing effects of relationship-specific investments seen.

Relationship-specific investments have a significant association with provider shirking, but not with poaching. If the broader concept of opportunism in general was the only consideration, these insights would not have been fleshed out. Exchange hazards and the basis of outsourcing firm power were found to have a meaningful impact on service provider opportunism. However, it is tenable that other environmental conditions and outsourcing firm practices can instigate or mitigate provider opportunism. If one assumes that some service providers act opportunistically, then a similar assumption regarding buyer behavior seems reasonable. This would certainly be of concern to outsourcing service providers.

U.S. EXPORT ADMINISTRATION REGULATIONS

LO 10.8 Identify the procedures necessary for importing goods to the United States.

Any business or individual wanting to import goods into the United States will have to work with the Export Administration (EA) of the U.S. Department of Commerce. For complete details, consult the U.S. Export Administration Regulations (EAR). Several steps that you will need to be aware of follow:

1. Determine whether the item(s) in question is subject to the exclusive jurisdiction of another federal agency.
2. Determine if the technology or software is publicly available.
3. For an item in a foreign country, determine the origin of the item.
4. Determine whether the foreign-made item is subject to general prohibition.

Imported items are classified as a commodity with respect to the commodity control list (CCL); the Export Control Commodity Number (ECCN) must be identified

for the commodities you are planning to import. You can request the EA to verify the ECCN of commodities you wish to officially classify. (Write to Export Administration, P.O. Box 273, Washington, DC 20044, for further information on this process or refer to the EAR.)

Most industrialized countries participate in the IC/DV. If the importer is an individual or business in the United States that is purchasing and/or expects to receive commodities from these countries, the importer is required to furnish an International Import Certificate (IIC). The form required can be obtained by contacting a local district office of the Department of Commerce. Once the form is reviewed and approved, the transaction is approved (bringing the commodities into the United States) and a validated letter of approval and the IIC will be sent to the importer. Once approved, the IIC is valid for 6 months from the time it was certified by the Department of Commerce. The importer also may need to contact additional agencies, particularly if it is buying guns, missiles, ammunition, or atomic and nuclear substances.

The U.S. Commerce Department enforces EAR. The Commerce Department considers the customer, not cloud service providers such as Microsoft, as the exporters of their own customer data. While most customer data is not considered "technology" or "technical data" subject to EAR export controls, Microsoft in-scope cloud services are structured to help customers manage and significantly mitigate the potential export control risks they face. Microsoft recommends the use of its government cloud services for eligible customers. Microsoft has developed procedures to assist clients (cloud users) with full compliance with U.S. export controls.

FOREIGN TRADE ZONES

LO 10.9 Describe how to effectively use foreign trade zones.

The FTC Act of 1934 created trade zones to encourage exports from foreign countries. The act allowed for the storage of goods within the U.S. boundaries without payment until the goods passed to the buying company. The **foreign trade zones** (FTZs) are operated by the U.S. Customs Service. When goods enter an FTZ, the goods are classified, inspected, and placed in storage. The classification categories are the following:

Foreign trade zone
A designated area where goods can be stored within the U.S. boundaries without payment until the goods are passed to the buying company.

- *Privileged foreign merchandise.* Import duty is assessed at the most favorable Class 1 duty rate. This rate is usually reserved for imported materials from countries that have "most favored nation" status. Materials on the U.S. government priority list may be awarded this classification without regard to the point of origin.
- *Privileged domestic merchandise.* Merchandise of domestic origin can reenter the U.S. customs territory duty-free. The classification also is applied to imported merchandise on which duty and taxes have been paid or merchandise that has been previously admitted duty-free.
- *Nonprivileged foreign merchandise.* Import duty is assessed at the less-favorable Class 2 merchandise duty rate. This category includes all merchandise that does not have a privileged or zone-restricted status.
- *Nonprivileged domestic merchandise.* This classification is never sought; it is the result of privileged domestic merchandise being reclassified because it loses its identity in the zone.

- *Zone-restricted merchandise.* This classification includes merchandise admitted to the zone from the U.S. customs territory for storage, export, or destruction. "Restricted" here means that manipulation, manufacture, or return to the U.S. customs territory is not allowed.

A list of the major FTZ offices in the United States is shown in Table 10.8. A receipt is then given to the owner. The Customs Service is notified when the goods are transferred to the ultimate buyer. The appraisal value of the goods is set by the transaction value.

Countertrade

Countertrade is the exchange of goods for goods in full or partial payment of a sales transaction. Progressive companies must participate in countertrade or risk losing market share. The big countertraders are Lockheed Martin, Boeing Ventures, and British Aerospace. Countertrade appears to be flourishing in the current climate, largely because of the recent changes that have occurred in the international arms market since the end of the Cold War. These changes have affected both the volume of the trade and also the means through which it is financed. There are a number of countertrade arrangements. Some of the more popular forms of countertrade are given here:

Countertrade The exchange of goods for goods in full or partial payment of a sales transaction.

1. *Direct offset.* Offsets are commercial compensation practices required as a condition of purchase of goods and services. Offsets include specific forms such as coproduction, licensed production, subcontractor production, and overseas investment or technology transfer. Offsets can be direct or indirect. Examples of direct offsets include the manufacture of German-designed naval patrol vessels in South Korea.
2. *Indirect offset.* Indirect offsets occur where products or services transferred in an offset arrangement are unrelated to the specific products referred to in the export agreement. In many developing countries where the industrial base and infrastructure are poorly developed, offsets are more likely to be of an indirect nature, for example, selling military aircraft to a developing country and making arrangements to provide aerospace education for some of the citizens of the developing country.
3. *Coproduction.* This form of agreement involves the purchaser being given a share in the manufacture of a foreign-designed product. Coproduction is encouraged by recipients because of the employment and technology transfer implications. An example would be the coproduction of the British Harrier aircraft by McDonnell Douglas in the United States. Tier I suppliers gain commercial advantages under this form of arrangement when there is a high degree of technology transfer.
4. *Licensed production.* Licensed production occurs when the recipient obtains a share of the production work for its own order. The agreement may cover the assembly of an entire product or service. The agreement may be phased so that the local share of production rises over time. As an example, by the terms of the 1991 South Korean $5.2 billion purchase of F-16 fighter aircraft from General Dynamics, 12 aircraft were to be bought from the U.S. plant and a further 36 were to be assembled in South Korea before, in the final phase, South Korea was to produce parts and subsystems for a further 72 aircraft.

TABLE 10.8

Foreign Trade Zone Offices in the United States

State	Zone	CBP Port of Entry
ALABAMA	FTZ No. 82 Mobile	Mobile
	FTZ No. 83 Huntsville	Huntsville
	FTZ No. 98 Birmingham	Birmingham
	FTZ No. 222 Montgomery	Birmingham
	FTZ No. 233 Dothan	Panama City
ALASKA	FTZ No. 108 Valdez	Valdez
	FTZ No. 160 Anchorage	Anchorage
	FTZ No. 195 Fairbanks	Fairbanks
	FTZ No. 232 Kodiak	Kodiak
ARIZONA	FTZ No. 60 Nogales	Nogales
	FTZ No. 75 Phoenix	Phoenix
	FTZ No. 139 Sierra Vista	Naco
	FTZ No. 174 Pima County	Tucson
	FTZ No. 219 Yuma	San Luis
	FTZ No. 221 Mesa	Phoenix
	FTZ No. 277 Western Maricopa County	Phoenix
ARKANSAS	FTZ No. 14 Little Rock	Little Rock
	FTZ No. 273 West Memphis	Memphis
CALIFORNIA	FTZ No. 3 San Francisco	San Francisco
	FTZ No. 18 San Jose	San Jose
	FTZ No. 50 Long Beach	Los Angeles/ Long Beach
	FTZ No. 56 Oakland	San Francisco
	FTZ No. 143 West Sacramento	San Francisco
	FTZ No. 153 San Diego	San Diego
	FTZ No. 191 Palmdale	Los Angeles/ Long Beach
	FTZ No. 202 Los Angeles	Los Angeles/ Long Beach
	FTZ No. 205 Port Hueneme	Port Hueneme
	FTZ No. 226 Merced, Madera, & Fresno Counties	Fresno
	FTZ No. 231 Stockton	San Francisco
	FTZ No. 236 Palm Springs	Palm Springs
	FTZ No. 243 Victorville	Victorville
	FTZ No. 244 Riverside County	Los Angeles/ Long Beach
	FTZ No. 248 Eureka	Eureka
	FTZ No. 257 Imperial County	Calexico
	FTZ No. 276 Kern County	Meadows Field Airport
COLORADO	FTZ No. 112 Colorado Springs	Denver
	FTZ No. 123 Denver	Denver
	FTZ No. 293 Limon	Denver
CONNECTICUT	FTZ No. 71 Windsor Locks	Hartford
	FTZ No. 76 Bridgeport	Bridgeport

State	Zone	CBP Port of Entry
	FTZ No. 162 New Haven	New Haven
	FTZ No. 208 New London	New London
DELAWARE	FTZ No. 99 Wilmington	Wilmington
FLORIDA	FTZ No. 25 Broward County	Port Everglades
	FTZ No. 32 Miami	Miami
	FTZ No. 42 Orlando	Orlando
	FTZ No. 64 Jacksonville	Jacksonville
	FTZ No. 65 Panama City	Panama City
	FTZ No. 79 Tampa	Tampa
	FTZ No. 135 Palm Beach County	West Palm Beach
	FTZ No. 136 Brevard County	Port Canaveral
	FTZ No. 166 Homestead	Miami
	FTZ No. 169 Manatee County	Port Manatee
	FTZ No. 180 Miami (Wynwood)	Miami
	FTZ No. 193 Pinellas County	St. Petersburg
	FTZ No. 198 Volusia County	Daytona Beach
	FTZ No. 213 Fort Myers	Fort Myers
	FTZ No. 215 Sebring	Port Manatee
	FTZ No. 218 St. Lucie County	Fort Pierce Station
	FTZ No. 241 Fort Lauderdale	Port Everglades
	FTZ No. 249 Pensacola	Pensacola
	FTZ No. 250 Seminole County	Sanford
	FTZ No. 281 Miami-Dade County	Miami
	FTZ No. 292 Lake County	Leesburg
GEORGIA	FTZ No. 26 Atlanta	Atlanta
	FTZ No. 104 Savannah	Savannah
	FTZ No. 144 Brunswick	Brunswick
HAWAII	FTZ No. 9 Honolulu	Honolulu
IDAHO	FTZ No. 242 Boundary County	Eastport
	FTZ No. 280 Ada and Canyon Counties	Boise
ILLINOIS	FTZ No. 22 Chicago	Chicago
	FTZ No. 31 Granite City	St. Louis
	FTZ No. 114 Peoria	Peoria
	FTZ No. 133 Quad Cities, Iowa/Illinois	Davenport, IA/Moline & Rock Island, IL
	FTZ No. 146 Lawrence County	Evansville
	FTZ No. 176 Rockford	Rockford
	FTZ No. 245 Decatur	Peoria
	FTZ No. 271 Jo-Daviess & Carroll Counties	Davenport, IA/Moline & Rock Island, IL
INDIANA	FTZ No. 72 Indianapolis	Indianapolis
	FTZ No. 125 South Bend	Chicago
	FTZ No. 152 Burns Harbor	Chicago
	FTZ No. 170 Clark County	Louisville

(*Continued*)

TABLE 10.8 (Continued)

State	Zone	CBP Port of Entry
	FTZ No. 177 Evansville	Evansville
	FTZ No. 182 Fort Wayne	Fort Wayne
IOWA	FTZ No. 107 Polk County	Des Moines
	FTZ No. 133 Quad Cities, Iowa/Illinois	Davenport, IA/Moline & Rock Island, IL
	FTZ No. 175 Cedar Rapids	Des Moines
	FTZ No. 288 Northwest Iowa	Sioux Falls
KANSAS	FTZ No. 17 Kansas City	Kansas City
	FTZ No. 161 Sedgwick County	Wichita
KENTUCKY	FTZ No. 29 Louisville	Louisville
	FTZ No. 47 Boone County	Cincinnati
	FTZ No. 294 Western Kentucky	Evansville
LOUISIANA	FTZ No. 2 New Orleans	New Orleans
	FTZ No. 87 Lake Charles	Lake Charles
	FTZ No. 124 Gramercy	Gramercy
	FTZ No. 145 Shreveport	Shreveport
	FTZ No. 154 Baton Rouge	Baton Rouge
	FTZ No. 261 Alexandria	Morgan City
	FTZ No. 279 Terrebonne Parish	Morgan City
	FTZ No. 291 Cameron Parish	Lake Charles
MAINE	FTZ No. 58 Bangor	Bangor
	FTZ No. 179 Madawaska	Madawaska
	FTZ No. 186 Waterville	Belfast
	FTZ No. 263 Auburn	Portland
MARYLAND	FTZ No. 63 Prince George's County	Washington, DC
	FTZ No. 73 BWI Airport	Baltimore
	FTZ No. 74 Baltimore	Baltimore
	FTZ No. 255 Washington County	Baltimore
MASSACHUSETTS	FTZ No. 27 Boston	Boston
	FTZ No. 28 New Bedford	New Bedford
	FTZ No. 201 Holyoke	Springfield
MICHIGAN	FTZ No. 16 Sault Ste. Marie	Sault Ste. Marie
	FTZ No. 43 Battle Creek	Battle Creek
	FTZ No. 70 Detroit	Detroit
	FTZ No. 140 Flint	Saginaw/ Bay City/ Flint
	FTZ No. 189 Kent/Ottawa/ Muskegon Counties	Grand Rapids
	FTZ No. 210 St. Clair County	Port Huron
	FTZ No. 275 Lansing	Lansing
MINNESOTA	FTZ No. 51 Duluth	Duluth
	FTZ No. 119 Minneapolis–St. Paul	Minneapolis
	FTZ No. 259 Koochiching County	International Falls
MISSISSIPPI	FTZ No. 92 Harrison County	Gulfport
	FTZ No. 158 Vicksburg/ Jackson	Jackson

State	Zone	CBP Port of Entry
	FTZ No. 262 Southaven	Memphis
	FTZ No. 287 Tunica County	Memphis
MISSOURI	FTZ No. 15 Kansas City	Kansas City
	FTZ No. 102 St. Louis	St. Louis
	FTZ No. 225 Springfield	Springfield
MONTANA	FTZ No. 88 Great Falls	Great Falls
	FTZ No. 187 Toole County	Sweetgrass
	FTZ No. 274 Butte–Silver Bow	Butte–Silver Bow
NEBRASKA	FTZ No. 19 Omaha	Omaha
	FTZ No. 59 Lincoln	Omaha
NEVADA	FTZ No. 89 Clark County	Las Vegas
	FTZ No. 126 Sparks	Reno
NEW HAMPSHIRE	FTZ No. 81 Portsmouth	Portsmouth
NEW JERSEY	FTZ No. 44 Morris County	New York/ Newark
	FTZ No. 49 Newark/ Elizabeth	New York/ Newark
	FTZ No. 142 Salem/Millville	Philadelphia
	FTZ No. 200 Mercer County	Philadelphia
	FTZ No. 235 Lakewood	Philadelphia
NEW MEXICO	FTZ No. 110 Albuquerque	Albuquerque
	FTZ No. 197 Dona Ana County	Santa Teresa
NEW YORK	FTZ No. 1 New York City	New York/ Newark
	FTZ No. 23 Buffalo	Buffalo
	FTZ No. 34 Niagara County	Buffalo
	FTZ No. 37 Orange County	New York/ Newark
	FTZ No. 52 Suffolk County	JFK Airport
	FTZ No. 54 Clinton County	Champlain
	FTZ No. 90 Onondaga	Syracuse
	FTZ No. 109 Watertown	Alexandria Bay
	FTZ No. 118 Ogdensburg	Ogdensburg
	FTZ No. 121 Albany	Albany
	FTZ No. 141 Monroe County	Rochester
	FTZ No. 172 Oneida County	Utica
	FTZ No. 284 Genesee County	Rochester
	FTZ No. 289 Ontario County	Rochester
	FTZ No. 290 Cortland County	Syracuse
NORTH CAROLINA	FTZ No. 57 Mecklenburg County	Charlotte
	FTZ No. 93 Raleigh/ Durham	Raleigh-Durham
	FTZ No. 214 Lenoir County	Morehead City/ Beaufort
	FTZ No. 230 Piedmont Triad Area	Winston-Salem
NORTH DAKOTA	FTZ No. 103 Grand Forks	Pembina
	FTZ No. 267 Fargo	Fargo
OHIO	FTZ No. 8 Toledo	Toledo-Sandusky
	FTZ No. 40 Cleveland	Cleveland
	FTZ No. 46 Cincinnati	Cincinnati

(*Continued*)

TABLE 10.8 (Continued)

State	Zone	CBP Port of Entry
	FTZ No. 100 Dayton	Dayton
	FTZ No. 101 Clinton County	Dayton
	FTZ No. 138 Franklin County	Columbus
	FTZ No. 151 Findlay	Toledo-Sandusky
	FTZ No. 181 Akron/Canton	Cleveland
	FTZ No. 270 Lawrence County	Charleston
OKLAHOMA	FTZ No. 53 Rogers County	Tulsa
	FTZ No. 106 Oklahoma City	Oklahoma City
	FTZ No. 164 Muskogee	Tulsa
	FTZ No. 227 Durant	Dallas-Fort Worth
OREGON	FTZ No. 45 Portland	Portland
	FTZ No. 132 Coos County	Coos Bay
PENNSYLVANIA	FTZ No. 24 Pittston	Wilkes-Barre/ Scranton
	FTZ No. 33 Pittsburgh	Pittsburgh
	FTZ No. 35 Philadelphia	Philadelphia
	FTZ No. 147 Berks County	Harrisburg
	FTZ No. 247 Erie	Erie
	FTZ No. 254 Jefferson County	Pittsburgh
	FTZ No. 272 Counties of Lehigh and Northampton	Lehigh Valley
	FTZ No. 295 Central Pennsylvania	Pittsburgh
PUERTO RICO	FTZ No. 7 Mayaguez	Mayaguez
	FTZ No. 61 San Juan	San Juan
	FTZ No. 163 Ponce	Ponce
RHODE ISLAND	FTZ No. 105 Providence & North Kingstown	Providence
SOUTH CAROLINA	FTZ No. 21 Dorchester County	Charleston
	FTZ No. 38 Spartanburg County	Greenville-Spartanburg
	FTZ No. 127 West Columbia	Columbia
SOUTH DAKOTA	FTZ No. 220 Sioux Falls	Sioux Falls
TENNESSEE	FTZ No. 77 Memphis	Memphis
	FTZ No. 78 Nashville	Nashville
	FTZ No. 134 Chattanooga	Chattanooga
	FTZ No. 148 Knoxville	Knoxville
	FTZ No. 204 Tri-Cities	Tri-Cities Airport
	FTZ No. 223 Memphis	Memphis
	FTZ No. 283 West Tennessee	Memphis
TEXAS	FTZ No. 12 McAllen	Hidalgo/ Pharr
	FTZ No. 36 Galveston	Houston
	FTZ No. 39 Dallas/Fort Worth	Dallas/Fort Worth
	FTZ No. 62 Brownsville	Brownsville/ Los Indios
	FTZ No. 68 El Paso	El Paso
	FTZ No. 80 San Antonio	San Antonio
	FTZ No. 84 Harris County	Houston

State	Zone	CBP Port of Entry
	FTZ No. 94 Laredo	Laredo
	FTZ No. 95 Starr County	Rio Grande City
	FTZ No. 96 Eagle Pass	Eagle Pass
	FTZ No. 113 Ellis County	Dallas/Fort Worth
	FTZ No. 115 Beaumont	Port Arthur
	FTZ No. 116 Port Arthur	Port Arthur
	FTZ No. 117 Orange	Port Arthur
	FTZ No. 122 Corpus Christi	Corpus Christi
	FTZ No. 149 Freeport	Freeport
	FTZ No. 150 El Paso	El Paso
	FTZ No. 155 Calhoun/ Victoria Counties	Port Lavaca-Point Comfort
	FTZ No. 156 Weslaco	Progreso
	FTZ No. 165 Midland	Midland
	FTZ No. 168 Dallas/Fort Worth	Dallas/Fort Worth
	FTZ No. 171 Liberty County	Houston
	FTZ No. 183 Austin	Austin
	FTZ No. 196 Fort Worth	Alliance Airport
	FTZ No. 199 Texas City	Houston
	FTZ No. 234 Gregg County	Shreveport–Bossier City
	FTZ No. 246 Waco	Dallas/Fort Worth
	FTZ No. 252 Amarillo	Amarillo
	FTZ No. 258 Bowie County	Shreveport–Bossier City
	FTZ No. 260 Lubbock	Lubbock
	FTZ No. 265 Conroe (Montgomery County)	Houston
	FTZ No. 269 Athens	Dallas/Fort Worth
UTAH	FTZ No. 30 Salt Lake City	Salt Lake City
VERMONT	FTZ No. 55 Burlington	Burlington International Airport
	FTZ No. 268 Brattleboro	Springfield
VIRGINIA	FTZ No. 20 Suffolk	Norfolk–Newport News
	FTZ No. 137 Washington Dulles International Airport	Washington-Dulles
	FTZ No. 185 Culpeper County	Front Royal
	FTZ No. 207 Richmond	Richmond-Petersburg
	FTZ No. 238 Dublin	New River Valley Airport
WASHINGTON	FTZ No. 5 Seattle	Puget Sound
	FTZ No. 85 Everett	Puget Sound
	FTZ No. 86 Tacoma	Puget Sound
	FTZ No. 120 Cowlitz County	Longview
	FTZ No. 128 Whatcom County	Puget Sound
	FTZ No. 129 Bellingham	Blaine
	FTZ No. 173 Grays Harbor	Aberdeen
	FTZ No. 203 Moses Lake	Port of Moses Lake

(*Continued*)

TABLE 10.8 (Continued)

State	Zone	CBP Port of Entry
	FTZ No. 212 Tacoma	Puget Sound
	FTZ No. 216 Olympia	Puget Sound
	FTZ No. 224 Spokane	Spokane
	FTZ No. 296 Vancouver	Portland
WEST VIRGINIA	FTZ No. 229 Charleston	Charleston
	FTZ No. 240 Martinsburg	Front Royal
WISCONSIN	FTZ No. 41 Milwaukee	Milwaukee
	FTZ No. 167 Brown County	Green Bay
	FTZ No. 266 Dane County	Milwaukee
WYOMING	FTZ No. 157 Casper	Natrona County Airport

Source: https://enforcement.trade.gov/ftzpage/letters/ftzlist-map.html

5. *Subcontractor production.* In this case, a prime contractor substitutes an existing supplier with one located in the buying country. As an example, Boeing placed subcontracts with several British firms to sell the E-3 AWACS aircraft to the United Kingdom. In some cases, this led to the elimination of U.S. subcontractors from Boeing's network of suppliers.
6. *Technology transfer.* Technology transfers are commitments for foreign direct investment made by the selling firm in order to establish joint ventures in the buying country.
7. *Barter.* Barter is the nonmonetary exchange of goods for goods. As an example, the so-called oil-for-food program between Iraq and the EU was designed as a barter program. However, some of the actual deals involved illegal cash transactions between some United Nations and Iraqi officials.
8. *Counterpurchase.* In a counterpurchase, the seller exchanges products for compensatory amounts of commodities. In the context of developing countries, this normally involves primary commodities. Chrysler, General Motors, and Toyota use countertrade as the method of payment in Argentina. They established programs that sell their products in exchange for grain. The grain is then traded through an intermediary for dollars and not in the heavily devalued peso. Furthermore, the car companies have to negotiate with the intermediaries and the purchaser over not only the quantity of grain but also its quality, availability, and optimum market price on the day of the sale.
9. *Buyback.* Under a buyback agreement, the original exporter agrees to accept as full or part payment products derived from the original exported product. As an example, if the exporter establishes a production facility for machine tools, the exporter agrees to accept a portion of the facility's output as payment.

SUMMARY

LO 10.1 Identify the costs associated with global sourcing and provide an example of each.

The costs of global sourcing can be grouped into the following categories: administrative, foreign, and common. Exclusively foreign costs are those that would not be incurred if a domestic source were found. Examples of these costs are duty charges, customs fees, import fees, and currency exchange costs. Administrative costs of foreign sourcing include identification, qualification, program development, travel, broker fees, and others not directly involved with the product. Common costs are similar whether sourcing nationally or globally and include items such as direct labor and materials costs, lead-time costs, transportation costs, and inventory costs are a part of both domestic and offshore sourcing.

LO 10.2 Explain the impact the exchange rate can have on overall costs.

One of the most important variables to consider is the exchange rate of currencies. Since predicting the fluctuation in currency markets is extremely difficult, foreign purchases may actually cost more or less than expected depending on the length of the contract. Depending on the performance and strength of the dollar, goods can cost American firms different amounts from what is expected. When the dollar is weak, the final cost of goods tends to be relatively more than originally agreed upon. When the dollar has a strong performance over the life of a contract, a firm can realize savings through the exchange rates.

LO 10.3 Discuss the challenges experienced in global sourcing in terms of ethics, lead times, and communication.

Firms can run into problems when global sourcing is introduced into their organizations. The resistance of the firm's buyers to learn to evaluate global sources is the reason for most of the problems. Many buyers simply do not want to learn about the other countries with whom they will be dealing. There are many ethical considerations you must learn to be successful. Some of these issues center around working conditions, human rights, bribery, corruption, and deforestation. Another factor to consider are the challenges related to lead and delivery times as well as communication. These are some of the reasons many companies hire brokers to do their sourcing.

LO 10.4 State the qualitative and quantitative factors impacting risk assessment in the strategic planning for global sourcing.

In certain industries, using foreign suppliers can reduce costs, thus making a company more competitive. Firms in the apparel and electronics industries that do not use global sourcing could find themselves out of business when competing with firms that source globally. Global sourcing is in no way meant to completely replace domestic sources; however, it is a way to meet a competitor's challenge and achieve better value for goods all over the world. Global sourcing is extremely complicated from a quantitative and qualitative viewpoint. The total cost of sourcing is perhaps the most important variable. Of course, the costs vary from firm to firm since the appropriate qualitative components of offshore sourcing must be considered. Examples of qualitative and quantitative issues that bear consideration include distance, communication, time value of money, quality issues, pipeline inventory problems, staffing issues, and competition.

LO 10.5 Define protectionism and its impact on global sourcing.

Protectionism is the practice of taxing imports as a means of shielding a country's domestic industries from foreign competition. Many countries and territories around the world are actively striving for the role as a world source for goods and services. Most of us like to think of the United States as free and open, unlike our stingy neighbors across the Atlantic with their walls of protectionism. However, the average U.S. tariff rate in 2017 was 3.4%, while the average rate for the European Union was 2.4%.

LO 10.6 Describe negotiation techniques for various cultures.

When negotiating a purchase agreement, there are certain general attributes in dealing with various

offshore suppliers. We attempted to explain the nuances of negotiating with the people of the following countries.

- *United Kingdom.* Polite and friendly; can be tough and ruthless when appropriate. Motivated by free time, status, intangibles. Often appear less prepared. Open and forthright; don't play games. Will scrutinize terms and conditions; risk averse. Decision-making can often be delayed.
- *Federal Republic of Germany.* Educated; specialists in one industry. Motivated to wrap things up and not leave anything hanging. Relate technical details. Honest, straightforward, precise, cautious, serious. Will have a goal in mind but will be slow to reveal it; risk averse. Decisions made by committee, so may be slow.
- *Mexico.* Personal relationships and hierarchies are important. Looking for a win-win.
- *Canada.* Very similar to American culture and values. Effort should be made to speak the language in French-speaking areas.
- *China.* Like to understand people they are dealing with. May iterate and change as they go. May be a slow process.

LO 10.7 Explain opportunism and provide an example of poaching and shirking.

There are two germane forms of opportunism associated with outsourcing: shirking and poaching. Shirking represents the extent to which the service provider is inclined to deliberately underperform or withhold resources should the customer be unable to detect such action. Shirking is often associated with the problem of moral hazard and is frequently cited as a typical form of passive yet intentional opportunism. Poaching is the extent to which the service provider is inclined to use information gained through its relationship with the customer for its own, perhaps unauthorized, benefit should the customer be unable to detect such action.

LO 10.8 Identify the procedures necessary for importing goods to the United States.

Imported items are classified as a commodity with respect to the commodity control list (CCL); the Export Control Commodity Number (ECCN) must be identified for the commodities you are planning to import. You can request the EA to verify the ECCN of commodities you wish to officially classify.

Most industrialized countries participate in the IC/DV. If the importer is an individual or business in the United States that is purchasing and/or expects to receive commodities from these countries, the importer is required to furnish an International Import Certificate (IIC). The form required can be obtained by contacting a local district office of the Department of Commerce. Once the form is reviewed and approved, the transaction is approved (bringing the commodities into the United States) and a validated letter of approval and the IIC will be sent to the importer. Once approved, the IIC is valid for 6 months from the time it was certified by the Department of Commerce.

LO 10.9 Describe how to effectively use foreign trade zones.

The FTC Act of 1934 created trade zones to encourage exports from foreign countries. The act allowed for the storage of goods within the U.S. boundaries without payment until the goods passed to the buying company. The foreign trade zones (FTZs) are operated by the U.S. Customs Service. When goods enter an FTZ, the goods are classified, inspected, and placed in storage. The Customs Service is notified when the goods are transferred to the ultimate buyer. The appraisal value of the goods is set by the transaction value.

KEY TERMS

Countertrade 235
Currency exchange rate 221
Foreign trade zone 234
Opportunism 232
Poaching 232
Protectionism 227
Purchase risk perception (PRP) 223
Shirking 232

DISCUSSION QUESTIONS

1. How should purchasing managers train buyers for global sourcing?
2. What are some of the advantages of global sourcing?
3. How do exchange rates impact global sourcing?
4. Discuss some of the behavioral issues associated with global sourcing.
5. What are some of the attributes associated with global sourcing?
6. Discuss how offshore quotas should be evaluated. Consider both qualitative and quantitative implications.
7. Discuss the differences and similarities of negotiating strategies for the United Kingdom, Germany, Mexico, Canada, and China.
8. What is meant by a foreign trade zone?

SUGGESTED CASES

Case 3: The Auction Case

Case 20: Microfuse, Inc. (B)

Case 29: Worldwide Auto Manufacturers, Inc.

APPENDIX: OUTSOURCING POLICY EXAMPLE

Global Sourcing and Operating Guidelines help to select business partners who follow workplace standards and business practices consistent with our company's values. These requirements are applied to every contractor who manufactures or finishes products for Levi Strauss & Co. Trained inspectors closely audit and monitor compliance among approximately 600 cutting, sewing, and finishing contractors in more than 60 countries.
The Levi Strauss & Co. Global Sourcing and Operating Guidelines include two parts:

I. **The Country Assessment Guidelines**, which address large external issues beyond the control of Levi Strauss & Co.'s individual business partners. These help assess the opportunities and risks of doing business in a particular country.

II. **The Business Partner Terms of Engagement**, which deal with issues substantially controllable by individual business partners. These Terms of Engagement are an integral part of our business relationships. Our employees and our business partners understand that complying with our Terms of Engagement is no less important than meeting our quality standards or delivery times.

Country Assessment Guidelines

The numerous countries where Levi Strauss & Co. has existing or future business interests present a variety of cultural, political, social, and economic circumstances. The Country Assessment Guidelines help us assess any issue that might present concern in light of the ethical principles we have set for ourselves. The Guidelines assist us in making practical and principled business decisions as we balance the potential risks and opportunities associated with conducting business in specific countries. Specifically, we assess whether the

- **Health and Safety Conditions** would meet the expectations we have for employees and their families or our company representatives;
- **Human Rights Environment** would allow us to conduct business activities in a manner that is consistent with our Global Sourcing and Operating Guidelines and other company policies;
- **Legal System** would provide the necessary support to adequately protect our trademarks, investments, or other commercial interests, or to implement the Global Sourcing and Operating Guidelines and other company policies; and

- **Political, Economic, and Social Environment** would protect the company's commercial interests and brand/corporate image. We will not conduct business in countries prohibited by U.S. laws.

Terms of Engagement

- *Ethical Standards.* We will seek to identify and utilize business partners who aspire as individuals and in the conduct of all their businesses to a set of ethical standards not incompatible with our own.
- *Legal Requirements.* We expect our business partners to be law abiding as individuals and to comply with legal requirements relevant to the conduct of all their businesses.
- *Environmental Requirements.* We will only do business with partners who share our commitment to the environment and who conduct their business in a way that is consistent with Levi Strauss & Co.'s Environmental Philosophy and Guiding Principles.
- *Community Involvement.* We will favor business partners who share our commitment to improving community conditions.
- *Employment Standards.* We will only do business with partners who adhere to the following guidelines:
    - *Child Labor:* Use of child labor is not permissible. Workers can be no less than 15 years of age and not younger than the compulsory age to be in school. We will not utilize partners who use child labor in any of their facilities. We support the development of legitimate workplace apprenticeship programs for the educational benefit of younger people.
    - *Prison Labor/Forced Labor:* We will not utilize prison or forced labor in contracting relationships in the manufacture and finishing of our products. We will not utilize or purchase materials from a business partner utilizing prison or forced labor.
    - *Disciplinary Practices:* We will not utilize business partners who use corporal punishment or other forms of mental or physical coercion.
    - *Working Hours:* While permitting flexibility in scheduling, we will identify local legal limits on work hours and seek business partners who do not exceed them except for appropriately compensated overtime. While we favor partners who utilize less than 60-hour workweeks, we will not use contractors who, on a regular basis, require in excess of a 60-hour week. Employees should be allowed at least one day off in seven.
    - *Wages and Benefits:* We will only do business with partners who provide wages and benefits that comply with any applicable law and match the prevailing local manufacturing or finishing industry practices.
    - *Freedom of Association:* We respect workers' rights to form and join organizations of their choice and to bargain collectively. We expect our suppliers to respect the right to free association and the right to organize and bargain collectively without unlawful interference. Business partners should ensure that workers who make such decisions or participate in such organizations are not the object of discrimination or punitive disciplinary actions and that the representatives of such organizations have access to their members under conditions established either by local laws or mutual agreement between the employer and the worker organizations.
    - *Discrimination:* While we recognize and respect cultural differences, we believe that workers should be employed on the basis of their ability to do the job, rather than on the basis of personal characteristics or beliefs. We will favor business partners who share this value.
    - *Health and Safety:* We will only utilize business partners who provide workers with a safe and healthy work environment. Business partners who provide residential facilities for their workers must provide safe and healthy facilities.

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11 Supply Partnerships and Supply Chain Power

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

11.1 Identify the elements of the supplier chain partnership Chrysler initiates with its suppliers that makes it an industry benchmark.

11.2 Describe the levels of supply chain partnerships and give an example of each.

11.3 Explain how supply chain partnerships can lead to a reduced supplier base.

11.4 Discuss the potential benefits of buyer–supplier partnerships.

11.5 Discuss the power component of supply chain relationships.

Eleanor Rosebud McHenry, the director of purchasing for Bitnet Computer, Inc., was becoming increasingly concerned about supply chain power imbalances between Bitnet and its strategic suppliers. According to Eleanor, power plays a significant role in the supply chain, and the different sources have contrasting effects on interfirm relationships in the Bitnet supply chain. Thus, both the power source (Signet—supplier) and the power target (Bitnet—buyer) must be able to recognize the presence of power and then reconcile supply chain strategy for power influences.

INTRODUCTION

Critical to the implementation of purchasing and supply management techniques is the development of *supply chain partnerships*. Also termed a *strategic alliance*, a supply chain partnership is a relationship formed between two independent entities in supply channels to achieve specific

objectives and benefits, and it is these partnerships that form the essential building blocks of supply chain management. The high levels of information flow and subsequent coordination of error-free deliveries by supply chain management require manufacturers to build tighter bonds with relatively few suppliers. Once traditionally driven by competition, the supplier relationships for many manufacturing firms have thus matured from an adversarial nature to one of supply chain partnerships.

Within the win-win partnership dyad, buyer and supplier share goals as well as inherent risks through joint planning and control, seeking to create a supply chain with increased information flow and enhanced loyalty. Like the overall goal of supply chain management, such coordination allows for improved service, technological innovation, and product design with decreased cost. Ideally, the end result for both firms should be decreased uncertainty, yielding greater control of costs, cycle times, inventory, quality, and, ultimately, customer satisfaction.

Like supply chain management, the frequency of partnering is increasing in industry, but implementation still remains a difficult process. And like supply chain management, buyer–supplier partnering extends beyond a simple interfirm relationship to involve integration of confidential and vital processes such as strategy formation, planning, information flow, and operations. Thus, both researchers and industry practitioners must clearly comprehend when, why, and how effective partnerships are formed as well as when, why, and how these partnerships are maintained. This chapter seeks to contribute to such an understanding through an analysis of buyer–supplier relationships.

BENCHMARK SUPPLIER PARTNERSHIPS: CHRYSLER CORPORATION

LO 11.1 Identify the elements of the supplier chain partnership Chrysler initiates with its suppliers that makes it an industry benchmark.

As an example of supply chain partnerships, the Chrysler (formerly DaimlerChrysler) Corporation is a leader in developing intimate relationships with its suppliers. When Chrysler's team designed its LH line (Dodge Intrepid, Eagle Vision, Chrysler Concorde) and compact sedans (Neon), Chrysler outsourced more than 70% of its parts to a limited number of suppliers. To achieve this supply chain partnership arrangement, Chrysler invited several key suppliers into the early stages of the development process and actually presourced 95% of the component parts for its new sedan by choosing suppliers prior to the design stage. In doing so, it eliminated the competitive bidding process. Several of Chrysler's domestic supply chain partners, like its Pacific Rim competitors, have full responsibility for developing the components themselves and coordinating with other subcontractors to carry out the component development process. In the end, the LH line was developed from scratch in just over 3 years versus the usual 5 to 6 years, and the Neon line was developed in only 2.5 years.

Furthermore, Chrysler's supplier cost reduction effort (SCORE) has led to 10,000 new ideas since 1993 and has resulted in $2.3 billion in supply chain savings, one third of which the suppliers retain. Chrysler also has used supplier involvement to become a virtual vehicle manufacturer as its suppliers accept more responsibility and do more assembly. While Chrysler takes a role in part design, it leaves a significant portion of the assembly to suppliers, cutting its own costs and increasing overall production efficiency in the process. Each Chrysler plant once carried around $26 million in inventory, but the number has dropped to below $8 million as supplier personnel work directly with plant purchasing personnel.

PARTNERSHIPS: DEFINITION AND OVERVIEW

LO 11.2 Describe the levels of supply chain partnerships and give an example of each.

Though partnering has received abundant recognition over the last few decades from both researchers and practitioners alike, the concept of a partnership is perhaps as old as, or even older than, business itself. Although many firms engage in partnering activities, the specific interpretation of a strategic alliance or partnership (the terms *partnership* and *alliance* are used interchangeably in this chapter) is at best vague. To understand the context of a partnership, it is helpful to consider the continuum of interfirm relationships shown in Figure 11.1. A basic interaction between two firms involves a discrete arm's-length relationship equivalent to the length of time it takes to complete the single transaction. Other interactions may involve significantly more attention by one or both firms and involve what is deemed as a **special influence transaction**. An example of such may be found in the national account groups of firms in which specific resources, both human and nonhuman, are devoted to handling larger, more important buyers.

Special influence transaction A type of interaction that goes beyond the length of time it takes for one discrete transaction.

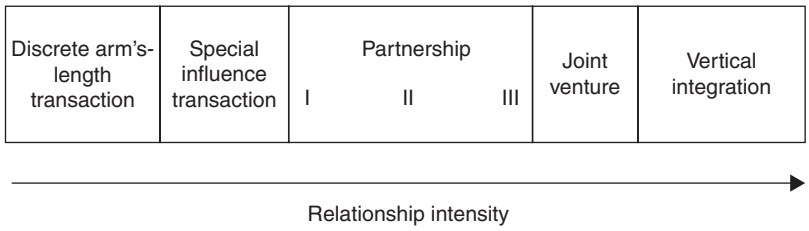
Partnerships move beyond special influence transactions by involving efforts of both firms to coordinate functional activities. Figure 11.1 shows how partnerships can be segmented into three tiers based on the intensity and duration of the leadership. The automotive industry is an excellent example of Tier 1–3 supply chain partnerships. Instead of producing all their components in-house, automotive manufacturers procure the individual modules from Tier 1 suppliers. The Tier 1 suppliers will in turn assemble components supplied by Tier 2 component suppliers. The suppliers of individual parts are found on the third tier. The tier boundaries are not always clearly defined. A supplier may serve as a Tier 1 supplier for Honda and a Tier 2 supplier for General Motors.

Beyond a partnership, firms may want to eventually involve themselves financially in significantly large, capital-intensive projects with their partners (joint ventures) or even go so far as to outright purchase or be purchased by the partner (vertical integration). Although the concepts of joint ventures and vertical integration expand beyond the scope of this book, a primary argument for implementation of strategic partnerships involves receiving benefits of joint ventures and vertical integration without the ownership commitment.

To narrow this discussion, Lambert, Emmelhainz, and Gardner (1999) formally defined a partnership as "a tailored business relationship based on mutual trust, openness, shared risk, and shared reward that yields a competitive advantage, resulting in business performance greater than would be achieved by the firms individually" (p. 2).

Several key concepts are critical to the essence of this definition, with the first of these being interdependence. Partnering involves an *interdependent* relationship of coordinated

FIGURE 11.1
Continuum of Interfirm Relationships



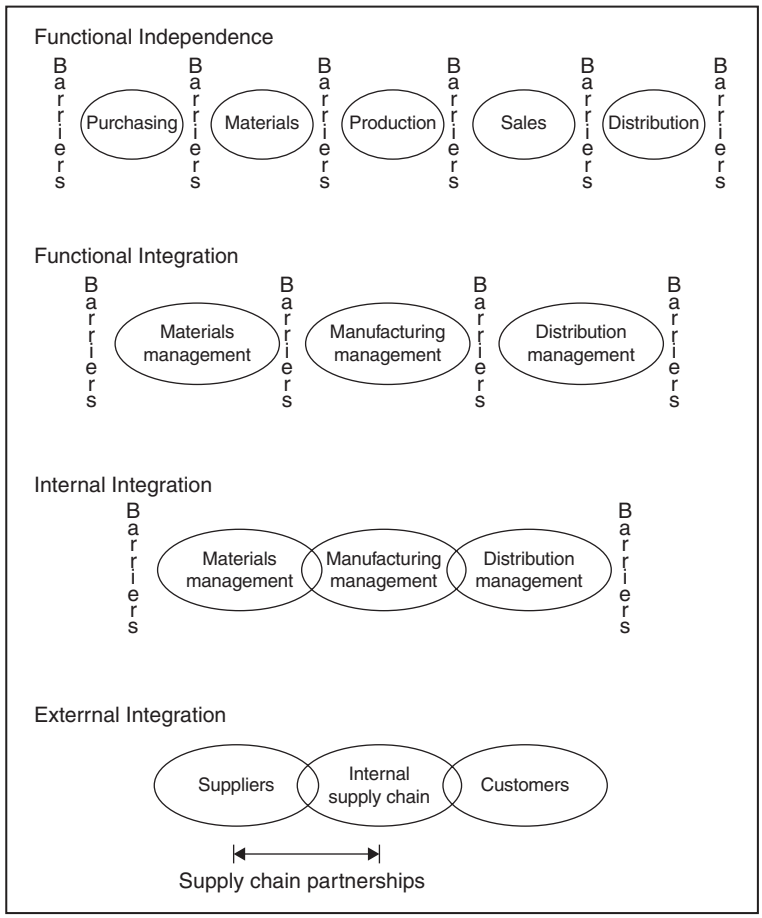
planning and strategy. Ultimately, the partners work toward a mutual goal that benefits all parties. The second significant component of the above definition is the notion of *synergy* within the partnership. The two firms create a whole that functions better than the sum of its parts. Interdependence and synergy are two guiding concepts within a partnership, but significantly more elements exist as necessary pieces of the alliance. Despite a formal definition of partnering, the orientation of partnership activities in practice is often vague. *When do firms officially move into the realm of partnerships?*

THE EVOLVING SUPPLY CHAIN STRATEGY

LO 11.3 Explain how supply chain partnerships can lead to a reduced supplier base.

We continue by applying the partnering concepts specifically to the supply chain. To do so, we first need to present the evolutionary background of supply chain strategy, as that is a primary driver for the intensified focus of supply chain partnerships. Firms have taken bold steps to break down both intra- and interfirm barriers to smooth uncertainty and enhance control of supply and distribution channels (see Figure 11.2). The evolution of

FIGURE 11.2
Stages in Intra- and Interfirm Integration



intrafirm functional integration has occurred for most firms over the last few decades, and the current push is toward external integration with both suppliers and customers. Supply chain partnerships bridge the barrier between buyer and seller, leading manufacturers to a reduced supplier base.

Historically, American manufacturers have formulated supply strategy around the transparent benefits of a large competitive supplier base. An abundant collection of suppliers encourages competition, which the manufacturer can exploit to negotiate lower costs, higher quality, reasonable delivery times, and special exigencies. Such a strategy enhances ultimate manufacturer bargaining power as well as shelters against interruptions in supply due to strikes and other unforeseen problems. In contrast, many Asian and American firms have recognized the benefits of the opposite concept of single sourcing, which leads to an abatement of adversarial attitudes, lower switching costs, and decreased shipping errors. The association with the single source also can lead to quantity and relationship-based discounts as well as a decreased cost of quality.

Some supply managers argue that implementation of many new manufacturing techniques necessitates a reduction in the number of suppliers. The two primary factors of Asian production techniques are reduced supplier lot sizes and single sourcing. Other supply managers proclaim that single sourcing is not as widespread in Japan as believed and that many Pacific Rim manufacturers actually exercise a single/dual hybrid approach. As an example, Chrysler Corporation single-sources an individual product (such as tires for a particular car line) but will have two or three suppliers for the commodity (tires in general) in case of problems. Likewise, most supply managers promote dual over single sourcing to reduce the potential for power influence.

Despite the differences in opinions about the size of the supplier base, the major issue remains that a closer relationship with suppliers facilitates a reduced number of suppliers. There is an increased tendency toward a smaller supplier base in the United States. With regard to the automobile industry, component part sales have increased while the number of suppliers has drastically decreased. In 1983, the automobile industry relied on approximately 10,000 suppliers to purchase $103 billion in component parts from Tier 1 suppliers. Twenty-five years later, such purchases rose to $300 billion while the number of Tier 1 suppliers fell to just 375. As an example of a reduced supplier base, Chrysler was able to reduce its total (all tiers) supplier base from 3,200 vendors in 1985 to approximately 525 in 2009, and 90% of its purchases actually come from just 80 Tier 1 suppliers. Furthermore, Chrysler was able to develop its LH line with approximately 200 suppliers, versus the typical 600–700.

The objective of a drastically reduced supplier base precludes an acceptance of supplier partnerships because a firm must accept dependence on fewer suppliers before it can internalize legitimate forms of supply chain management and supplier partnerships. Although voluminous knowledge exists to examine a reduced supplier base, one key problem that is often overlooked, **power asymmetry**, may potentially inhibit the implementation of such a strategy in Western cultures. Asian suppliers are not "suppliers" in the Western sense of the word, and, in most instances, single sourcing will not mechanically work in the United States, as the power imbalance will lead to opportunism and exploitation. Thus, relying on a reduced supplier base requires a transformation of ingrained Western supply chain practices, and such a change may not be completely possible due to behavioral and cultural considerations. Efforts to investigate the implementation of reduced supplier bases have neglected the role of power asymmetry and thus have not realistically challenged the reality of single sourcing.

Power asymmetry The relationship between two individuals in which the most powerful individual has control over the actions of the other individual.

SUPPLY CHAIN PARTNERSHIPS

LO 11.4 Discuss the potential benefits of buyer–supplier partnerships.

A Harvard Business School study concluded that a key driver in the decline of U.S. competitiveness in the international marketplace originated from investing less in intangible benefits such as supplier relations. It is impossible to operate as a discrete entity, but while virtually no firm engages in completely discrete engagements, conventional Western and American business practices have been more oriented toward the discrete than the relational. Traditionally, U.S. firms have based their drive for success on autonomy and have viewed competition as a Darwinistic keeper of American superiority. Long-run U.S. firm planning has been independent, and considerable efforts are made to ensure privacy of corporate information.

Over recent decades, however, firms within the supply chain have begun to realize the advantages enjoyed from sharing of technology, information, and planning with other firms, even competitors, and many modern business thinkers claim that a more open and relational attitude is not only advantageous but actually essential to maintaining a competitive advantage. As shown in Figure 11.3, the idea of relationalism between firms seeks to move away from the concept of discrete transactions, breaking down traditional interfirm barriers. Firms unite to share information and planning efforts, thus reducing uncertainty as well as increasing control. In the end, the partners reap the benefits of the joint effort.

Recognizing partnerships between buyer and supplier as a fundamental driver for the success of the Pacific Rim supply chain processes, American firms have begun to emulate these supplier alliances. Asian firms are not completely responsible for the move to supplier partnerships; many supplier alliances were due to raw materials shortages, oil crises, government price controls, and general changes in attitudes. However, the primary root of the success of the concept lies with the Pacific Rim. Modern manufacturing improvements, such as just-in-time, require the tighter control evaluated by the supply chain partnership, and there is growing evidence that Western firms have begun to implement such relational strategies.

Initial efforts to involve suppliers began with their inclusion of suppliers in cross-functional sourcing teams. There must be establishment of such teams to improve supply chain effectiveness. Supply alliances, however, extend well beyond this notion to an even more relational level of exchange in which partners create an intensive, interdependent relationship

FIGURE 11.3
Discrete Versus Relational Business Strategies

Contractual Element	Discrete Orientation	Retational Orientation
Duration	One time	Long term
Transferability (switching parties)	Completely transferable	Extremely difficult to transfer
Attitude	Independent, suspicious	Open, trusting, cooperative
Communication	Very little	Complex
Information	proprietary	Shared
Planning and goals	Individual, short term	Joint, long term
Benefits and risks	Individual	Shared
Problem solving	Power driven	Mutual, judicious

from which both can mutually benefit. Supply partnerships emphasize direct, long-term association, encouraging mutual planning and problem-solving efforts. Figure 11.4 displays the critical elements of a supply partnership in comparison to traditional thinking.

Benefits of Supplier Partnerships

While many firms have sought vertical integration through acquisition to harness supplier expertise, some argue that partnerships can provide similar benefits without the necessity of ownership and arduous exit barriers. Buyers can gain from higher quality, and transaction costs may be reduced through economies of scale, decreased administrative and switching efforts, process integration, coordination of processes, and quantity discounts. Furthermore, the relationship will be enhanced by market stability for both the supplier and buyer. Several further benefits specific to manufacturing processes, including setup time reduction, improved process-oriented layout, better product design, and enhanced data capture, also have been proposed. Less-tangible benefits from which both firms can benefit are increased communication and goal congruence, leading to enhanced conflict resolution, less probability of opportunism, and decreased risk from externalities. A detailed list of possible advantages of supply chain relationships composed from several sources is summarized in Figure 11.5.

Some supply professionals believe supplier partnerships lead to improved quality of supplier operations, improved quality products, decreased supplier costs, and improved reaction to buyer changes to delivery date. However, such profit improvements tend not to be recognizable before several years of the alliance.

Risks of Supplier Partnerships

With its many benefits, supply chain partnerships retain several inherent risks that can be potentially damaging to participants. First and foremost, heavy reliance on one partner can be disastrous if the partner does not meet expectations. Also, firms risk decreased competitiveness due to loss of partnership control, complacency, and overspecialization with an affirmed partner. Furthermore, firms may overestimate partnership benefits while ignoring potential shortcomings. There is a need for more research examining direct comparisons of the conventional and partnership strategies. There are beneficial insights from both conventional and partnership perspectives. Partnerships may actually open the weaker party up to negative influence potential, and research suggests that competition may abate power.

FIGURE 11.4
Traditional versus Partnership Supply Strategies

Traditional Supplier Relationships	Supply Chain Partnerships
• Pricing driven supplier selection	• Multiple dimensions for supplier selection
• Short-term contracts for suppliers	• Long-term contracts for suppliers
• Bid evaluation	• Intensive evaluation of supplier value added
• Large supplier base	• reduced supplier base
• Proprietary information	• Shared information
• Power-driven problem solving	• Joint problem solving
• Transactional relationships	• continuous Improvement
	• Success sharing

FIGURE 11.5
Potential Benefits of Supplier Partnerships

Reduced uncertainty for buyers in

- Material costs
- Quality
- Timing
- Reduced supplier base, which is easier to manage

Reduced uncertainty for suppliers in

- Market
- Understanding customer needs
- Product specifications

Reduced uncertainty for both buyers and suppliers in

- Convergent expectation and goals
- Reduced effects from externalities
- Reduced opportunism
- Increased communication and feedback

Joint product and process development

- Faster product development
- Increased shared technology
- Greater joint involvement of product design

Greater flexibility/Cost savings

- Economies of scale in ordering, production, and transaction
- Decreased administrative costs
- Fewer switching costs
- Enhanced process integration
- Technical or physical integration
- Improved asset utilization

Time management

- Faster product development
- Faster to market for new products
- Improved cycle time

Shared risks and rewards

- Joint investments
- Joint research and development
- Market shifts
- Increased profitability

Stability

- Lead times
- Priorities and attention

Partnership Implementation and Critical Success Factors

Before firms can enjoy the benefits of a buyer–supplier partnership, they must first endure the complicated and intricate partnership implementation process. A supplier partnership involves a significant attitudinal as well as structural change from traditional supply arrangements, so the allying firms must be meticulous to ensure that a true win–win partnership is developed. Steps in the implementation process are summarized in Figure 11.6. For a more robust discussion of this process, please revisit Chapters 8 and 9.

The first step in the supplier partnership implementation process includes the strategic verification of the need for a supplier partnership. Here, the firm must evaluate the potential risks and benefits of a partnership in comparison to traditional processes. Next, criteria for potential partners are developed, and candidates are assessed. Once a partner is selected, the establishment of the actual relationship provides the next critical step in which the partners must create a complete sense of awareness about the needs and participation of all involved parties. The final step in the partnering process includes the maintenance of the relationship to either enhance its development or bring about its dissolution.

The entire partnership implementation process holds many elements critical to the success of the relationship (see Figure 11.7). One rudiment that must be established immediately is top management advocacy. This requires overcoming social and attitudinal barriers as well as managerial, procedural, and structural obstacles associated with corporate change. In

FIGURE 11.6

Supplier Partnership Implementation Steps
1. Establish strategic need for partnership.
2. Develop partner criteria, evaluate suppliers, and select partner.
3. Formally establish partnership.
4. Maintain and refine partnership (possible reduction or dissolvement).

FIGURE 11.7
Supplier Partnership Critical Success Factors

Supplier Partnership Critical Success Factors in the Phases of Implementation
Phase I. Competitive Strategy
• Communication • Central coordination
Phase II. Analysis
• Social and attitudinal barriers • Procedural and structural barriers
Phase II. Selection
• Total cost and profit benefit • Partner capabilities • Cultural compatibility • Financial stability
Phase III. Partnership Establishment
• Information sharing • Information systems interaction • Documentation
Phase IV. Relationship Management
• Trust • Flexibility • Conflict management skills • Social exchange • personnel exchange • Performance measurement

practice, overcoming the social and attitudinal barriers and managerial practices may prove to be extremely difficult if not impossible.

In the supplier evaluation and selection step, the chance of choosing the wrong supplier presents a severe problem in partnering. An additional list of selection criteria for supply

chain partners including such elements as cultural compatibility, long-term strategic plans, financial stability, technology/design capability, management compatibility, and location also must be considered.

As shown in Figure 11.7, the final steps for establishing and maintaining the relationship necessitate several factors. Overall, the most important attitudinal factors involve cooperation, trust, and goodwill, as well as the ability for both parties to be flexible and to handle conflicts. Furthermore, attitude, communication, and shared goals are described as success factors. Other critical success factors include effective performance measurement, as well as proper establishment of boundary personnel and procedures.

Ultimate dissolution of the partnership may be necessary if the firms are unable to successfully work through the critical steps of partnership formation or if synergies cannot be recognized. Abandonment of partners may lead to suspicion, making future partners difficult to attract. Ultimately, little is known about disengagement, so dissolution may offer a pessimistic, yet rich, source of research. A rule of thumb must be developed that can be used to decide whether a partnership has sufficient potential.

POWER INFLUENCES ON SUPPLY CHAIN RELATIONSHIPS

LO 11.5 Discuss the power component of supply chain relationships.

The notion of interfirm power holds its roots in the social science (psychology, social psychology, and political science) literature and has been extensively developed by marketing channel researchers. The **power** component of partnerships begins with the definition of power:

Power The ability of one party (buyer or seller) to influence or control the environment around them, including the behavior of others.

> The power of a supply chain member [is] the ability to control the decision variables in the supply strategy of another member in a given chain at a different level of the supply chain. It should be different from the influenced member's original level of control over their own supply strategy. With a supply-side orientation, an appropriate definition of power in the supply chain is the ability of one channel member (the source) to influence the actions and intentions of another supply chain member (the target). (Maloni & Benton, 2000)

Extremely complex in nature, power serves as a composite relationship–oriented variable, affecting both the target and the source in many transparent as well as concealed ways. The following section examines the effects of influence strategies on critical relationship factors including dependence, commitment, trust, compliance, cooperation, conflict, satisfaction, performance, and profitability. Exploration of the effects of power on factors of the supplier–buyer alliance provides the key to understanding the concept of the power-partnership link under investigation (see de Jong & Benton, 2018).

Power and Dependence

The notion of power in an interfirm relationship implies target dependence on the source; otherwise the target would not need to subject itself to the unbalanced relationship. Power is a direct result of dependence, and the extent of dependence is directly induced by perceptions of power. However, in situations with exercised power-dependence relationships in the presence of high commitment, no correlation has been found between power and dependence.

An explanation is that power sources and dependence are inseparable, and, thus, dependence measurement will not add insight to the presence of power since they essentially measure the same concept (see Handley, de Jong, & Benton, 2019).

With the subordinate relationship caused by dependence, one might logically conclude that the target–source relationship would be fairly strong (due to necessity) since the target would be forced to abide by the will of the source. The greater dependence is more than likely associated with greater cooperation in the relationship. Moreover, economic dependence increases compliance.

Dependence created by power could possibly yield a closer relationship, but the presence of dependence does not invite a relationship like that of the simple conceptual partnership. Critical elements of supplier partnerships include trust, goodwill, shared goals, and social exchange. A state of dependence would indicate compliance due to necessity rather than cooperation on the part of the target out of trust and goodwill. Thus, critical dependence questions that should be addressed when establishing a supply relationship are as follows:

- Does a state of dependence negate the possibility for critical supply chain partnership success factors such as goodwill, trust, and shared goals?
- Does a state of dependence create a relationship that differs from a true, mutually beneficial supply chain partnership?

Power and Commitment

Commitment The feeling of being emotionally impelled.

A key factor driven by power and critical to the partnership dyad is commitment. **Commitment** may be defined as the feeling of being emotionally impelled. The relationship between power and commitment depends on the origins of the commitment. Commitment is nothing more than a form of compliance (instrumental) as well as identification and involvement (normative).

Interorganizational power has been shown to affect relationships between supply chain partners. One popular power framework is given in Table 11.1.

As an example assume that a buying organization uses mediated power sources to influence strategies with the direct intention of bringing about some opportunistic action toward the selling organization. Such mediated power bases represent the competitive, negative uses of power. Alternatively, nonmediated power sources, which are more relational and positive in orientation, include expert, referent, and traditional legitimate power. These power bases occur as a natural part of the buyer and seller relationship and do not necessitate intention from the buying organization. In fact, the buying organization may not be aware that some mediated power bases exist.

Buying organizations tend to use noncoercive influence strategies, which are logically supported by the idea that use of coercion may risk the buying organization's power advantage. The use of mediated power by the buying organization forces the supplying organization to be committed to maintain the relationship for its sustenance, but genuine psychological commitment is lower due to the resentment over the subordinate situation. On the other hand, the use of nonmediated power by the buying organization can increase true commitment. Ultimately, commitment in the form of attitude and goodwill is implied as a critical success factor for supply chain partnerships. Thus, power used positively by the source may enhance a partnering relationship.

TABLE 11.1
Bases of Interorganizational Power

Type of Power	Power Base	Description	Example
Nonmediated	Direct involvement	Power source has knowledge, expertise, or skills desired by the power target.	The supplier knows what the customer wants or has knowledge and expertise in designing new products or equipment and providing product training for the customer.
	Referent power	Power target values identification with the power source.	If the supplier has developed a strong bond through its demonstrated concern, management style, and organizational personality, it has power over the customer.
Mediated	Legal, legitimate power	Power source retains judiciary right to influence power target.	Two supply chain members maintain a formal (sales) contract.
	Incentive	Power source has the ability to mediate rewards to the power target.	One supply chain member has the ability to provide rewards or rebates that are attractive to the other supply chain member.
	Competitive pressure; coercive	Power source has the ability to mediate punishment to the power target.	One supply chain member can provide punishments to the other member, can cancel business or reduce volume, or can withhold rewards.

Power, Cooperation, and Compliance

Power essentially attempts to force a target to comply with the source's desires, and, like commitment, the levels of compliance and, more importantly, cooperation are critical to the relationship tenure as well as profitability. **Compliance** is action without inherent desire, and, thus, compliance remains a relatively easy factor to measure since it implies action, not feeling. These findings point to the idea that power yields compliance regardless of the power strategy.

Compliance Action without inherent desire.

Cooperation, however, endures as a more difficult idea to measure due to the fact that it implies internal agreement with actions. A target acting as the source reveals compliance, but true cooperation may not be determined without an assessment of the target's internal reasons for compliance. Thus, there can be compliance without cooperation.

Cooperation Implies internal agreement with actions.

In a supply chain partnership, cooperation needs to be the key driver of strategy, and the presence of compliance would essentially void a true partnership. The use of coercive power

will cause compliance and eradicate a partnership. Thus, the major compliance and cooperation questions addressed when establishing supply chain partnerships are as follows:

- Can cooperation exist in a mediated power-driven supply chain partnership relationship?
- Do relational power strategies actually enhance cooperation and strengthen a supply chain partnership?

Power and Conflict

Conflict Tension between two or more social entities that arises from incompatibility of actual or desired responses.

Conflict can be defined as "tension between two or more social entities . . . which arises from incompatibility of actual or desired responses. Conflict is present in the supply chain when one supply chain member hinders goal attainment and performance of another. Conflict is an omnipresent factor in any supply chain relationship" (Maloni & Benton, 2000).

Conflict will obviously be harmful if not extending to supply chain partnerships. Subsequently, the critical issues for establishing supply chain partnerships are the following:

- Does a power imbalance in a supply relationship create a level of conflict that will harm and subsequently destroy a supply chain partnership?
- Does use of relational power strategies decrease conflict and promote a supply chain partnership?
- How does power affect conflict resolution?

Power and Satisfaction

Satisfaction The extent of contentment with the relationship.

Satisfaction in the supply chain can be defined as the extent of contentment with the relationship. Ultimate supply chain partner satisfaction remains the overriding factor in determining the future of a supply chain partnership. Drivers of satisfaction within supply chain partnerships include relationship-oriented factors such as planning, mutuality, interdependence, and operational information exchange. Without satisfaction, supply chain members will be unable to generate the psychological factors such as trust, commitment, and goodwill necessary for the partnership to be sustained. Subsequently, the critical issues for establishing supply chain partnerships are the following:

- How does power influence satisfaction within the supply chain?
- Within a power imbalance, can the target firm experience sufficient levels of satisfaction to retain commitment to the supply chain relationship?
- Within a power imbalance, can the source firm retain sufficient levels of satisfaction to retain commitment to the supply chain relationship?

Power, Performance, and Profitability

Performance The ability to execute intentions and goals.

A final point on the effects of power concerns the ultimate performance and subsequent profitability of the supply chain members, as well as the supply chain itself. **Performance** may be defined as the ability to execute intentions and goals. Supply chain member performance

can be affected by power, as well as countervailing power. An example of countervailing power is the formation of a trade union to offset business's excessive advantage of power. The use of mediated power sometimes erodes performance of the target, while use of nonmediated power will improve the target's opinion of the source's performance.

There are two implications for supply chain partnerships, one negative and one positive. First, it appears that a power source can benefit from increased profitability and performance through use of such power, suggesting that a partnership may not be necessary for the source's own success. On the other hand, nonmediated forms of power can actually help performance, supporting the notion of a true win–win partnership. Thus, important issues for establishing supply chain partnerships are the following:

- How does power influence source performance and profitability in a power-asymmetric supply chain relationship?
- How does power influence target performance and profitability in a power-asymmetric supply chain relationship?
- How does power influence supply chain performance and profitability in the supply chain?

Automobile Industry Example of Power Asymmetry

The automobile industry in the United States represents a breeding ground for power research. The industry consists of five manufacturers (GM, Ford, Chrysler, Honda, and Toyota) that account for 85% of market share, and these manufacturers source from a supplier base of thousands. Such an oligopolistic buying structure has created a power-asymmetric environment. With a few manufacturers comprising a large percentage of the suppliers' sales, the supplier must bow to the authority of the buyers or risk financial collapse. To compound the problems created by the power imbalance, firms in the automobile industry face intense competition. Each year, the manufacturers are pressed to build higher-quality, more technologically advanced cars while maintaining competitive prices. Such pressure directly affects the supplier base. The industry power imbalance has allowed the manufacturers to relinquish many of the responsibilities for product and process improvement to the suppliers. These first-tier suppliers are the key to maintaining the competitive capacities of the manufacturers, and those suppliers that cannot perform are systematically exiled to financial ruin.

To recognize the synergy from coordination between manufacturers and suppliers as well as among the suppliers themselves, there has been an industrywide inclination toward integration of the supply chain. The members of the supply chain synthesize processes and strategies, allowing the entire supply chain to work together to attack pressures from cost reduction, faster cycle times, and increased quality benchmarks. Supply chain management grants the supply chain a potential source of competitive advantage and will become an increasingly important part of the industry strategy.

Manufacturers in the automobile industry have been aware of their power advantage, and suppliers have long suffered from competitive, coercive power influences from these manufacturers. The use of such coercive strategy is best exemplified by General Motors. As the largest manufacturer in the industry, General Motors purchased over $30 billion of components and materials from suppliers in 2019. General Motors has capitalized on its

buying power, maintaining a demanding attitude in its supplier relations. It is the power source that must enact the change in the relationship but needs some motivation to change its opportunistic tendencies.

SUMMARY

LO 11.1 Identify the elements of the supplier chain partnership Chrysler initiates with its suppliers that makes it an industry benchmark.

Chrysler invited several key suppliers into the early stages of the development process and actually presourced 95% of the component parts for its new sedan by choosing vendors prior to the design stage. Chrysler leaves a significant portion of the assembly to suppliers, cutting its own costs and increasing overall production efficiency in the process.

LO 11.2 Describe the levels of supply chain partnerships and give an example of each.

Partnerships move beyond special influence transactions by involving efforts of both firms to coordinate functional activities. Partnerships can be segmented into three tiers based on the intensity and duration of the leadership. The automotive industry is an excellent example of Tier 1–3 supply chain partnerships. Despite a formal definition of partnering, the orientation of partnership activities in practice is often vague.

LO 11.3 Explain how supply chain partnerships can lead to a reduced supplier base.

Many Asian and American firms have recognized the benefits of the opposite concept of single sourcing, which leads to an abatement of adversarial attitudes, lower switching costs, and decreased shipping errors. The association with the single source also can lead to quantity and relationship-based discounts as well as a decreased cost of quality. Some supply managers argue that implementation of many new manufacturing techniques necessitates a reduction in the number of suppliers. The two primary factors of Asian production techniques are reduced supplier lot sizes and single sourcing.

LO 11.4 Discuss the potential benefits of buyer–supplier partnerships.

Traditionally, U.S. firms have based their drive for success on autonomy and have viewed competition as a Darwinistic keeper of American superiority. Long-run U.S. firm planning has been independent, and considerable efforts are made to ensure privacy of corporate information.

Over recent decades, however, firms within the supply chain have begun to realize the advantages enjoyed from sharing of technology, information, and planning with other firms, even competitors, and many modern business thinkers will claim that a more open and relational attitude is not only advantageous but actually essential to maintaining a competitive advantage. Supply partnerships emphasize direct, long-term association, encouraging mutual planning and problem-solving efforts.

LO 11.5 Discuss the power component of supply chain relationships.

Extremely complex in nature, power serves as a composite relationship–oriented variable, affecting both the target and the source in many transparent as well as concealed ways. We examined the effects of influence strategies on critical relationship factors including dependence, commitment, compliance, cooperation, conflict, satisfaction, performance, and profitability. Exploration of the effects of power on factors of the supplier–buyer alliance provides the key to understanding the concept of the power-partnership link under investigation.

Buying organizations tend to use noncoercive influence strategies, which are logically supported by the idea that use of coercion may risk the buying organization's power advantage. The use of mediated power by the buying organization forces the supplying organization to be committed to maintain the relationship for its sustenance, but genuine psychological commitment is lower due to the resentment over the subordinate situation. On the other hand, the use of nonmediated power by the buying organization can increase true commitment.

KEY TERMS

Commitment 258
Compliance 259
Conflict 260
Cooperation 259
Performance 260
Power 257
Power asymmetry 252
Satisfaction 260
Special influence transaction 250

DISCUSSION QUESTIONS

1. What is the definition of a supply partnership?
2. What are some of the benefits of supplier partnerships?
3. What are the critical implementation factors?
4. What are some of the risks associated with supplier partnerships?
5. What is the definition of supply chain power?
6. What are the critical success factors for supply chain partnerships?
7. What factors do power have influence over in the supply chain?
8. How is supply chain power associated with the purchasing function?

SUGGESTED CASES

Case 15: The K-Car Airbag Assembly

Case 19: Michigan City Tractor (MCT), Inc.

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12 Total Quality Management (TQM) and Purchasing

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

12.1 Explain the relationship between total quality management (TQM) and supply chain management.

12.2 Identify TQM implementation challenges.

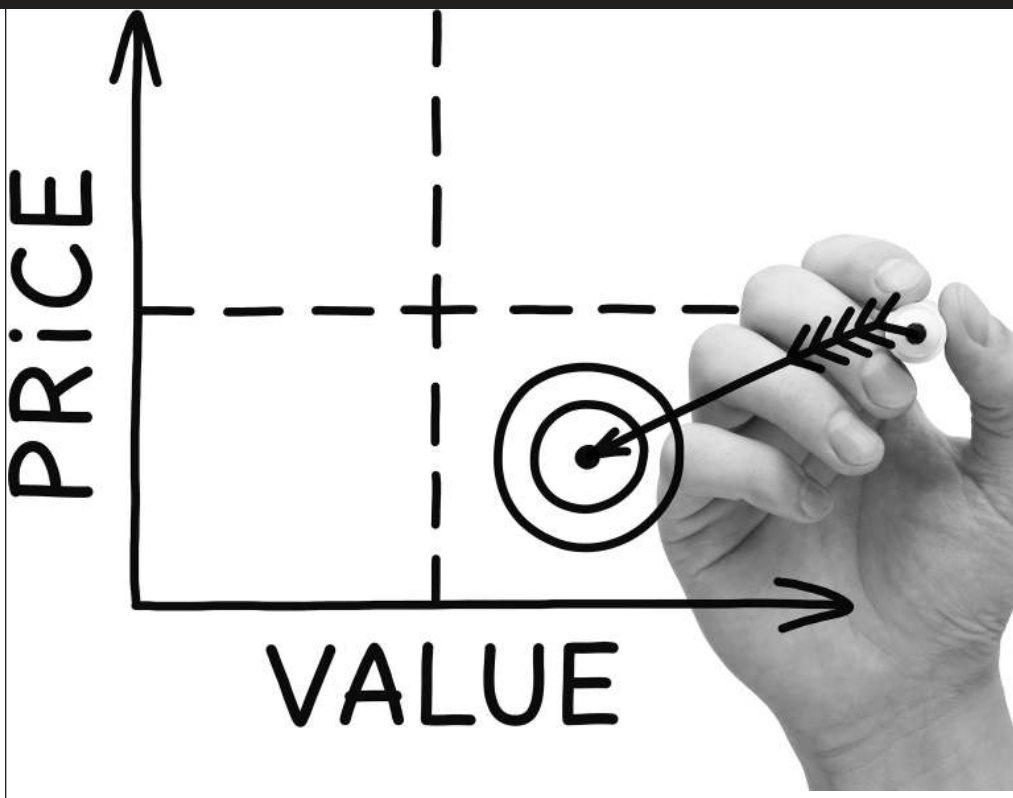
12.3 Describe how the supplier satisfies the buying firm's performance expectations.

12.4 Demonstrate how to use statistical process control for detecting quality variation.

12.5 Discuss the various quality awards and certifications earned by suppliers.

12.6 Explain the importance of continuous improvement.

12.7 Explain how cost is influenced by design quality.



On March 2, 2020, Kalie Houston, the global sourcing manager for Honda Engine, in Anna, Ohio, was interrupted. James Kelley, QA manager, burst into Kalie's office, exclaiming, "The report is back from the QC lab. Wang's shipment of crankshafts has been rejected due to inferior bearings." Wang, LTD, is located in Chengdu, China. Kalie was shocked! This was Wang's third shipment of the crankshafts. The first two shipments were high-quality.

INTRODUCTION

Total quality management (TQM) expands beyond the traditional view of quality. Japanese automobile manufacturers have captured almost 30% of

the American automobile and electronics markets by offering high-value products. In response to the boom in competition, many American firms have implemented a variety of progressive quality programs. Effective TQM requires the integration of production planning, marketing, engineering, distribution, and field service. TQM is a continuous improvement process. It reaches much wider than the traditional quality view of incoming inspection and process control—it means the entire organization is working as a team, including top management and each and every employee. TQM is an innovative way of thinking that affects the culture, strategy, and technology of a company. Implementing TQM requires the following:

- Defining the mission
- Identifying systems output
- Identifying customers
- Negotiating customer requirements
- Developing a "supplier specification" that details customer requirements and expectations
- Determining the necessary activities required to fulfill those requirements and expectations

Purchasing is a critical process that total quality management should focus on. Without high-quality raw materials or component parts from suppliers, a quality management program will not be successful. Therefore, any firm that wishes to achieve a high level of total quality management must carefully examine its purchasing process.

A managerial approach to a TQM-driven organization is based on the commitment of customer satisfaction of all employees and supply chain members. There must be a complete cultural focus on continuous improvement.

To compete in today's competitive markets, firms have to involve their suppliers in the early stages of their product design and development. Firms need to provide suppliers with the notion that the entire supply chain is responsible for the ultimate product or service. For example, Honda does not inspect the incoming materials from its suppliers; it works closely with its suppliers to improve the quality of incoming materials and holds suppliers responsible for any defects that eventually affect Honda's production.

However, the value of a supplier sharing information about the quality distribution (i.e., dimensional mean or variance) of components with an assembler who matches such parts with the selective assembly of an intermediary component remains an open problem. As an example, Honda's supplier does not currently provide any information about the crankshafts' diameter measurements to Honda, prior to delivery, thus binning is based on historical crankshaft data. In a recent study, we show that such shared information can save Honda thousands of dollars annually in inventory-related costs for bearings (Clottey & Benton, 2019).

One of the potential problems in establishing long-term relationships with a few key suppliers is that a supplier may have increasing power in the supply chain and may ask for more than the market price. To solve this problem, a firm usually has one key supplier for each item and a few other backup suppliers. The firm usually works closely with the key supplier and gives more than half of the order volume to the key supplier to gain the economies of scale. The key suppliers usually get the long-run demand forecast and are involved in the

manufacturer's product development. The backup suppliers usually get a small volume of business and do not have a close working relationship with the manufacturer.

TOTAL QUALITY MANAGEMENT AND SUPPLY CHAIN MANAGEMENT

LO 12.1 Explain the relationship between total quality management (TQM) and supply chain management.

Today successful organizations rely on their suppliers more than ever before. In general, supplying organizations are extensions of the buying organization. The product quality and manufacturing processes of the supplying organizations have a significant effect on the acceptance of the buying organization's final product. The incentive for the supplier is a long-term contract. In other words, the entire supply chain must practice TQM. TQM expands the traditional view of quality, from looking only at the quality of the final product or services to looking at the quality of *every aspect of the process* that produces the product or service. TQM systems are intended to prevent poor quality from occurring. Table 12.1 illustrates the differences between cultures of a TQM organization and a more traditional organization.

Practicing TQM throughout the supply chain will lead to a competitive advantage for the supply chain as well as the members. In some cases, the procurement specifications released by buying organizations are flawed, and the supplying organizations often remain

TABLE 12.1
Traditional Versus TQM Organizations

Aspect	Traditional	Total Quality Management
Overall Missions	Maximize return on investment	Meet or exceed customer expectations
Objectives	Emphasis on short term	Balance of long term and short term
Management	Not always open; sometimes inconsistent objectives	Open; encourages employee input; consistent objectives
Role of manager	Issue orders; enforce	Coach; remove barriers; build trust
Customer requirements	Not highest priority; may be unclear	Highest priority; important to identify and understand
Problems	Assign blame; punish	Identify and resolve
Problem solving	Not systematic; individuals	Systematic; teams
Improvement	Erratic	Continuous
Suppliers	Adversarial	Partners
Jobs	Narrow, specialized, much individual effort	Board, more general; much team effort
Focus	Product oriented	Process oriented

silent. This practice will not produce the best outcomes for the supply chain buyer–seller relationship. The needs and expectations of the ultimate customer must be considered throughout the supply chain. Supply chain TQM effectiveness will become a competitive weapon for future buyer–seller relationships. Buying organizations must realize the following activities:

- Select supplying organizations that have a TQM supply chain philosophy.
- Replace suppliers that ignore the TQM supply chain philosophy concept.
- Investigate customer requirements and include supplying organizations in the new product development process.

TQM IMPLEMENTATION PROBLEMS

LO 12.2 Identify TQM implementation challenges.

The implementation of the TQM philosophy is not easy. There have been varying levels of success. Among the factors cited in the literature are the following:

- Lack of a quality focus throughout the supply chain: There are no measurable implementation goals.
- There is no sense of urgency for change throughout the buying organization: There is no strategic plan for change.
- There is no customer or supplier focus: Without customer and supplier focus, there is a risk of customer and supplier dissatisfaction.
- There is minimal positive communication throughout the buying organization: The lack of communication leads to confusion throughout both the company and the supply chain.
- The buying organization's employees are not integrated and involved in the TQM philosophy: This lack of employee involvement will lead to serious trust problems internally and externally.
- Lack of long-term view throughout the buying and supplying organizations.
- Lack of long-term view throughout the supply chain.
- Lack of leadership internally and externally.

QUALITY REQUIREMENTS FOR SUPPLIERS

LO 12.3 Describe how the supplier satisfies the buying firm's performance expectations.

In the competitive business of supply chain activities, quality is first defined in terms of the relationship between the buying and selling organization. The important thing is not confined to the quality of a specific item but the satisfaction of a specific need.

Quality Assurance Expectations

The suppliers' quality assurance systems must be consistent with the in-house quality requirements of the customer. Thus, the stated targets and expectations of the customer must meet the minimum level of performance. In cases where the quality target expectations are not achieved, the system must be programmed to rapidly respond to return to the agreed-upon quality targets. The typical life cycle of key component parts in a manufacturing setting are *part approval for production* (component part approval) and *production quality management* (process control).

Quality Target Commitment

Each buying firm must specify in detail the agreed-upon quality targets. As an example, at a minimum, the following four issues should be addressed in any purchasing contract:

1. *PPM (parts per million) target agreement.* The PPM value is determined by the number of rejected parts divided by those delivered and then multiplied by 1,000,000 (PPM = 1,000,000 x number of rejects/total quantity delivered).
2. *Field failure and reliability requirements.* Field failures can be devastating for most firms. It is difficult to precisely quantify a field failure. Thus, there should be zero defects in the field.
3. *Warranty agreement.* In the unlikely case of a field failure, there should be a warranty agreement that covers the reimbursement of all costs (e.g., parts, repair, and handling costs) related to the field failure.
4. *Urgency to solve problems.* The speed to solution of any quality variance is vital. Customer satisfaction is usually directly related to the speed with which the solution was achieved.

Preventive Quality

The idea is to detect quality problems before they occur. There is a need to monitor the output of a process as it occurs and identify the process changes sometime after they occur. When a variation is identified, the process is stopped and the operating cause is determined. Appropriate corrective action is then taken to prevent the production of more defects. Statistical process control techniques are used to detect the specification variations.

Strategic Components

Strategic components are the most critical parts in a project or platform and require more extensive quality assurance requirements. Strategic components generally meet one or more of the following criteria:

- Supplier participation in the designing of the component part
- A high level of systems integration required for a complex component part
- An expensive component part
- Long lead time for the component part

- Component parts that require extensive testing
- Parts with critical characteristics
- Component parts with complex legal implications

All strategic components should be required to go through a rigorous parts quality assurance (PQA) process. The PQA process validates the quality supplied to the buying firm and is a formal process that requires documentation. The general steps of a PQA process are given here:

1. Review the technical specifications.
2. Validate the reliability of the design characteristics.
3. Develop and document a quality assurance plan.
4. Identify the need for a tooling plan.
5. Perform a preprocess audit.
6. Perform a legal and governmental conformity audit.
7. Perform a packaging analysis and plan.
8. Project the effect of a process mode failure.
9. Develop a statistical process control plan.
10. Perform a production test run.
11. Perform a process audit.
12. Develop a part-handling plan.

The new or modified part agreement between the buying and selling firm is complete after an acceptable final test sample has been generated and verified.

STATISTICAL PROCESS CONTROL, SIX SIGMA, AND THE TAGUCHI METHOD

LO 12.4 Demonstrate how to use statistical process control for detecting quality variation.

The traditional approach to manufacturing process control is to select production samples and compare the attributes/variables of the sample to the specifications. If the product does not meet specifications, the product is either reworked or scrapped. This method of process control is reactive and expensive. The goal should be to prevent process errors before they occur.

Statistical Process Control (SPC)

Statistical process control (SPC) can resolve this manufacturing process control issue. SPC normally uses two control charts to ensure quality in manufacturing: the sample mean (X-bar) chart and the sample range (R) chart. The specification limits are established for X-bar and R charts based on tolerances set during the design stage of the product. Samples of purchased and in-process parts are taken and measured to check if they lie within control

Statistical process control (SPC) The use of statistical techniques to control a process or production method.

limits. The sample mean is plotted on an X-bar chart, and the range of the sample is plotted on an *R* chart. Over time, the trends of samples are analyzed to detect trends that may predict the disposition of the process. In most cases, problems are diagnosed and resolved before any substandard parts are produced, thus reducing scrap and rework (see Figure 12.1).

The specification is a description of the required output, including specific characteristics such as weights and measurements that enable the product to work in a manner acceptable to the consumer. There is always flexibility in specifications, no matter the level of design precision. As an example, if a bottle of motor oil should have 32 ounces of liquid, it is unlikely that the customer would mind (or would notice) if some bottles contained 32.1 ounces or 31.9 ounces instead of precisely 32 ounces all the time.

The upper control limit (UCL) is the highest fill level (expected based on the sample distribution) without causing an error, and the lower control limit (LCL) is the lowest fill level (expected based on the sample distribution) without causing an error. Consider that for the motor oil example, the UCL is 32.3 ounces and the LCL is 31.7 ounces. Thus, if a can of motor oil exceeded 32.3 or was less than 31.7, that can would fall outside of the acceptable product specification limits and would be rejected by the customer, as can be seen in Figure 12.2. The control limits of a process control chart refer to the sample. Characteristics (e.g., means and ranges) are used to identify whether the process is in control, as an example, to detect assignable

FIGURE 12.1
Basic Quality Control Charts

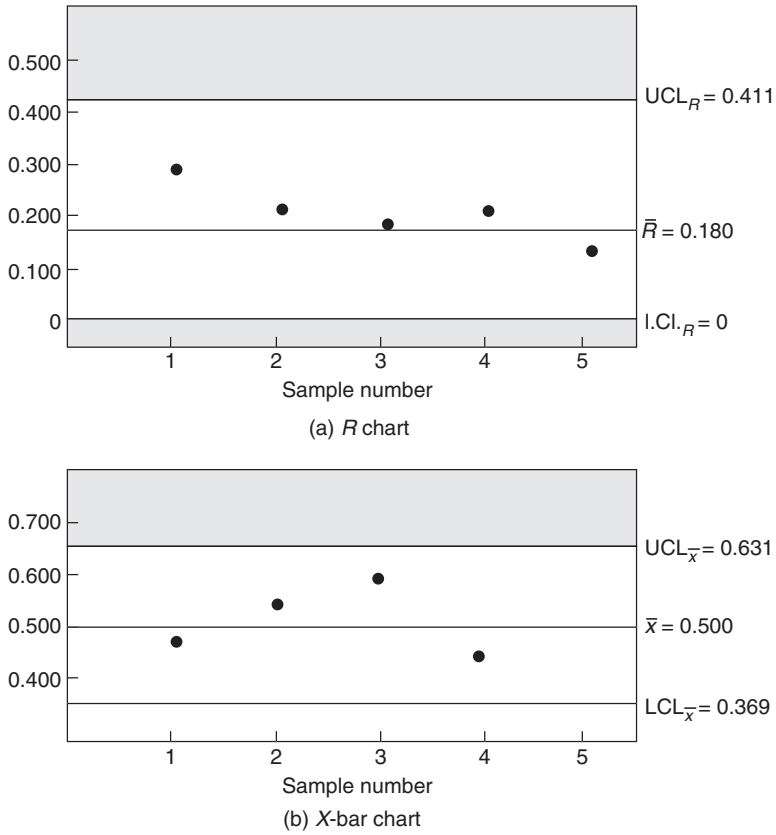
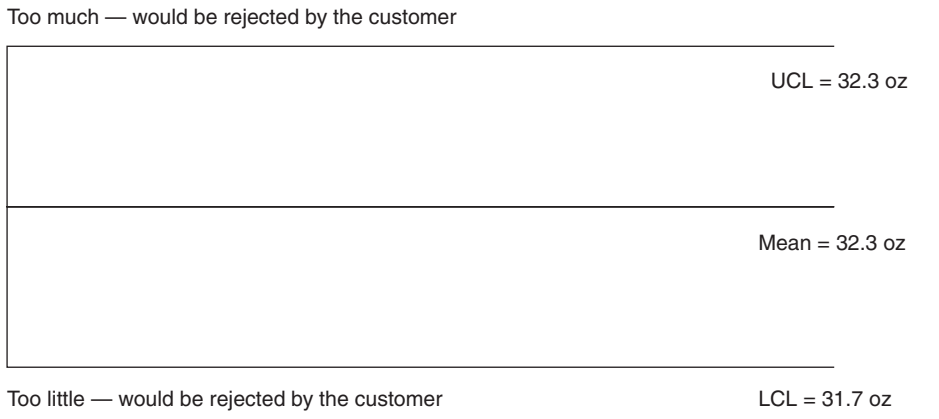


FIGURE 12.2
Control Chart



cause (as opposed to common or random cause) variation, which may lead to more-than-expected defects. It would be possible to have a unit outside of the product specifications, but the sample measurement could still be within the process control limits. The UCL/LCL process control limits and the upper/lower product specifications are related but different.

The dividing line between the UCL and the LCL is the mean. In most cases, the products produced should fall close to the mean. Of course, the normal distribution is assumed when implementing traditional SPC. The central limit theorem provides the justification for the normality assumption. In other words, the SPC chart represents a normal distribution turned on its side, as shown in Figure 12.3. As seen in Figure 12.3, most of the units fall close to the mean, but production process variances result in several observations falling outside the specifications. Product variance is synonymous with production errors. As we know from basic statistics, variance is defined as the average of the squared deviations from the mean, and the standard deviation (sigma) is defined as the square root of the variance. The standard deviation is actually the average distance a normal point is from the mean. Thus, the standard deviation represents a more tractable measure of the variance. Given the normal curve, 68% of the values fall between plus and minus one standard deviation, which alternatively means that 32% of the production process output would be rejected. On the other hand, a process control system where 95% of the production values fall between plus and minus two standard deviations (two sigma) represents a production process where only 5% of the output would be rejected. A process control system that is set at three sigma results in a false rejection rate of 0.3%. It is important to note that increasing sigma does not widen the acceptable specification limits. The control limits are actually set by customer specifications, and the specifications remain constant. To increase the sigma level, the production process variance must be reduced. Please refer to Figure 12.4. SPC is then used to detect when the process is (becoming) out of control.

As can be seen from the examples, six sigma requires a near elimination of production process variance. Six sigma will result in variances of 3.4 defects out of every 1 million parts produced. Six sigma is impressive as it represents a variance reduction of approximately 1,800 times greater than the case of four sigma.

If the buying firm has implemented six sigma, the strategic suppliers also should apply six sigma. Six-sigma standards can be applied to both manufacturing and service firms using the same

FIGURE 12.3
SPC Chart

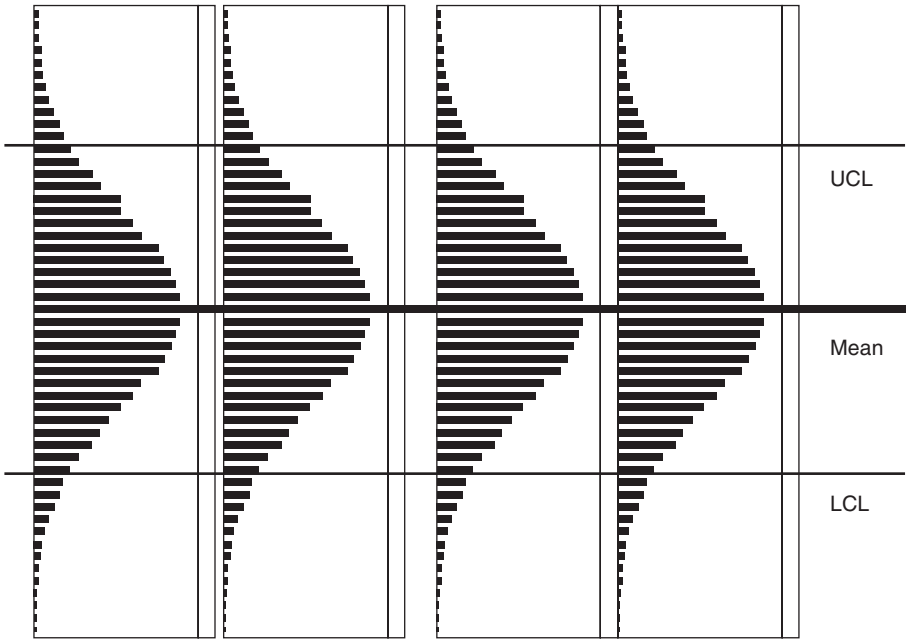
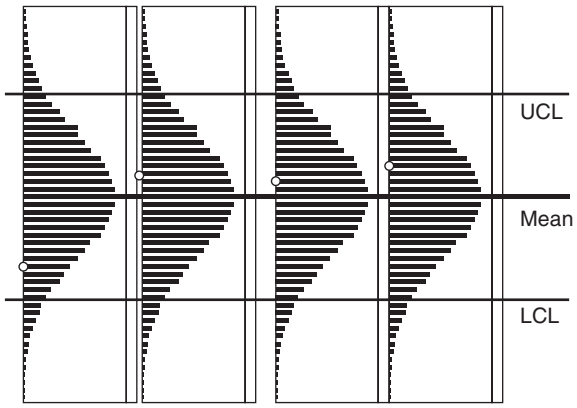
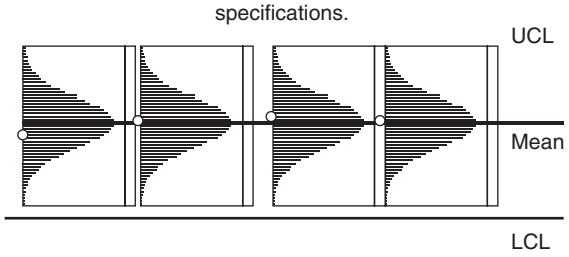


FIGURE 12.4
SPC Chart Indicating Out-of-Control Process

(a) High variance. Many products produced (represented by the dots) fall outside of customer specifications.



(b) Low variance. Very few products produced fall outside of specifications.

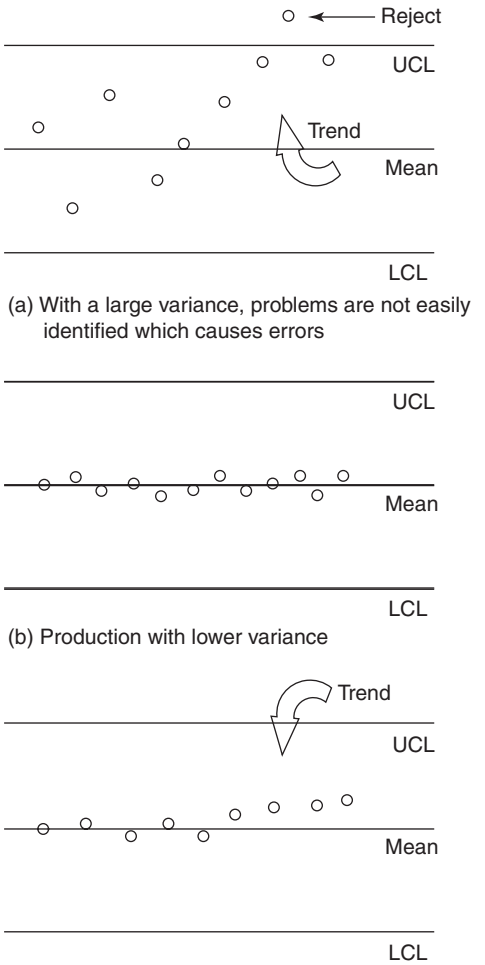


methodology. SPC provides input to the six-sigma approach. However, if a firm is not currently using SPC, it is not necessary for the implementation of six-sigma standards. In most instances when a firm is able to reduce variation, it is also able to identify the potential problems before they occur. As an example, if there is a systematic trend inconsistent with the normal distribution, in most cases the firm would be able to correct whatever was causing the variation before the problem forced production outside of the control limits. The ability to identify errors before they occur reduces scrap material, eliminates downstream inspections, and increases profitability.

Six Sigma and the Supplier

Six sigma is a way to measure supplier quality. Supplying firms that follow the core philosophy of six sigma will make excellent strategic partners. Six-sigma suppliers focus on (1) defects per million as a standard metric, (2) extensive employee training, and (3) the reduction of non-value-added activities. If there is a pattern not consistent with the normal

FIGURE 12.5
Inconsistent Distribution Pattern UCL

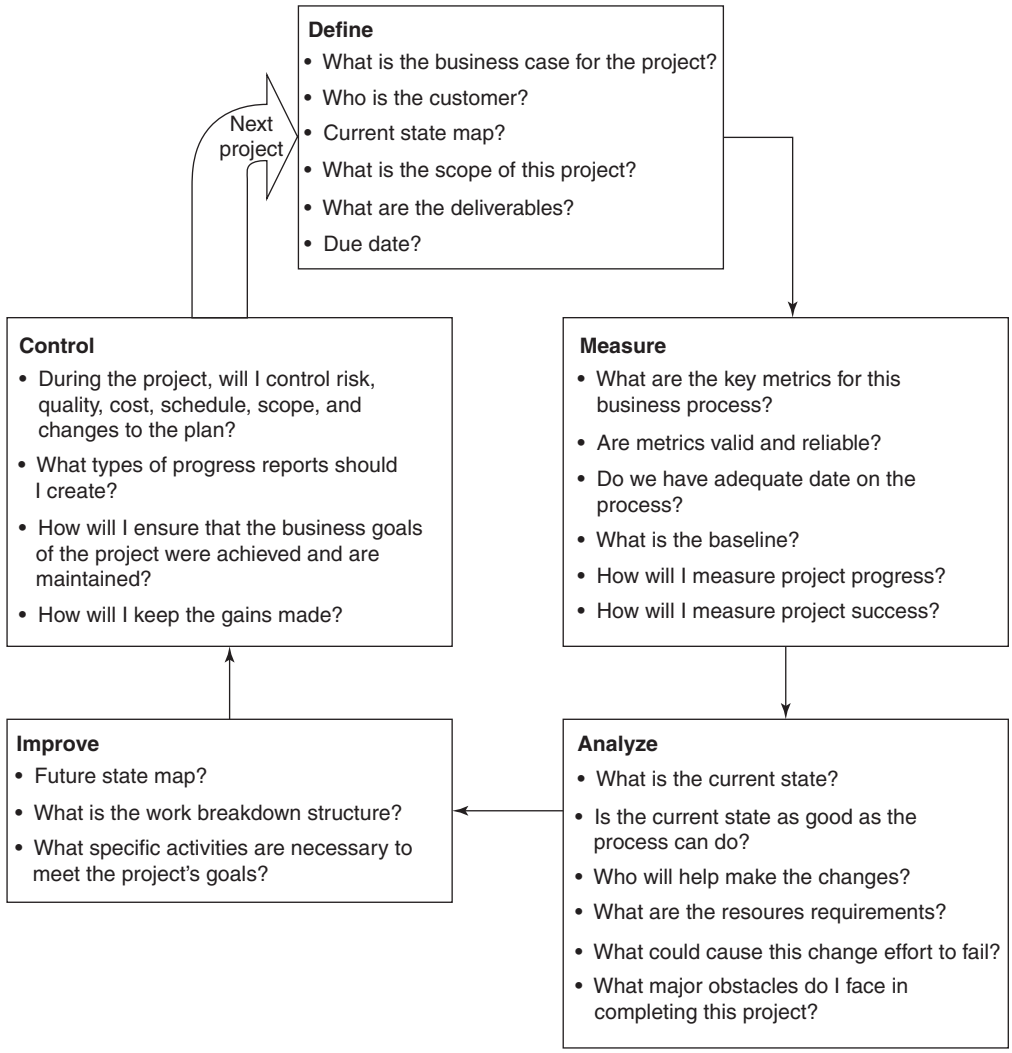


distribution, corrective action could be taken, as shown in Figure 12.5. There are a number of six-sigma implementation approaches. Two of the most successful six-sigma implementations are those of Motorola and General Electric. The well-known General Electric approach to six-sigma problem solving is shown in Figure 12.6.

Taguchi Method

While it is apparent that SPC does improve quality, the improvements tend to be incremental. Next, we attempt to address some of the shortcomings of the SPC method by reviewing the Taguchi method. See Appendix A for a tutorial on the Taguchi method (TM) (also see Benton, 1991).

FIGURE 12.6
Six-Sigma Problem-Solving Approach
Six-Sigma Project DMAIC Cycle Questions*



*DMAIC = define, measure, analyze, improve, and control

The TM nicely complements many of the advantages of SPC. Nevertheless, TM has some problems. First, although the basic ideas of TM are simple, the statistical procedures are complex and can be difficult to implement. Many managers and engineers do not have the basic statistical tools essential for the understanding of TM procedures. Even with high-speed computers and statistical techniques for simplifying analysis, testing the interactions for off-target parameters can be time-consuming and costly in systems with hundreds of interactions.

Second, unlike SPC, quantifying quality losses in terms of "losses to society" is almost impossible. Thus, many American manufacturing firms have only implemented SPC alone because of its statistical simplicity and its reliance on measurable costs of poor quality. Typically, TM increases overhead without offering benefits that can immediately be quantified. As a result, from a financial standpoint, full implementation of TM cannot be easily cost justified, even though the Japanese have demonstrated the desirability of the method. On a long-term basis, TM gives the firm strong competitive advantage, which results from increased customer acceptance of superior products. If quality were considered as a line function instead of an overhead expense, its costs could be managed, not merely accounted for. Under this scenario, implementing TM would encounter less resistance since it would not drive up overhead.

Finally, some of the methods that Taguchi employs have been challenged by mainstream statisticians. There is now literature documenting the formal statistical shortcomings of TM. If industry can critically evaluate the statistical shortcomings of TM, it may result in a viable alternative to conventional quality assurance methods.

Acceptance Sampling and Commodity Components

Commodity-based components are those not defined as strategic components. Intensive price competition and information technology have led to the implementation of a reverse auction procurement approach for commodity components. However, prequalification of suppliers and incoming inspection have become more important.

Acceptance sampling is a methodology used to determine whether to accept or reject a batch of nonstrategic components or items. In most cases, incoming purchased parts are inspected before placing the parts into inventory. Sampling is usually used to decide whether to accept or reject a batch. (See Appendix B for an illustration of the acceptance sampling process.)

QUALITY AWARDS AND CERTIFICATIONS

LO 12.5 Discuss the various quality awards and certifications earned by suppliers.

There are major quality awards that ensure suppliers are TQM effective. The most universally known quality awards are the Deming Award and the Malcolm Baldrige National Quality Award (also see Deming, 1987).

The Deming Prize

Dr. W. Edwards Deming (1900–1993) is known as the father of the Japanese postwar industrial revival and was regarded by many as the leading quality guru in the United States. Trained as a statistician, his expertise was used during World War II to assist the United States in its effort to improve the quality of war materials. The Japanese Union of Scientists and Engineers (JUSE) created the first major management award for "contributions to quality and product dependability."

JUSE's Deming Prize Committee administers two types of awards honoring Deming: the Deming Prize and the Deming Application Prize. The Deming Prize is given to a person or group of people who have advanced the practice and furthered awareness of TQM. The Deming Application Prize, in turn, goes only to companies based on successes attributable to implementing TQM.

Interestingly, this most significant of Japan's business awards honors the American, Deming. Many Japanese government and academic leaders credit Deming with revolutionizing Japanese postwar industry through his advocacy in Japan of quality control and managerial efficiency.

Dr. Deming is best known for his contributions in the area of statistical process control. He also suggests a 14-point system for successful quality management:

1. Create consistency of purpose with a plan.
2. Adopt the new philosophy of quality.
3. Cease dependence on mass inspection.
4. End the practice of choosing suppliers based on price.
5. Find problems and work continuously on the system.
6. Use modern methods of training on the job.
7. Change from production numbers to quality.
8. Drive out fear.
9. Break down barriers between departments.
10. Stop asking for productivity improvement without providing methods.
11. Eliminate work standards that prescribe numerical quotas.
12. Remove barriers to pride of workmanship.
13. Institute vigorous education and retraining.
14. Create a structure in top management that will push every day on the above 13 points.

The Malcolm Baldrige National Quality Award

In 1987, Congress established the Malcolm Baldrige National Quality Award. It was initiated as a result of foreign firms increasingly dominating American markets. The Malcolm Baldrige Award is much more than an award; it is equivalent to a mini revolution in the business world. As a result of this award, all major firms in America have established continuous improvement quality programs (also see Juran & Grynan, 1980).

The Malcolm Baldrige Award has led to a national quality campaign, and hundreds of major U.S. firms have enlisted in this total quality management competitive weapon. To qualify for the award, applicants must address the following categories:

1. *Leadership.* This includes senior executives' personal leadership and involvement in creating and sustaining customer focus and clean and visible quality values. Also examined is how the quality values are integrated into the company's management system and reflected in the manner in which the company addresses its public responsibilities.

2. *Information and analysis.* This includes the scope, validity, analysis, management, and use of data and information to drive quality excellence and improve competition performance. Also addressed is the adequacy of the company's data, information, and analysis system to support improvement of the company's product, services, and internal operations.
3. *Strategic quality planning.* This includes the company's planning process and how all key quality requirements are integrated into overall business planning. Also examined are the company's short- and long-term plans and how quality and performance requirements are deployed to all work units.
4. *Human resource development and management.* This includes the key element of how the company develops and realizes the full potential of the workforce to pursue the company's quality and performance objectives. Also examined are the company's efforts to build and maintain an environment for quality excellence conducive to full participation and personal organizational growth.
5. *Management of process quality.* This includes the systematic processes used to pursue even higher quality and company performance. The key elements of process management are design, management of process quality for all work units and suppliers, systemic quality improvement, and quality assessment.
6. *Quality and operational results.* This includes the quality levels and improvement trends of quality, company operational performance, and supplier quality. Also examined are the current quality and performance levels of competitors.
7. *Customer focus and satisfaction.* Relationships with customers and the knowledge of customer requirements are the key quality factors that determine marketplace competitiveness. This includes methods to determine customer satisfaction, current trends and levels of satisfaction, and competition.

ISO 9000

The ISO standards originated in manufacturing. They are now used to certify a variety of organizations and business concerns. ISO 9001 is a set of standards that document the implementation of a quality program. Most companies require their suppliers to provide a certification that proves they have complied with all ISO 9001 requirements. To be certified, suppliers need to provide documentation to an external examiner that they meet the ISO 9001 requirements. Once a firm is certified, it will be listed in a directory so that all of its potential customers can know which firms have been certified and to what level.

The primary requirements for ISO 9001 are listed here:

- Establishing a set of procedures that cover all key processes in the business
- Monitoring processes to ensure they are effective
- Keeping adequate records
- Checking output for defects, with appropriate and corrective action where necessary

- regularly reviewing individual processes and the quality system itself for effectiveness
- Facilitating continual improvement

A firm independently audited and certified to be in conformance with ISO 9001 may publicly state that it is "ISO 9001 certified" or "ISO 9001 registered." Certification to an ISO 9000 standard does not guarantee any quality of end products and services; rather, it certifies that formalized business processes are being applied. Some companies enter the ISO 9001 certification as a marketing tool.

CONTINUOUS IMPROVEMENT AND THE SUPPLIER

LO 12.6 Explain the importance of continuous improvement.

Continuous improvement in a management context means a continuous effort to detect and eliminate operating problems. The continuous improvement process involves many incremental improvements rather than one major innovation. Continuous improvement is a philosophy.

In most industrial settings, there is aggressive competition for market share. To successfully achieve a zero-defect target, buying and supplying organizations must continuously improve their processes.

The objective of the continuous improvement process is to incrementally improve processes. Continuous improvement teams are established to accomplish process improvements. The continuous improvement teams are focused on the expectations and requirements of internal and external customers. Top management must implement the continuous process. The employees must be trained and motivated by top management. An actual continuous improvement program between a buying and supplying organization is given in Figure 12.7.

Quality Function Deployment (QFD)

Quality function deployment (QFD) The process of understanding customer expectations and how well providers of products address these expectations.

Quality function deployment (QFD) focuses on how businesses develop high-quality products for their customers. QFD is driven by cross-functional market research. This is the process of understanding customer expectations and how well providers of products address these expectations. Customer expectations include (1) function, (2) appearance, (3) maintainability, and (4) reliability. It is impossible to consistently design products that will attract customers unless businesses understand what customers want. The customer information is then processed by marketing. Quality function deployment (QFD) is a methodology for collecting information on customer expectations to drive product development.

Supplier Evaluations

The buyer's evaluation of the supplier's performance is a catalyst for the supplier development activities. There are two main categories for the supplier evaluation: process-based evaluations and performance-based evaluations.

The process-based evaluation is an assessment of the supplier's production or service process. Typically, the buyer will conduct an audit at the supplier's site to assess the level of capability in the supplier organization's systems for costing, quality, technology, and other specific

FIGURE 12.7
Continuous Improvement Example

ABC CONTROLS	Continuous improvement WW-P0S-ST (06-01-01)	Rev 01	Page 1 of 2
Rev Level 01	**Revision Date 30-Oct-2021**		**Description of Changes**

Continuous improvement (CI) in all areas of business is fundamental to remaining competitive in the automobile industry, We expect each supplier to embrace the CI concept at all levels of the organization and in all areas of its business. Although the actual details will vary from supplier to supplier, the following list details the basic elements of a CI system:

- Supplier leadership commitment to continuous improvement
- Cross-functional continuous improvement teams
- Data-driven improvement based on key measures (using a QOS/MOS format)
- Regularly scheduled reviews
- A quality system in place that allows improvements to be embodied in the normal operating procedures of the business

It is essential that key business measures (defined by you and your customers' expectations) are established and tracked. We expect that quantifiable improvement will be pursued in these areas, even if there is currently no perceived problem. *Examples* of key areas for improvement are

- Unscheduled machine downtime
- Machine setup, die change, and machine changeover times
- Excessive cycle time
- Scrap, rework, and repair
- Non-value-added use of floor space
- Less than 100 percent first-run capability
- Test requirements not justified by results
- Waste of labor and materials
- Excessive cost of nonconforming product
- Difficult assembly or installation of the product
- Excessive handling and storage
- New target values or optimize customer processes
- Marginal measurement system capabilty

ABC Controls has a Supplier Continuous Improvement Group dedicated to working with our suppliers to improve efficiency and eliminate waste. As part of our commitment to our suppliers, we will work to create an environment that promotes continuous improvement and train their employees how to continue the process on their own with the support of ABC Controls materials.

factors. Process flowcharts can be developed to identify the non-value-added activities that should be eliminated to improve the business efficiency. Increasingly, large buying organizations are demanding that their suppliers should become certified through a third-party organization, such as ISO 9000 certification or Malcolm Baldrige National Quality Awards.

The performance-based evaluation is an assessment of the supplier's actual performance on a variety of criteria, such as delivery reliability, cost, quality defect rate, and so on. It is a more tactical assessment and measures the day-to-day actual performance of the supplying firm; hence it is an after-the-fact evaluation. The performance-based evaluation is more common than the process-based evaluation, perhaps because it is reactive and easily measured.

Once completed, the evaluation can be either compared to the buying firm's stated goals or benchmarked to the performance evaluations of the supplier's competitors. The buying firm chooses whether to communicate the evaluation to the supplier.

ENGINEERING AND DESIGN

LO 12.7 Explain how cost is influenced by design quality.

Although engineering and design account for less than 5% of the cost of a product, decisions made in the design phase of product development account for more than 75% of the production cost. When engineering and design are complete, 75% of the cost of production is yet to come, and quality control can impact less than 30% of the product cost.

Preliminary studies indicate that assembly time is roughly proportional to the number of parts assembled. It has been shown that the number of parts in a design can be decreased by 20% to 40% when engineers are told to design the product to minimize the number of parts. One caveat to this is that, in some instances, simply minimizing parts can increase the complexity of manufacture, or require retooling, which increases cost. In general, though, material costs per unit are reduced by cutting the number of parts.

When material costs are reduced, so are the carrying costs. The systems cost of carrying a part in inventory for one year ranges from $500 to $2,500 for a typical manufacturing firm. Obviously, reducing the number of parts that are ordered and held in inventory will reduce these costs significantly. Finally, in a manufacturing facility of more than 500 employees, the cost to modify a design once it has been released for manufacture ranges from $5,000 to $10,000 per change.

In considering these facts, the question is, how can most firms afford not to use the Taguchi method? Even if a complete TM system is not implemented, the introduction of the TM ideas for manufacturing and design engineers would be invaluable. If followed, two simple programs can allow a firm to reap the benefits of TM. First, at least one manufacturing engineer should be assigned to each design team from the start of projects. A manufacturing engineer who is familiar with the precision of machines (process capability) would be invaluable in the parameter and tolerance design phases. The design team should proceed by using QFD techniques. Design and manufacturing engineers must have the means to evaluate and improve the manufacturability of a product during the design phase. This would prevent many of the problems created by "over-the-wall" designs for manufacturing.

Second, after the design team program has been established, all engineers should be educated in the Taguchi philosophy for quality and in the technical tools necessary to implement the philosophy. An awareness of the Taguchi philosophy, with a program to integrate design and manufacturing, is the ingredient many manufacturers need to produce high-quality, low-cost products. SPC alone will only facilitate conformance to design. It will not produce designs that enable firms to compete effectively in the world market in the millennium.

SUMMARY

LO 12.1 Explain the relationship between total quality management (TQM) and supply chain management.

The product quality and manufacturing processes of the supplying organizations have a significant effect on the acceptance of the buying organization's final product. The incentive for the supplier is a long-term contract. In other words, the entire supply chain must practice TQM. TQM expands the traditional view of quality, from looking only at the quality of the final product or services to looking at the quality of *every aspect of the process* that produces the product or service.

LO 12.2 Identify TQM implementation challenges.

The implementation of the TQM philosophy is not easy. There have been varying levels of success. Among the factors cited in the literature are the following:

- Lack of a quality focus throughout the supply chain: There are no measurable implementation goals.
- There is no sense of urgency for change throughout the buying organization: There is no strategic plan for change.
- There is no customer or supplier focus: Without customer and supplier focus, there is a risk of customer and supplier dissatisfaction.
- There is minimal positive communications throughout the buying organization: The lack of communications leads to confusion throughout both the company and the supply chain.

LO 12.3 Describe how the supplier satisfies the buying firm's performance expectations.

The targets and expectations of the customer must meet the minimum level of performance. In cases where the quality target expectations are not achieved, the system must be programmed to rapidly respond to return to the agreed-upon quality targets. The typical life cycle of key component parts in a manufacturing setting are *part approval for production* (component part approval) and *production quality management* (process control).

LO 12.4 Demonstrate how to use statistical process control for detecting quality variation.

Statistical process control (SPC) can resolve this manufacturing process control issue. SPC normally uses two control charts to ensure quality in manufacturing: the sample mean (X-bar) chart and the sample range (*R*) chart. The specification limits are established for X-bar and *R* charts based on tolerances set during the design stage of the product. Samples of purchased and in-process parts are taken and measured to check if they lie within control limits. Over time, the trends of samples are analyzed to detect trends that may predict the disposition of the process.

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KEY TERMS

Quality function deployment (QFD) 278

Statistical process control (SPC) 269

DISCUSSION QUESTIONS

1. Why should the purchasing department be concerned with a firm's overall quality assurance program?
2. What are the quality requirements for suppliers?
3. What is six sigma? What are the differences between statistical process control and six sigma?
4. What is ISO 9000, and why is it important to a purchasing professional?
5. What is the difference between the Malcolm Baldrige Award and ISO certification? Which one is the most important certification if the organization is sourcing globally?
6. Go to the Malcolm Baldrige website at www.nist.gov/baldrige and write a two-page report on one of the most recent award winners.
7. What are the key requirements for TQM?
8. Who needs to be involved in setting TQM standards for suppliers?
9. An aircraft manufacturer is producing landing gear struts that conform to the military specification. However, the manufacturer is experiencing significant quality-related costs. Speculate on the source of the increased quality-related costs.
10. Explain the Japanese approach to TQM. Are there differences between the Japanese and American approaches to TQM?
11. Discuss how TQM affects productivity.
12. What are the advantages of using the Taguchi method?
13. How does the Taguchi philosophy affect the purchasing department?
14. What are the costs associated with implementing a world-class quality assurance program?
15. What is a loss function?
16. What is AQL?
17. What is an OC curve? How is it used?

SUGGESTED CASES

Case 16: The Kemper Engine Plant

Case 19: Michigan City Tractor (MCT), Inc.

Case 29: Worldwide Auto Manufacturers, Inc.

APPENDIX A: THE TAGUCHI METHOD

The Taguchi method (TM) addresses design and engineering (offline), as well as manufacturing (online) quality. This fundamentally differentiates TM from SPC, which is purely an online quality control method.

Taguchi's ideas can be broken down into two fundamental principles. First, quality losses increase as deviation from target occurs, instead of showing zero losses until the arbitrary control limits are exceeded, as

with SPC. The loss function quantifies these "losses to society."

The second principle, the achievement of high system quality through *design* of the manufacturing process, also sets TM apart from SPC. As described, quality is primarily designed and not manufactured into the product. Conventional SPC-based methodologies consider only manufacturing processes that follow predetermined specifications. Manufacturing firms operating in this manner only consider manufacturing and purchasing functions located below the dashed line in Figure 12.8. These firms have clearly disregarded the quality assurance of the design processes as shown above the dashed line in Figure 12.8. Compared with conventional SPC methods, quality assurance at the design stage will greatly reduce the defect level of the design. Testing for manufacturability should be used by the engineers as a means for correcting the initial design. The same testing and correcting actions used at the manufacturing processing stage can be used at the design stage.

Loss Function

The heart of the Taguchi philosophy is the quality *loss function*. Taguchi defines the cost of poor quality as the losses a product imparts to society from the time a product is shipped. This definition sets the Taguchi method apart from the traditional SPC approach to quality, which defines the cost of poor quality chiefly as the cost of scrap, rework, and warranty repair. Taguchi states that any deviation from target reduces the value of the product to society.

Figure 12.9a demonstrates the difference between the SPC "goalpost" approach and the loss function of the Taguchi method. As shown in Figure 12.9a, there is very little difference to the customer between Product A and Product B on the specification scale. The lower specification level (LSL) and upper specification level (USL) are the customer's tolerance intervals. This incongruity between manufacturing and the customer's view of the world is a result of the goalpost approach. On the other hand, consider the loss function in Figure 12.9b. With the Taguchi method, a very small monetary loss occurs between A and B. This brings TM's view of the world in line with the view of the consumer. Since the loss function of the Taguchi method results in losses to society when any deviation from the nominal value occurs, reductions in variability are sought. Under the Taguchi philosophy, even though A is within the tolerance limits, further improvements in the production process would be sought. Refer to Figure 12.1. Under the Taguchi philosophy, even though Supplier 1 is within tolerance limits, further improvements in the process should be sought. The value of the loss function can deviate from the target both during the product's life span and across each unit of the product. Specifically, the loss function is a random variable with an associated probability distribution. The larger the variation in the loss function, the larger the loss is to the end user

FIGURE 12.8
Two Quality Assurance Approaches

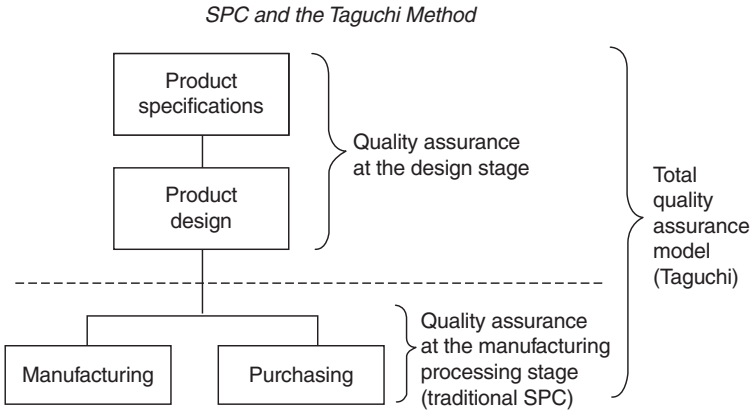
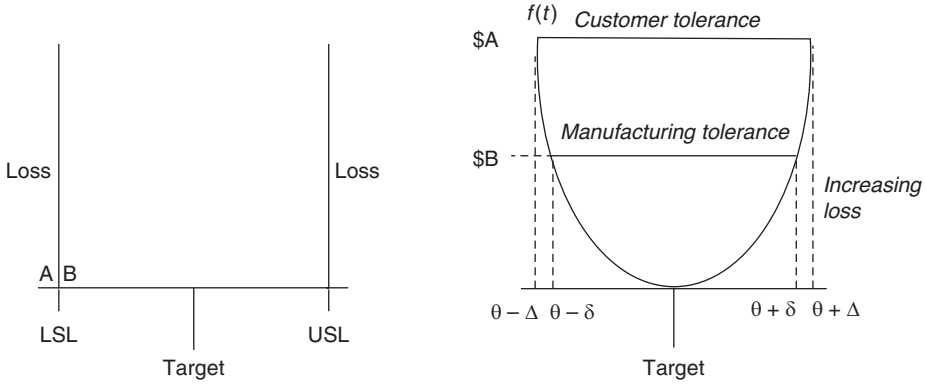


FIGURE 12.9
The Traditional SPC Versus the Taguchi Loss Function



(a) Traditional SPC

(b) Taguchi loss function

(customer). In practice, it is difficult to determine the actual form of the loss function.

As an example of the quality loss function, a few years ago, Ford partially outsourced a major subassembly to a Japanese firm. Ford and the Japanese firm were producing an identical subassembly to the same specification. However, over time it became apparent that warranty complaints were much higher for the American-made Ford product than for the Japanese product. The former was much noisier and less reliable than the latter (Gunter, 1987).

Ford collected samples of the Ford- and Japanese-made subassemblies. Upon investigating, they found that the Japanese parts were always on target. That is, the variability in the Japanese-made subassembly parts was significantly less than for the Ford-built subassembly parts. The Ford parts merely conformed to specification, as depicted by Supplier 1 in Figure 12.10. Gears and bearings fit better in the Japanese subassembly and thus worked more smoothly than did the Ford subassembly. The result was fewer complaints, repairs, and replacements even though both subassemblies had "zero defects."

Additionally, Ford found that since the Japanese had worked to reduce variability and not just to eliminate scrap and rework, they could carry less inventory, resulting in lower costs and more consistent quality performance. In short, the Japanese had imparted fewer losses to society (and themselves) than Ford because of the use of the Taguchi philosophy.

Quality by Design

Taguchi calls for a robust design to handle variability in purchasing, manufacturing, production, and end use. Instead of tightening SPC control limits (which increases the cost of production) to ensure nominal performance, Taguchi and Deming advocate *designing* the product so that nominal performance is achieved, even when variability in production and end-use conditions exist. Taguchi breaks the design process into two distinct phases:

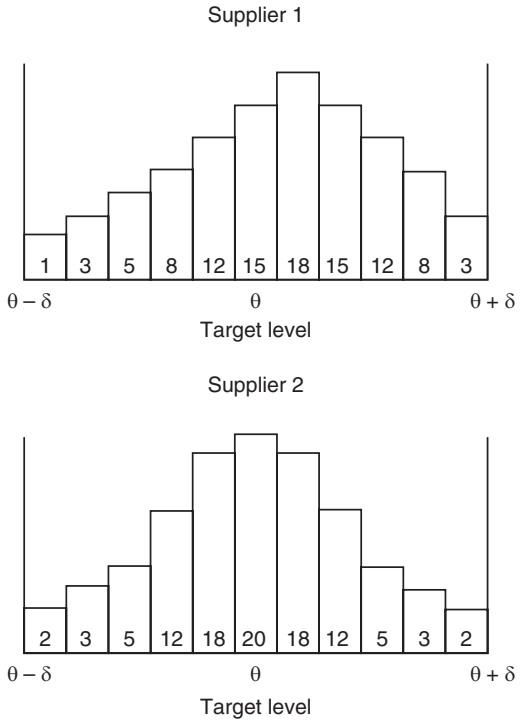
1. The system design, where the engineering concept is set. System design is primarily concerned with achieving quality at a reasonable cost to be competitive in the marketplace. In this phase, TM offers little help.
2. The parameter design, where the design nominals are set. Allowance design is the setting of design tolerances for production. In parameter and allowance design, TM provides suggestions to help design quality into the product.

The phases of design blend together, thus creating simultaneous engineering of the design and production process.

Parameter Design

As an example, consider the performance of a hypothetical product with parameter settings ranging

FIGURE 12.10
Zero Defects Versus Low Variability



from a high setting (A) to a low setting (B). Suppose that, for consistent performance of the product, the parameter setting is set at B. At this point, wide variability in the parameter results in little change in performance. If the higher performance is critical, then the variability around A must be limited, thus driving up the manufacturing cost. The design engineer must ask if the higher performance is critical.

If the performance at parameter setting B is insufficient, all is not lost. Taguchi contends there is often duality among parameters affecting design performance. Namely, there are signal variables and control variables that can be internal (design parameter) or external (environmental) in affecting performance. The example above demonstrates a control variable—a variable where performance behaves nonlinearly as the parameter varies. A control variable setting therefore can be used to control the performance when variability in parameters occurs. Signal variables, on the other hand, linearly affect the performance of the product. By strategically setting signal variables and using the appropriate settings for control variables, the design of the product can become robust. Its performance is relatively unaffected by internal and external variability. Recognizing the effect each variable has on product performance gives the design engineer a powerful tool to create a robust design.

A second consideration is the interaction of variables; in this case, a high parameter setting for B results in little variation in performance even when A changes drastically. At low levels of B, the nominal performance would be greater, but the variability in performance would be dramatic if parameter setting A is difficult to control. If B is easily controllable and A is not and peak performance is not required, then B should have a high setting (Gunter, 1987).

Allowance Design

Once the parameter design phase is completed, tolerances around the nominal must be set for production. At this point, TM asserts that, in setting the tolerances, the effect of parameter interaction must be considered. As was shown earlier, the design must be created such that variations in parameters do not affect nominal performance.

In addressing this issue, TM advocates the use of advanced statistical techniques (see also Taguchi, 1989). The basic idea is that simply varying one parameter at a time to find its effect on product performance (a naive approach) does nothing to predict effects of interactions when several parameters are off target. Complex system interactions are important and must be investigated through experimental design. Alternatively, systems can be simulated to determine the effect of design and parameter changes. The use of high-speed computers has facilitated simulation of complex systems.

By identifying critical interactions prior to the manufacturing process, further parameter design can be used to decrease the sensitivity of performance to parameter variation. For this reason, parameter and allowance design tend to blend together into one function under TM. The result is simultaneous engineering of the product design and manufacturing process. That is, TM's focus is on design for manufacturability. This is in sharp contrast to the technique of traditional product development processes (see Figure 12.9) (Gunter, 1987).

APPENDIX B: ACCEPTANCE SAMPLING

One of the key techniques in purchasing is acceptance sampling. Competitive firms today are all concerned with the quality of their outputs. Acceptance sampling is a methodology used to determine whether to accept or reject a batch of components or items. Customers must never be dissatisfied with the expected quality of products or services. The most severe penalty for poor quality expectations is the loss of sales. If the quality of the inputs to the productive system is inferior, the final product will be inferior. Acceptance plans must be developed to determine the disposition of a lot of raw materials on component parts. If a batch of parts is inferior, it should be rejected and returned to the supplier. Setting the acceptance criteria is usually based on either predetermined standards or basic statistics. Examples of predetermined attributes are government standards for oil, gasoline, and so forth.

When sampling a batch or lot, there is a danger of making two kinds of errors based on the results. First, a buying firm could reject a batch of products that are in fact acceptable based on a predetermined maximum defect level (set by management). This type of error is a Type I error ([H9251]). On the other hand, the probability of accepting a bad batch is known as a Type II error ([H9252]). Type I errors are referred to as the *producer's risk*, and Type II errors are referred to as the *consumer's risk*.

The second approach is based on the acceptance quality levels (AQL) curve. The operating characteristic (OC) curve is an important tool when using AQL. Four things can happen when applying acceptance plans, and two of them are not good. The buyer can (1) accept good lots, (2) reject bad lots, (3) accept bad lots, or (4) reject good lots. Consider the OC curve in Figure 12.11. The OC curve shows how well an acceptance plan discriminates between good and bad lots.

Operating Characteristic (OC) Curve

An OC curve is used to reflect how well various sampling plans discriminate. A single sampling plan is shown in Figure 12.11. The curve shows the probability that the sampling plan will result in accepting a bad batch. As can be seen in the figure, a lot with 1% of defects would have a probability of about 0.90 of being accepted or 0.10 (1.00 - 0.90 = 0.10) chance of being rejected. The 0.10 probability is the producer's risk. At the same time, if a lot contains 6% defects, the probability of acceptance drops to 0.10. The 0.10 is the consumer's risk.

The shape of the curve determines the discriminating power of the OC curve. The steeper the curve, the more discriminating the sampling plan. As an example, Figure 12.12 shows the effect of doubling the sample size. When the number of defective units in a shipment is no larger than 1%, the shipment is acceptable. The acceptance number is defined as the maximum number of defective units a shipment is allowed to have. Comparing the two curves in Figure 12.12, it is easy to see that the probability of rejecting an acceptable shipment is 0.10 (1 - 0.90) for n = 100, and 0.03 for n = 200. In addition, the error or consumer's risk decreases as sample size increases. If the actual percentage error was 2%, the probability of accepting the shipment has decreased from 0.877 to 0.829 with a doubling of sample size. Figure 12.13 shows the effect of changes in the OC curve if the acceptance number were changed.

FIGURE 12.11
Single Sampling Plan

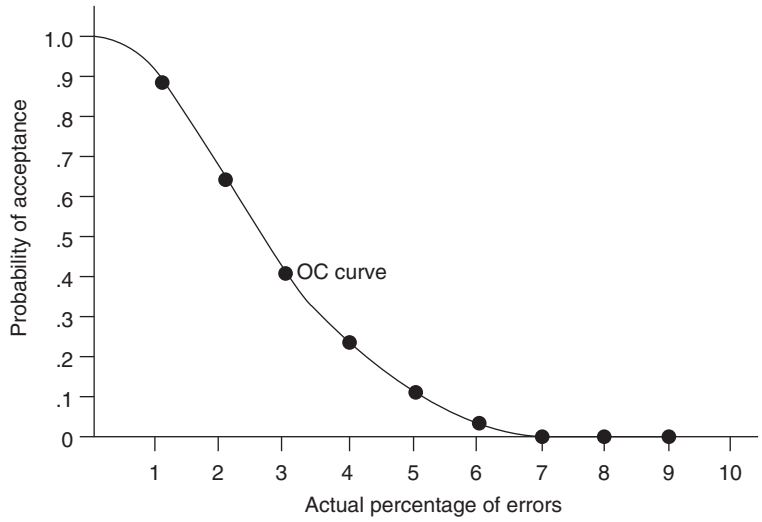
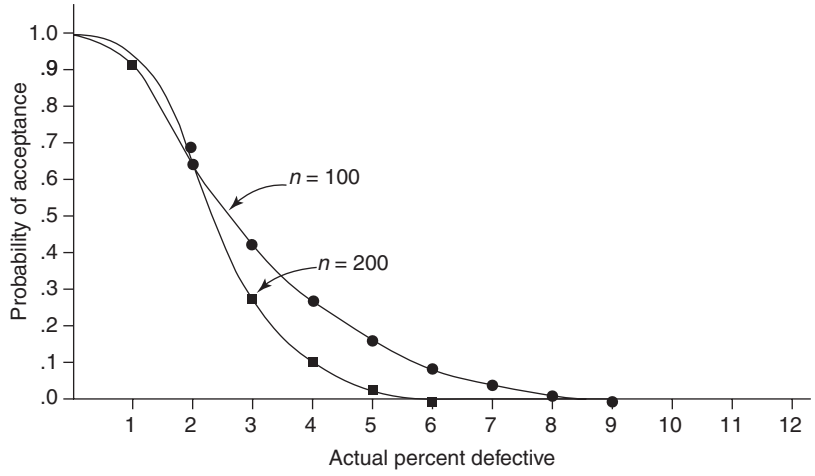


FIGURE 12.12
The Effect of the Sample Size on the OC Curve



From this analysis, it is clear that the only way to reduce both the producer's risk and the consumer's risk is to increase the sample size or reduce the acceptance number.

In most cases, incoming purchased parts are inspected before they are placed into inventory. Sampling is usually used to decide whether to accept or reject a batch. As shown in Figure 12.14, a decision can be made to accept the sample, reject the sample, or take another sample.

Acceptance sampling plans can be classified as single, double, or multiple. With multiple samples, if a clear-cut decision cannot be made after the first sample, additional samples are taken until the choice is clear. The single sampling plan requires the inspector to compare

the number of defective items from a single sample with an acceptance number. Double sampling is similar to multiple sampling, except that no more than two samples are taken.

The total cost of the alternative sampling plans determines which is most appropriate. The trade-off is between the number of samples needed and the total number of observations. Single samples usually require a larger sample size than a multiple-sampling plan. In cases where the cost of inspection is expensive, a single-sampling plan should probably be used.

FIGURE 12.13
The Effect of the Acceptance Number on the OC Curve

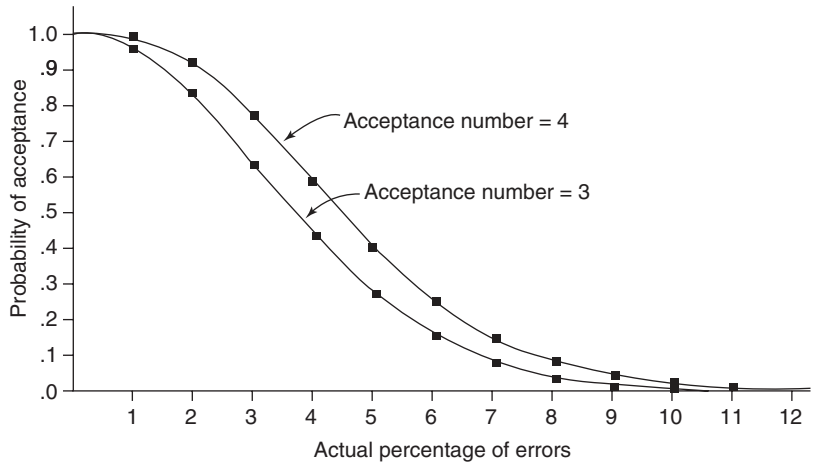
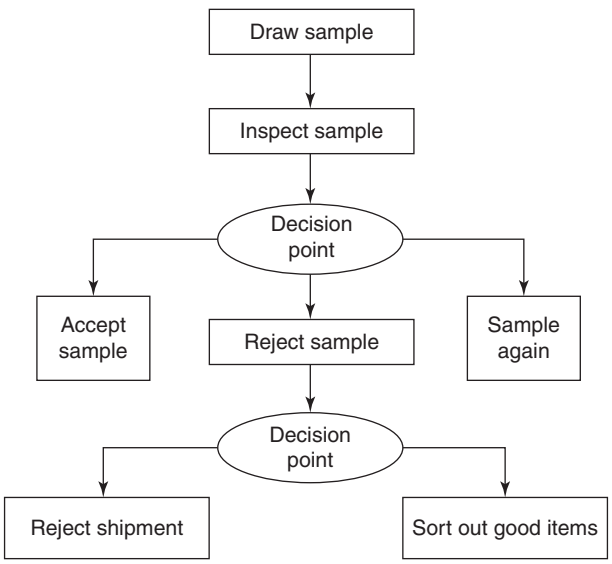


FIGURE 12.14
Acceptance Sampling Decision Model



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PART IV

Price/Cost Analysis and Negotiation Strategies

13 Price Determination

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

13.1 State the factors that impact the purchasing decision.

13.2 State the differences in price/cost setting strategies based on economics and psychology.

13.3 Describe the common discounts a supplier may offer a buyer.

13.4 Explain the relationship between cost and price when determining pricing.

13.5 Discuss how learning curve analysis relates to materials purchase price.

13.6 Explain how to implement various pricing methods.

13.7 State the difference between gross margin and markup.

13.8 Explain how the price/cost analysis process can be used to effectively negotiate and protect against a competitive bidding trap.

"Mike, this is Bill Simpson from engineering. What's going on with the prices of the 541, 234, 567, and 876 capacitors this year? At this rate, we're spending the department's budget twice as fast as we did last year."

"Look, Bill, we got an excellent price on several solenoid parts from a new supplier, but we had to accept higher prices for your components. Overall, the company will save more than 60% on more expensive components."

"Thanks for the lesson in purchasing. For your information, we don't use solenoids. Furthermore, I can get better prices online. I thought the purchasing department was supposed to save us money."

"Bill, you are correct. Purchasing must look at the overall budget, not just yours."

INTRODUCTION

One of the most important and complex decisions a firm has to make is how much to pay for its items and services. The buying professional should be able to easily detect prices that are too high. Thus, pricing decisions must be given careful consideration when buying industrial products and services.

The price of a product or service should be expected to cover the cost of production, promotion, and distribution, plus a reasonable profit. Pricing is usually based on a variation of cost. Determining price is the ultimate responsibility of the purchasing professional. To obtain the most efficient and acceptable price, the purchasing professional must make sure she or he is aware of market conditions and prices associated with quality levels required for the buying organization's needs. The effective buyer must become an expert for the item she or he purchases. Some purchasing managers believe in buying at the lowest possible price without consideration for delivery time, acceptable quality levels, or the appropriate quantities.

The effective buyer in a competitive environment will more than likely obtain purchased goods and services at a market price given that quality, delivery, and proper quantities are appropriate. If you buy items for one half the market price without obtaining appropriate quality, delivery, or quantity standards, your firm will be rendered noncompetitive. Price is important; however, one must remember it is only one of many variables that go into purchasing decisions.

THE PURCHASING DECISION

LO 13.1 State the factors that impact the purchasing decision.

The objective of the purchasing department is to buy the *right materials* from the *right supplier* at the *right time* and at the *right price*. At first glance, this sounds like a straightforward purchasing objective. Even though the objective appears simple, it fails to consider the interaction between the many variables. Perhaps the most important factor associated with the purchasing decision is the business environment and the power imbalance between the buying and supplying firms. There are some instances where the supplier will employ short-term strategic pricing to gain market share or dump unwanted items. In these cases, buying below the competitive market price is a good business decision, if there is a need. However, if the supplier is cutting costs in order to keep the doors open, it may result in poor services and even affect the buying firm's ability to meet market demand.

Given the complexity of the buying decision, the purchasing professional must be prepared to analyze each significant buying situation based on the conceptual and economic impacts of various buying decisions. The analysis phase requires the decision-maker to investigate at least two potential sources of supply. The purchasing process requires constant monitoring and adjusting to the changing operations environment. For the purchasing professional to survive as an effective buyer, she or he must have an adequate understanding of economics and psychology. In addition, the federal, state, and local laws that affect price also must be followed. A significant environmental factor is whether the economy is growing or slowing down. Each of the concepts just mentioned is examined in detail in the following pages.

PRICE-SETTING STRATEGY

LO 13.2 State the differences in price/cost setting strategies based on economics and psychology.

The economic and psychological factors impacting price-setting strategies are addressed in the following sections.

Economic

Nash equilibrium Involves two or more players in which each player is assumed to know the strategies such that all players reach a point of maximum benefit.

Price/cost analysis A powerful approach to pricing that allows the buying organization to determine what prices should be based on industry norms for direct cost, indirect cost, and a reasonable profit margin.

Market pricing The current price at which a good or service can be bought or sold.

Target pricing The maximum price the buyer is able to pay without compromising the integrity of the product or the profitability of the supplier.

Economic pricing strategies are based on the concept of **Nash equilibrium**. There is no grand formula for setting prices for goods and services. Price setting in the chemical industry appears to be precise and firm. However, price setting in the personal computer industry appears to be completely random. The chemical industry apparently bases its pricing strategy on cost analysis, and the computer industry probably uses a more responsive market-based approach. The price/cost analysis approach is investigated later in this chapter. In the short term, a firm can sell its products below its total cost; however, at some point, the firm will be required to make a profit or quit the business. In other words, a cost-based approach cannot succeed in a competitive market if the product does not remain acceptable to the buying firm. In most cases, the intelligent buyer will do a **price/cost analysis** by comparing the costs and prices from two or more suppliers.

The market approach to pricing is more erratic simply because the supplier, through the use of market research, collects information on its competitors and from their customers to determine where the price should be pegged. The customer perception of quality and service is also important when determining market prices.

In today's competitive environment in which customers are demanding more service and quality, **market pricing** is perhaps the most popular approach. Market pricing is in the interests of both the selling firm and the buying firm. With market pricing, the buyer is able to exercise its full range of competitive priorities based on its true needs. In the end, the buying firm must determine whether the purchase price fits its competitive cost structure. This is called **target pricing**. If the target price is too low to generate interest from suppliers, the buyer may need to consider applying a value analysis approach to the product or service in question.

Psychological

To become an effective buyer, the purchasing professional must attempt to predict changes in the industry. The major psychological influence in a buyer–supplier relationship is power. It is conceivable that a powerful buyer could force a supplier to eliminate its overhead from the ultimate price. The danger for the buyer is that this so-called good buy may drive the supplier out of business, and this reduction in competition may result in massive price increases in the long run. The buying firm, no matter how powerful, should attempt to obtain a fair price and good consensus. Remember, if the buyer drives all suppliers from the market, it will be forced to enter a new business.

DISCOUNTS

LO 13.3 Describe the common discounts a supplier may offer a buyer.

The first question a purchasing professional should ask a supplier is, "How much of a discount can I receive if I buy from you?" Some of the more popular discounts are cash, trade, and quantity discounts.

Cash Discounts

In today's business environment, when sound money management is so important, selling firms will offer **cash discounts** if payments for goods and services are promptly remitted. The amount of the cash discount depends on the industry and item purchased. If a buying firm is offered a cash discount of 3/10, net 30, it means that if the buyer pays for the items within 10 days of the shipment date of the invoice, it may deduct 3% from the invoice price. As an example, a $300 savings can be deducted from a $10,000 invoice if it is paid in 10 days. Thus, $300 is even more impressive if you assume that a similar purchase is made 12 times per year. The savings would then be $3,600 (12 × $300). Thus, if the buying firm is given a 3% discount for anticipating payment by 20 days, this is equivalent to a rate of 3% multiplied by 18 periods, or 54% annually, since there are approximately 18 periods of 20 days each in a year.

Cash discount A deduction allowed by some sellers of goods or by some providers of services in order to motivate customers to pay within a specified time.

The buyer should consider the cash discount when comparing competing suppliers. Cash discounts can be easily viewed as a reduction in item costs.

Trade Discounts

A **trade discount** represents the compensation for the buyer who eliminates a distributor or other middlemen from the transaction. Trade discounts are usually used by the manufacturer to protect a unique selling opportunity. This is accomplished by providing the buying firm an incentive to buy directly from the manufacturer. In other words, the manufacturing or buying firm splits the wholesaler profit margin. An example of a trade discount is a discount given by a manufacturer if the product is purchased online from the manufacturer.

Trade discount The reduction in price a manufacturer or wholesaler gives a wholesaler or retailer when it buys a product or group of products.

Quantity Discounts

Recall from Chapter 5 that quantity discounts are an incentive offered to a buyer that results in a decreased cost per unit of goods or materials when purchased in greater numbers. Quantity discounts are granted to the buyer for buying larger quantities. The supplier can easily justify quantity discounts based on increased revenues received from selling larger quantities. There also may be a savings in production planning and scheduling associated with longer production runs.

The buying firm must consider its total cost of accepting a quantity discount. Specifically, the holding costs associated with carrying larger quantities must be compared to the expected benefit of the discounts. In other words, quantity discounts must be tied to the buying firm's cost structure (see Chapter 5 for a more comprehensive discussion).

The Robinson–Patman Act

The supplier must not discriminate with product pricing. The Robinson–Patman Act states that it is illegal to offer a quantity discount for commodities of like grade and quality that is not based on differences in the cost of manufacturer sales, or delivery resulting from the differing methods, or quantities in which such commodities are sold or delivered. Justifying a quantity discount is the responsibility of the selling firm. The seller must be able to document the actual cost savings. The following actions from the U.S. Department of Commerce describe the courses of action that can be taken to enforce the Robinson–Patman Act.

1. *Informing the seller.* The fact that you are charged more than somebody else for an item is not in itself proof of illegal discrimination. You may be able to get your

supplier to eliminate discrimination or to show why she or he is not discriminating illegally if you inform her or him when you believe she or he is discriminating against your organization.

2. *Reporting to the Federal Trade Commission (FTC).* The FTC carries the major burden for enforcing the Robinson–Patman Act. Its normal procedures include investigation, complaint, hearing, and—if the facts seem to warrant—a cease-and-desist order. Orders may be appealed to the circuit court of appeals and finally to the Supreme Court. The procedure is normally slow since the seller does not have to change his or her pricing practice until an order against him or her becomes final.
3. *Reporting to the Department of Justice.* The antidiscrimination section of the Robinson–Patman Act is a part of the Clayton Act.
4. *Bringing private suit.* You may ask the courts for injunctive relief against threatened damage from illegal price discrimination. You also can bring suit for triple damages for losses you have sustained because of a discriminatory high price.

Given the complexity of the Robinson–Patman Act, it makes more business sense to discuss the incident directly with the seller. Both parties can then reach a business solution to the problem. If this approach fails, the legal solution could result in both sides suffering the consequences of a lawsuit. (See Appendix A for price discrimination examples.)

PRICE DETERMINATION

LO 13.4 Explain the relationship between cost and price when determining pricing.

Price determination is becoming the most important competitive weapon necessary to ensure survival in today's competitive environment. Companies are spending an increasingly larger percentage of their revenue dollars for the acquisition of goods and services. Ten years ago, manufacturing firms fabricated more than 60% of component parts in-house. Today, more than 70% of component parts and services are purchased from outside suppliers. Moreover, in the past, the vice president of manufacturing was responsible for making sure that fabrication or in-house service costs were kept under control. As resource shifts occur from fabrication to outsourcing companies, managerial responsibility must change to adapt to the new assemble-to-order manufacturing environment. Later in this chapter, we consider price/cost analysis as a key competitive advantage in the new environment.

Price

Price reflects more than cost and profit; pricing decisions also must be based on the degrees of competition and buyer–seller relationships. As can be seen in Figure 13.1, the competitive pressures of price also must consider the number of sellers in the market, the number of buyers in the market, and the general economic environment.

The dynamics of simultaneous shifts in the number of sellers, the number of buyers, and the general economic conditions will ensure a better measure of price determination for buying firms. As an example, consider the business cycle in Figure 13.2. The buying firm operating in this environment must plan for critical materials/components/service requirements at

FIGURE 13.1
Competitive Pressure

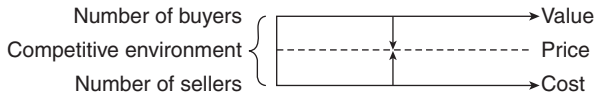
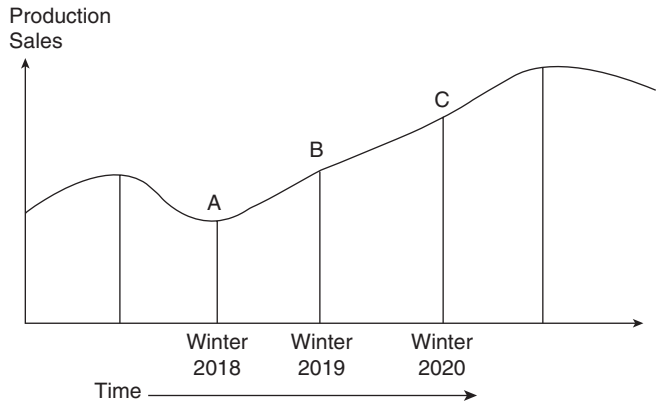


FIGURE 13.2
Business Cycle



Points A and B. If critical requirements are not planned between Points A and B, the buyer will forgo an important window of opportunity. The interval between A and B ensures reasonable contract prices and short lead times due to low use in the industry. This is especially true for the computer/microprocessor industry.

The firms that enter into contracts after Point B will pay premium prices and experience extended lead times. This planning approach sounds like a good strategy; however, it is naive to assume the buying firm has the financial strength to lock in economical long-term blanket orders or systems contracts during a recessionary period. In the case of both financially healthy and not-so-healthy firms, strategic planning must be incorporated into the overall business strategy. Consider Z, a healthy Fortune 500 company, and Y, a 5-year-old threshold firm. Both companies are in the personal computer business. Firm Z, which can easily afford to set up long-term blanket orders, misses the window of opportunity and pays premium prices for component parts. On the other hand, a well-managed lean firm, Y, purchased component parts by negotiating a partnership agreement where both buyer and seller agreed to share in the savings.

Source of Price Information

The general sources of price information are (1) published price lists on the Internet, (2) supplier quotations, (3) other buyers in the market, (4) trade journals, (5) negotiations, (6) competitive bidding, and (7) distributors. Perhaps the specific supplier is the best source of price information. Although there are no written rules that require the supplier to furnish cost information, the buyer should always be able to obtain a cost breakdown.

Costs

Direct costs Expenses relating to the actual units of production (e.g., labor, materials).

Indirect costs Also known as facilities and administrative costs. The cost of operations that cannot be assigned to specific projects, such as electricity and central administrative services; sometimes referred to as *overhead*.

The cost components of price determination can be divided into *direct* and *indirect* costs. **Direct costs** relate to the actual units of production. Direct labor and direct materials costs are classified as direct costs. If the unit is not produced, direct costs are not incurred. **Indirect costs** are associated with non-manufacturing-related costs. Insurance, managerial salaries, property taxes, and depreciation expenses are examples of indirect costs.

A facility operating at a high utilization level is incurring significant operating costs. At the same time, if a facility is operating at low utilization levels, there are still costs associated with operating the facility. Facility overhead costs can be complicated since this cost category is associated with salaried workers and various operating supplies. In some cases, supplies are treated as expense items.

Finally, one of the most important costs from the suppliers' viewpoint is profit. A firm cannot afford to operate without a realized profit. Profit is essentially an economic *cost* of doing business. The learning curve concept and its usefulness in the prediction of variable cost (direct labor hours/direct material) is discussed next.

THE LEARNING CURVE

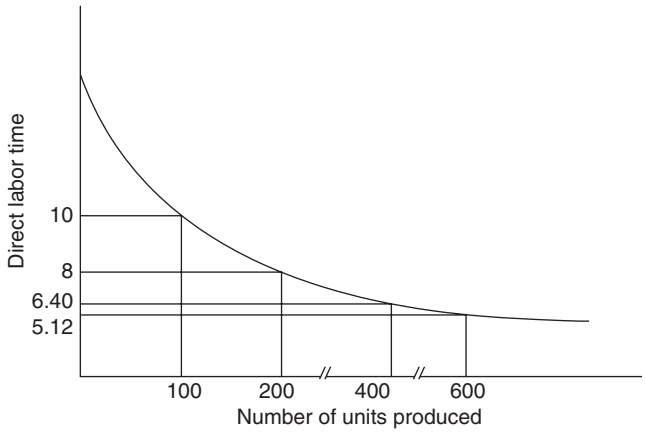
LO 13.5 Discuss how learning curve analysis relates to materials purchase price.

The purchasing professional must understand the dynamic nature of variable cost. Improvements are possible in the way most tasks are performed. The improvement process may have a significant effect on the buyer's total purchase price. It would be a mistake to assume the supplier's costs remain constant as volumes increase. The **learning curve** is a well-known method used to measure and predict the efficiencies of increasing outputs. The underlying behavior of the improvement curve reflects a systematic improvement (percentage reduction) of labor per unit as a function of cumulative units produced. Figure 13.3 shows an 80% learning curve.

Learning curve Method used to measure and predict the efficiencies of increasing outputs.

The earliest use of the learning curve was in the airframes industry. It was observed that as aircraft production increased, the direct labor cost per airplane decreased. This observation was the result of the labor force learning how to do their jobs better as they

FIGURE 13.3
Eighty-Percent Learning Curve



produced more and more units. As major defense contractors use the learning curve to evaluate subcontractors, they estimate cost and report progress to the buyer. The characteristic learning curve is exponential and depicts a constant percentage reduction of labor as a function of cumulative units produced. Learning curves are especially important in various assembly operations.

Learning curves have been applied and misapplied to a variety of problem situations. The learning curve techniques have been used extensively in cost estimating, pricing, negotiating contracts, and estimating the major implications of changes in design. For additional information on learning curves, see Cochran (1969), Conway and Schultz (1959), and Hirschman (1964).

The Learning Curve Model

As stated previously, the learning curve model is based on a constant percentage reduction in required inputs as output increases. These reductions are most typically expressed in terms of the effect of output doubling. As can be seen in Figure 13.3, when output doubles, a 20% reduction in cost occurs. The curve represents an 80% learning curve; if the 100th unit requires 10 direct labor hours, then the 200th unit requires 8 direct labor hours (10 x 0.80), the 400th unit requires 6.40 direct labors hours (8 x 0.80), and so on. This relationship can be expressed mathematically in the following way:

$$y_i = y_1 \times i^{-b} \qquad \textbf{(Equation 1)}$$

where

y_i = Direct labor hours required for the i^{th} unit

y_1 = Direct labor hours for the first unit

i = Count of cumulative units produced

b = Slope of the learning curve

Figure 13.4 shows the relationship between unit cost and cumulative average time. As can be seen, the time for the curves intersects at the first unit. Specifically, the unit cost and the cumulative average costs are the same for the first unit. The cumulative cost curve is observed to be log linear over the entire unit production range. The unit cost curve is asymptotically parallel to the cumulative cost curve.

If any two values of i are stated so that $i_2 \div i_1 = 2$, we know the power to which 2 must be raised in order to achieve the desired learning percentage. Thus $2^{-.3219} = 0.80$ and a curve for which b = 0.3219 is an 80% learning curve, and $2^{-.2345} = 0.85$ and an 85% learning curve. To solve for the slope of the learning curve on your calculator for this example, you need to find $\log_2(0.80)$, or the logarithm of 0.80 to base 2. This is equivalent to $\log_{10}(0.80)/\log_{10}(2)$, which may be useful if your calculator can only find base 10.

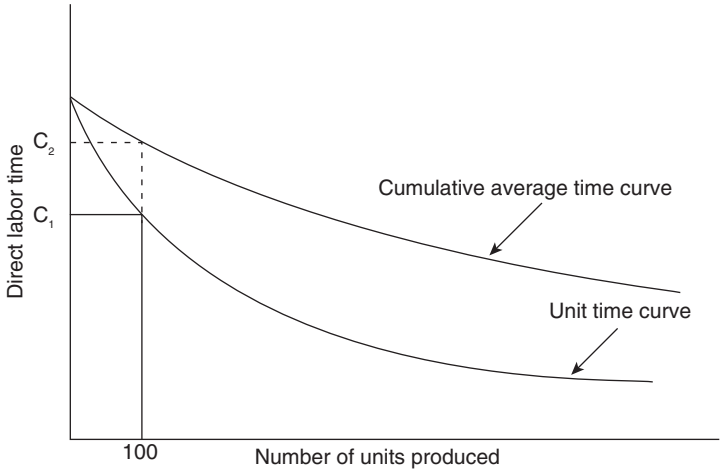
If you are not comfortable with logarithms, Appendix B provides an alternative. To use the table in Appendix B, we need a pivot percentage (PP) and a percent learning curve (PLC). The pivot percentage is the unit in question divided by the base unit:

$$\text{Pivot percentage (PP)} = \text{Unit in question (UIQ)}/\text{Base unit (BU)}$$

$$PP = UIQ/BU \qquad \textbf{(Equation 2)}$$

$$\text{Estimated time or cost} = F \times \text{time or cost for base unit (BU)} \qquad \textbf{(Equation 3)}$$

FIGURE 13.4
Unit Cost Curve and the Cumulative Cost Curve Relationship



Example 13.1

CALCULATION OF A LEARNING CURVE

Try an example with an 84% learning curve. It took 5 direct labor hours to build the 10th unit, and you want to know how much time is required to build the 12th unit. If you have UIQ = 12 and BU = 10 then PP = 120%. We are now ready to find the F factor using Appendix B. The row entry is PP, here 120%. The column entry is PLC, here 84%. The table value for this problem is 0.9552.

Estimated time or cost = F x Time or cost for BU
(Equation 3)

= 0.9552 x 5 = 4.77 hours

Try another example. Consider a company that estimates it will take 20 direct labor hours to construct the 50th unit and that an 80% learning curve will be experienced. What is the average time for the first 4 units?

Using Equations (2) and (3), we find

PP = 5/50 = 10%

Estimated time = 2.0986 x 20 = 42 hours
(see Figure 13.5)

Easy, right? Try using the first unit. Run into trouble?

PP = 1/50 = 2%

There is no 2% value in Appendix B. We must figure out a way around this inconsistency. For example, assume that we shift from BU = 50 to BU = 5. Why did we choose 5? The reason is that Unit 5 is the only other unit about which we have information. Making the shift from BU = 50 to BU = 5 enables us to work the problem, as shown below using Equation (2):

PP = 1/5 = 20% by Formula 1 shown in Equation 2

Thus, a PP of 20% and a PLC = 80% yield a table value for *F* of 1.6789.

Then, using Equation (3), we have

Estimated time = 1.6789 x 42 = 70 hours

Stated differently, it takes 70 hours to make the first unit and 42 hours to make the fifth unit. Now try your luck for Units 2, 3, and 4.

Your answers should be the following:

56 hours for Unit 2

50 hours for Unit 3

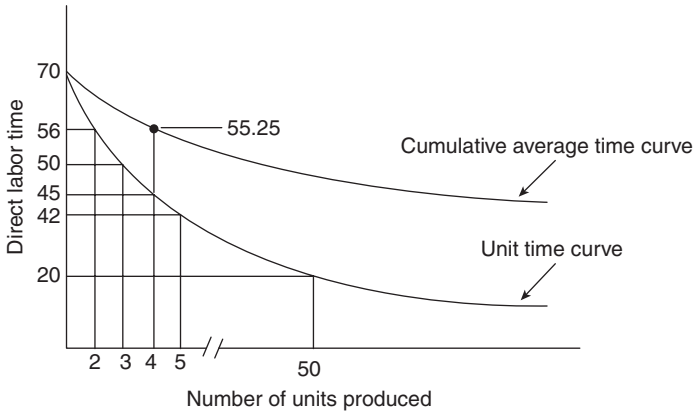
45 hours for Unit 4

The average time for the first four units is [(70 + 56 + 50 + 45)/4] = 55.25 hours

In summary,

1. Identify BU and the input required for BU.
2. Identify the unit in question.
3. Get the value of PP by Equation (2).
4. Solve the problem by Equation (3) *if possible*, that is, if the computed value of PP appears in (Appendix B) the *F* table.
5. If PP is not listed, shift to another value of BU that enables you to solve the problem.

FIGURE 13.5
Cumulative Average Cost Example



You can connect the steps you followed in these examples back to the model at the beginning of this section to see how the F factor from Appendix B was calculated. Note this is a more general formulation, because the base unit is not required to be the first unit produced.

$$Estimate\ time\ or\ cost = Time\ or\ cost\ \ for\ BU \times (PP)^{\frac{\log \mathrm{PLC}}{\log 2}} \qquad \textbf{(Equation 4)}$$

Try an example where you begin with an 84% learning curve, and you know that the 12th unit took 4.77 hours to make. How can you estimate how long it took to make the 10th unit?

$$4.77 = Time\ or\ cost\ \ for\ BU \times \left(\frac{12}{10}\right)^{\frac{\log(0.84)}{\log 2}} \qquad \textbf{(Equation 5)}$$

This should look familiar! The term on the right-hand side simplifies to the F factor from Appendix B, 0.9552, and you find that the 10th unit took 5 hours to make.

What if you want to estimate the learning curve from your cost data? We can continue with the same example. This time, you only know that the 12th unit took 4.77 hours, and you know that the 10th unit took 5 hours.

$$4.77 = 5 \times \left(\frac{12}{10}\right)^{\frac{\log \mathrm{PLC}}{\log 2}} \qquad \textbf{(Equation 6)}$$

First, remember Equation (3). Estimated time or cost = F x Time or cost for BU. Since we know both the estimated time and the time for the base unit, we solve for F, and find that F = (4.77/5) = 0.954. Next, use Equation (2) to find the pivot percentage. Since PP = UIQ/BU, we know that PP = 120%. If you have been using Appendix B, you can find the percent learning curve by looking in the row for PP = 120 for a value close to 0.954. If you prefer manual calculations, you need to solve:

$$0.954 = 1.2^{\frac{\log \mathrm{PLC}}{\log 2}} \qquad \textbf{(Equation 7)}$$

First, find the value of the exponent by taking $\log_{1.2}$ (0.954) or log (0.954)/log (1.2). Next, raise 2 to the power of that number) ($2^{-0.25829}$). Your answer should be 0.836, which rounds up to an 84% learning curve. You should now have a solid understanding of the learning curve model.

Here is another learning curve example:

Consider the following situation where there is no historical production output data available. Let's determine the learning curve for a 25-unit order situation where the first unit required 987 direct labor hours to produce and the 25th and final unit required 347 hours to produce.

Final unit (hours) = first unit (hours) x (25^{-b})

(347 hours) = (987 hours) x (25^{-b})

(347 hours)/(987 hours) = 0.35157

= log(0.35157)/log(25) = –0,3246

Learning rate = ($2^{-.32476}$)

Learning rate = .798434

An illustration of how to determine the Percent Learning Curve Rate from historical data is shown in Figure 13.6.

FIGURE 13.6

Consider a purchasing contract in which the buyer is purchasing a hand-held power tool. The pricing strategy is based on bidding a contract for 500 similar power tools built in-house last year. Production control produced the following historical data.

Unit	Time (minutes)	Find Percent Learning Curve*
1	65.6	20/10 → 30.2/36.5 = 82.73
10	36.5	40/20 → 26.3/30.2 = 87.08
20	30.2	60/30 → 23/27.4 = 83.94
30	27.4	Average = 84.5
40	26.3	or approximately an 85% LC
50	23.9	
60	23	

*Each time output doubles, calculate a ratio using the associated information for the doubling effect. Next, sum all ratios and divide by the number of ratios

PRICING STRATEGY

LO 13.6 Explain how to implement various pricing methods.

A competitive firm's purchasing objectives must include the following:

1. The right material (quality)
2. The right quantity
3. The right source
4. The right timing
5. The right price

The first four objectives must be considered as a given if a firm is operating in a profit-maximizing mode in today's global markets. The fifth objective must follow the correct pricing method to achieve a competitive advantage. The most used pricing methods are standard price lists, competitive bidding, and negotiations.

Standard Price Lists

Standard price lists are usually prices generated based on the seller's total cost structure. The selling firm usually offers quantity discount schedules to influence the behavior of the buying firm. This pricing method also is used when selling commodities.

Competitive Bidding

The competitive bidding process must begin with an assessment sizing up the suppliers' pricing strategies on competitive positions. The buyer can determine the selling firms' pricing strategies. If the suppliers are selling their products in target markets other than the buying firm's market, the pricing will more than likely be higher. On the other hand, when the buying firm is buying from sellers that service firms similar to the buying firm's markets, the prices will more than likely decrease. The supplier's competitive advantage is critical when the formal competitive bidding process is used. In most government competitively bid contracts, the lowest bid is the winning bid.

In the case of sealed bids, each certified bidder submits a written bid that is opened at a prespecified date. The sealed-bid method is excellent when the bid is for specified construction contracts, standardized capital equipment, janitorial services, and so forth. In cases where highly specialized or professional services are procured, negotiated bidding should be employed. In these cases, the winning criterion is based on much more than price. After the winning bid has been selected, the contracting officer may negotiate several cost components, quality upgrades, and delivery objectives. The competitive bidding process should be employed when the following conditions prevail:

1. The dollar value of the spend must be large enough to justify the expense of the competitive bidding process.
2. The specifications of the product or service must be precise enough for both the buying and selling firms to accurately estimate.
3. There are enough selling firms in the market.
4. There is adequate time to use this form of bidding. The competitive process usually takes from 4 to 8 weeks for most industrial firms.

After the decision to use the competitive bidding process, a buying strategy must be designed. Most well-managed selling firms that use the competitive bidding process usually use a probabilistic bidding strategy. The probabilistic bidding strategy is based on the profit-maximization strategy. The probabilistic strategy also assumes that the buying firm will select the firm with the lowest bid.

The buying firm must develop an estimate of a reasonable bid amount. The buying firm's estimate should be based on market data, including the following:

- The dollar value of previous bids
- The expected profit from previous bids

The data set is used to estimate the probability of different bid scenarios. The scenario should include mock bids with low, moderate, and high profit margins. The expected profit equation is given as

$$E(\pi_A) = P(A) * y(A)$$

where

A = Dollar amount of bid

$P(A)$ = Probability of accepting bid price

$Y(A)$ = Profit if bid A is accepted

$E(\pi A)$ = Expected profit at this bid

Consider a mock competitive bidding process by the buying firm in which we have data on 10 bids, cost, and profit combinations. These data will enable the buyer to estimate various expected bid prices given that we set $E(\pi_A)$ *a priori*. The purchasing manager can easily assess the historical bidding on similar buys. Suppose the purchasing director tabulates the data in Table 13.1.

The buying analysis in Table 13.1 indicates that the highest bid should not exceed $410,000. Thus, the bidding range should be between $360,000 and $410,000 depending on the economic environment. Sixty percent of the bidders should fall within this range. Finally, as with another pricing strategy, competitive bidding, the final price is determined by the number of sellers and buyers and the economic environment.

TABLE 13.1
Historical Bid Tabs

Cumulative Probability of Winning Bid at Expected Profit				
Bid Price (*A*)	**Actual Cost**	**Profit, *P* (*A*)**	**Profit, *y* (*A*)**	***E* (πA)**
$480,000	$360,000	0.00	$120,000	$0
460,000	360,000	0.03	100,000	3,000
450,000	360,000	0.10	90,000	9,000
440,000	360,000	0.20	80,000	16,000
420,000	360,000	0.38	60,000	22,800
410,000	360,000	0.54	50,000	27,000
380,000	360,000	0.73	20,000	14,600
360,000	360,000	0.92	—	—
350,000	360,000	0.98	10,000	9,800
340,000	360,000	1.00	20,000	20,000

Negotiations

Negotiations should include discussions around each of the five purchasing objectives. Negotiations should be used exclusively when there are time constraints, the specifications are not clearly stated, there are not enough sellers, and the dollar value is too low to consider using the competitive bidding process. Negotiation should be used any time the buyer does not have confidence in the standard price lists and competitive bidding seems unreasonable. This topic is covered extensively in the next chapter.

PROJECT PRICING

LO 13.7 State the difference between gross margin and markup.

In the following section we show the complexities of the differences between markups and margins.

Markups Versus Margins

In today's competitive construction market, markup and margin are sometimes used interchangeably. However, gross margin and markup are not the same. A clear understanding of markup versus gross margin is an important concept when estimating and bidding jobs in the construction industry. Using gross margins in the construction industry involves complicated calculations and can lead to erroneous competitive bidding results.

Specifically, **gross margin** is defined as the difference between the price of the job and the costs to build a job. By definition, the gross margin includes overhead and profit for the specific job. As an example, a 30% gross margin on a job that sells for $100,000 generates $30,000 to cover overhead and profit. **Net margin** refers to profit alone. Consider that an 8% net margin on a $100,000 sale yields $8,000.

Gross margin The difference between the price of the job and the costs to build a job.

Net margin Profit.

Markup A percentage that can be added to the total of all direct costs to determine a final price or contract sum. Allows the contractor or subcontractor to recover the costs associated with overhead.

On the other hand, **markup** is job costs times a factor that covers direct costs, overhead cost, and profit. The difference between gross margin and markup is illustrated in the following example:

forecasted annual dollar value - Annual job cost = Gross margin

$150,000 – $100,500 = $49,500
$49,500 is the projected gross margin for the year.
The gross margin percentage is

Gross margin/Forecasted annual dollar volume = Gross margin percentage

$$\frac{\$49,500}{\$150,000} = 33\%$$

The markup factor is

Forecasted annual dollar volume/Forecasted annual job

$$\frac{\$150,000}{\$100,500} = 1.49$$

If a contractor projects a 33% annual gross margin for the business, the markup must be set to a factor of 1.49 times the job cost. This illustrative example shows that a 33% gross margin is not equivalent to a 1.33 markup. Mathematically, markup will always be a larger result

Example 13.2

CALCULATING MARKUP

Consider another example. A margin of 30% for a $100,000 job is $30,000. A 30% gross margin leaves $70,000 contribution for the job cost. Now calculate the total selling price for the project using a 1.30 markup (1.30 x $70,000). As can be seen, the selling price for the job is $91,000, which is $9,000 less than the $100,000 expected job selling price. Thus, to achieve a 30% gross margin for the job, the markup is 1.43 ($100,000/70,000).

Example 13.3

CALCULATING BREAKEVEN

Let's take a look at an example of breakeven.

$$\text{Breakeven} = \text{Total overhead} \div \frac{\text{(Total sales – Total job costs)}}{\text{Total sales}}$$

- Total sales = $150,000
- Total overhead = $37,500
- Total job costs = $100,500

$$\text{Breakeven} = \$37{,}500 \div \left(\frac{\$150{,}000 - \$100{,}500}{\$150{,}000}\right)$$

$$= \$37{,}500 \div \left(\frac{\$49{,}500}{\$150{,}000}\right)$$

$$= \$37{,}500 \div 0.33$$

$$= \$113{,}636$$

Thus, the breakeven point for the year is $113,636. Once the firm has sold and built jobs equal to $113,636 of the forecasted $150,000, the total projected overhead and job costs for the year will have been covered.

TABLE 13.2
Margin Versus Markup Conversion Chart*

15% Markup	13.0% Gross Profit
20% Markup	16.7% Gross Profit
25% Markup	20.0% Gross Profit
30% Markup	23.0% Gross Profit
33.3% Markup	25.0% Gross Profit
40% Markup	28.6% Gross Profit
43% Markup	30.0% Gross Profit
50% Markup	33.0% Gross Profit
75% Markup	42.9% Gross Profit
100% Markup	50.0% Gross Profit

*Formula: Markup Cost/(1 - Desired GP [decimal])
For example, if you want a GP of 25%, the markup should be Cost/(1 - 0.25) = 1.33 times the cost, or 33% of the cost.

compared to the gross margin. Consequently, contractors who do not understand the differences between margin and markup will overstate their profitability. (See Example 13.2.)

In practice, the inexperienced building contractor who focuses on the so-called "big margins" may not understand markup. If the business generates annual sales of $1,000,000, a 30% gross margin appears to be a reasonable return for the business. On the other hand, if annual sales are $150,000, there is only $45,000 generated to pay all of the company's bills (including salaries, profit, and overhead costs). This pricing scenario is not unique to the construction industry. The markup for each firm is based on the firm's cost structure (specific management salaries, expected profit margins, and overhead costs).

Successful construction-related businesses use the markup pricing approach. A margin versus markup conversion chart is given in Table 13.2.

Breakeven

Breakeven is that point in time when total income from all jobs sold, built, and collected equals the total expenses. The breakeven point is an important measure for any business simply because management can determine whether the company is ahead of schedule or behind schedule in terms of its goals.

Breakeven The point in time when total income from all jobs sold, built, and collected equals the total expenses.

The breakeven point is calculated on the total projected annual sales for a company each year. The breakeven point should be calculated after the company decides on the annual goals.

The breakeven analysis provides an effective monitoring mechanism for the construction-related business. As an example, if the breakeven is expected in July and is actually achieved in May, the company is ahead of schedule in terms of performance to the goal. On the other hand, if the breakeven point is reached in September, the profitability goal is lagging behind schedule. (See Example 13.3.)

THE PRICE/COST ANALYSIS PROCESS

LO 13.8 Explain how the price/cost analysis process can be used to effectively negotiate and protect against a competitive bidding trap.

A buying firm must consider the price variation inherent in buying high-priced components in order to understand various design specifications and associated costs. Moreover, the buyer must obtain reasonable cost comparisons based on historical data of similar equipment and from his or her own experience with conditions in the specific industry. In other words, the buyer must become an expert in the associated industry. It is a good practice to make a careful estimate of the probable cost. After performing research and analyzing the production process/materials, a per-unit cost estimate must be made.

At the same time, several requests for proposals (RFPs) should be sent out. Ideally, the usable RFPs will have cost estimates that are lower than the in-house production cost estimate. Example proposals from two feasible bidding firms are given in Table 13.3.

The adjustments are made for each of the firms in Table 13.4. Using the appropriate standard cost components, Firm A is encouraged to reduce direct labor costs from $5 per hour to $4.50 per hour, and, alternatively, Firm B is encouraged to reduce the labor hours from 7 DLH (direct labor hours) to 6 DLH. Similar comparisons between Firms A and B and subsequent adjustments were made for the remaining cost components in Table 13.4.

TABLE 13.3
Price/Cost Analysis Example Problem

	Firm A	Firm B
Direct labor hours (DLC) (avarage)	6 hours	7 hours
Hourly rate	$5/hour	$4.50/hour
Direct labor cost (DLC)	6 × $5 = $30.00	7 × $4.50 = $31.50
Direct material cost (DMC)	$10.00	$10.00
Tooling cost (TC)	$2.00	$3.00
Manufacturing overhead (MO)	50% × DLC = $15.00	75% × DLC = $23.62
General and administration expense	5% × (DLC + DMC + TC + MO) = $2.85	7% × (DLC + DMC + TC + MO) = $4.77
Total cost	$59.85	$72.89
Profit	7% × total cost = $4.19	5% × Total cost = $3.64
Selling price	$64.03	$76.53

TABLE 13.4
Price/Cost Analysis Solution

	Firm A	Firm B
Direct labor hours (DLC) (avarage)	6 hours	6 hours (B1)
Rate	$4.50/hour (A1)	$4.50 per hour
Direct labor cost (DLC)	6 × $4.5 = $27.00	6 × $4.50 = $27.50
Direct material cost (DMC)	$10.00	$10.00
Tolling cost (TC)	$2.00	$2.50 (B2)
Manufacturing overhead (MO)	50% × DLC = $13.50	50% × DLC = $13.75 (B3)
General and administration expense	5% × (DLC + DMC + TC + MO) = $2.62	7% × (DLC + DMC + TC + MO) = $3.76
Total cost	$55.12	$57.51
Profit	7% × total cost = $3.86	5% × Total cost = $2.88
Selling price	$58.97	$60.39

As can be seen from Table 13.3, the following observations should be discussed with respect to Firms A and B.

1. Direct labor for Firm A is probably too high, and measures should be made to reconcile Firm A's labor costs. Maybe the average hours needed to produce each unit are overstated. Alternatively, the learning curve may be a source of the inconsistency in the variance in labor hours between Firms A and B. We show the proposed negotiated adjustments in Table 13.4.
2. The tooling cost for Firm B is too high. Why does the tooling cost exceed industry norms? This should be investigated. The buyer should negotiate an adjustment.
3. The manufacturing overhead for Firm B is significantly higher than Firm A's overhead costs. This issue should be addressed. If the selling firm insists on this rate, the buyer should ask for exact data to support the claim. The supplier will probably make adjustments before agreeing to an audit. Please see the adjustments in Table 13.4.

Finally, consider buyers who buy on impulse. If a buying firm fails to negotiate, there will be an immediate competitive disadvantage $\left[\left(\frac{\$64.03-\$58.97}{\$58.97}\right)\times 100 = 8.5\%\right]$ (ceteris paribus). One key negotiating issue is setup cost. Setup and tooling costs usually occur during the early stages of the initial production run. Setup cost must be explicitly accounted for. If setup cost and learning curve rates are ignored, a buying firm will more than likely fall into a **competitive bidding trap**. Large setup and tooling costs can easily be amortized by the selling firm. If the buying firm fails to give explicit specifications and/or prices for alternative quantities of the item, what appears to be a good buy may result in an excessive price. A selling firm may include in the contract price various setup and tooling costs each time the item is purchased. Setup and tooling costs should be amortized over several quantity levels and

Competitive bidding trap Incomplete bidding documents with missing provisions and information may result in increased costs for the buying organization.

completely applied in the first purchase order. As an example, consider a buying firm expected to need 10,000 barrels of Chemical X. The entire 10,000 barrels will be consumed in the first year. The best way to price Chemical X is to ask for quotes on quantities of 10,000, 20,000, 30,000, 40,000, and 50,000 barrels of Chemical X. This approach will force the supplier to amortize the setup and tooling costs. The buying firm has implicitly forced the supplier into a quantity discount schedule. Thus, the buyer will avoid a competitive bidding trap. By investigating alternative quantities, the buying firm can predict the expected process improvement rate. An illustrative example of an actual price/cost analysis is given in Appendix C.

Buyers can often benefit from taking a deeper dive into labor costs when direct labor costs are a major portion of total costs, as occurs with service contracts. Billable wages generally consist of a bare wage, which is the dollar amount per hour paid to the employee, and a markup, which is an amount per hour added to the bare wage to cover items such as employment taxes, insurance, and fringe benefits (e.g., health insurance, pensions, vacation). Depending on the industry, the markup can also contain allowances for tools, training programs, and so forth. Wage deductions for some programs (e.g., unemployment programs) are capped. This means that after the employee has earned a certain amount of wages, no further program fees are assessed. Buyers with cost-plus contracts should ensure they are not being charged as if these fees were levied year-round, with the supplier pocketing the difference. Many contracts use an all-in rate that does not vary, regardless of changes to the underlying cost structure. While the specific cost elements involved in service contracts may differ from those in Table 13.4, the general price/cost analysis approach is equally applicable to many service industries.

SUMMARY

LO 13.1 State the factors that impact the purchasing decision.

The objective of the purchasing department is to buy the *right materials* from the *right supplier* at the *right time* and at the *right price*. Even though the objective appears simple, it fails to consider the interaction between the many variables. Factors that must be considered in purchasing decisions include the business environment and the power imbalance between the buying and supplying firms, competition, service factors, market demand, changes in operations, laws, and the state of the economy.

LO 13.2 State the differences in price/cost setting strategies based on economics and psychology.

Economic pricing strategies are based on the concept of Nash equilibrium. There is no grand formula for setting prices for goods and services. Customers are demanding more service and quality; market pricing is perhaps the most popular approach. Market pricing is in the interests of both the selling and buying firm. With market pricing, the buyer is able to exercise its full range of competitive priorities based on its true needs. In the end, the buying firm must determine whether the purchase price fits its competitive cost structure. To become an effective buyer, the purchasing professional must attempt to predict changes in the industry. The major psychological influence in a buyer–supplier relationship is power. It is conceivable that a powerful buyer could force a supplier to eliminate its overhead from the ultimate price.

LO 13.3 Describe the common discounts a supplier may offer a buyer.

Some of the more popular discounts are cash, trade, and quantity discounts. Cash discount is a deduction allowed by some sellers of goods or by some providers of services in order to motivate customers to pay within a specified time.

A trade discount represents the compensation for the buyer who eliminates a distributor or other middlemen from the transaction. Quantity discounts are an incentive offered to a buyer that results in a decreased cost per unit of goods or materials when purchased in greater numbers.

LO 13.4 Explain the relationship between cost and price when determining pricing.

Price determination is becoming the most important competitive weapon necessary to ensure survival in today's competitive environment. Companies are spending an increasingly larger percentage of their revenue dollars for the acquisition of goods and services. Price reflects more than cost and profit; pricing decisions also must be based on the degrees of competition and buyer–seller relationships.

LO 13.5 Discuss how learning curve analysis relates to materials purchase price.

It would be a mistake to assume that the supplier's costs remain constant as volumes increase. The learning curve is a well-known method used to measure and predict the efficiencies of increasing outputs. The underlying behavior of the learning curve reflects a systematic improvement (percentage reduction) of labor per unit as a function of cumulative units produced.

LO 13.6 Explain how to implement various pricing methods.

Standard price lists are usually generated based on the seller's total cost structure. The selling firm usually offers quantity discount schedules to influence the behavior of the buying firm. This pricing method also is used when selling commodities.

The competitive bidding process must begin with an assessment sizing up the suppliers' pricing strategies on competitive positions. If suppliers are selling their products in target markets other than the buying firm's market, the pricing will more than likely be higher. On the other hand, when the buying firm is buying from sellers that service firms similar to the buying firm's markets, the prices will more than likely decrease.

LO 13.7 State the difference between gross margin and markup.

A clear understanding of markup versus gross margin is an important concept when estimating and bidding jobs in the construction industry. Gross margin is defined as the difference between the price of the job and the costs to build a job. By definition, the gross margin includes overhead and profit for the specific job. Net margin refers to profit alone. Markup is job costs times a factor that covers direct costs, overhead cost, and profit.

LO 13.8 Explain how the price/cost analysis process can be used to effectively negotiate and protect against a competitive bidding trap.

Price/cost analysis is a natural input into the negotiation process. The negotiation process is a learned behavior. To effectively negotiate for industrial firms, both the buyer and seller must win. Because of dynamic business cycles and loosely defined cost components, each and every aspect of a business transaction is negotiable. Direct labor, overhead, and administrative costs are all excellent candidates for negotiations. To the extent that these costs can be pegged to competing suppliers, there exists a possibility for negotiation.

KEY TERMS

Breakeven 306
Cash discount 295
Competitive bidding trap 308
Direct costs 298
Gross margin 305
Indirect costs 298
Learning curve 298
Market pricing 294
Markup 305
Nash equilibrium 294
Net margin 305
Price/cost analysis 294
Target pricing 294
Trade discount 295

DISCUSSION QUESTIONS

1. What are the components of pricing? What are the psychological aspects of pricing?
2. How is pricing included in the negotiation process?
3. Explain why price/cost analysis is frequently slighted by purchasing managers.
4. What is the difference between cost and value? Why is this important for the negotiation process?
5. What is meant by competitive bidding?
6. What are the elements of price/cost analysis?
7. What is a learning curve? Why should a buying firm be concerned about the effect of the learning curve?
8. How is price/cost analysis related to the negotiation process?
9. What is meant by the learning curve phenomenon?
10. What are the assumptions that drive learning curve theory?

SUGGESTED CASES

Case 2: The Art and Science of Bidding Not to Get a Job

Case 6: Carter Systems Canada, Inc.

Case 7: Case Construction Company

Case 16: The Kemper Engine Plant

EXERCISES

13.1 AVCO, Inc., manufactures microsurgical instruments used in products such as minimal invasive surgical procedures. The primary customers for these products are hospitals. Hospitals require that the learning curves be employed in the bid process for awarding contracts. AVCO is planning to bid on a contract offered by Ohio State Medical Center for 700 units. AVCO estimates that the second unit will require 96 hours of direct labor to produce. The industry learning rate for this particular type of product is 82%. Determine the average number of labor hours required to produce the first 100 units. How many hours are required to produce 700 units?

13.2 Professor Mercer teaches a course in supply chain management at Texas Christian University. She is scheduled to give her class of 26 students a final exam on the last day of exam week, and she is leaving town the same day. She is concerned about her ability to finish grading her exams. From past experience, she knows the first exam will take her about 30 minutes to grade. She estimates her learning rate to be about 82%. What is the expected grading time for the 13th exam? What is your estimate of her total grading time? What is the average grading time for the entire batch of exams?

13.3 The Bureau of Disability Services (BDS) has a large pool of clerical employees who process Level 1 disability claim forms on networked computers. When BDS hires a new clerical employee, it takes that person about 75 minutes to process a claim form. The historical learning rate for a clerical employee is 78%, but no additional learning will take place after the 40th form is processed. BDS has recently acquired a smaller competitor that will add 1,000 new forms per week to its clerical pool. If an employee works 7 hours per day per 5-day week, how many employees would BDS need to hire to complete 1,200 forms per week?

13.4 ABC, Inc., hired 10 students from Cal State Fullerton to work part time, 20 hours per week, to assemble digital blood pressure monitors. The prototype unit required 27 hours of direct labor; from experience, the owners knew that their

assembly operation has an 84% learning rate. How long will it take ABC to deliver 500 monitors? If the 10 students are paid $20 per hour, how should ABC price the monitor? (Assume that ABC's overhead rate is 150% of direct labor cost and the expected profit margin is 12.5%.)

13.5 The Lineal Aircraft Company produces avionics testing equipment for the U.S. military. The company is planning to bid on a new digital radome specially equipped for desert military action. The company has experienced an 84% learning curve in the past for producing similar components. Based on a prototype model, it estimates the first radome produced will require 1,230 hours of direct labor. The order is for 500 digital radome components. Determine the time that will be required for the 50th and 100th units. If the cost is $210 per direct labor hour, determine the total contract value including a 15% profit margin and a 150% overhead rate based on the direct labor cost.

13.6 Lineal is also considering making a bid for a drone interceptor for the U.S. military. However, the company has almost no experience in producing this type of weapons system. Although Lineal could not obtain direct learning curve rates, it did learn from one contact that for a system with similar features, the first unit required 1,538 hours of direct labor to produce, and the 100th and final unit required 756 hours to produce. Determine the learning curve rate for the drone interceptor.

13.7 The Lubbock Automated Assembly Company was asked to bid on an automated packaging system assembly for an automotive brake supplier. The company estimates that it will take 5 hours to complete the 50th unit, and, based on historical data on similar packaging assemblies, a 92% learning curve is expected.

a. What is the expected average time for the first two units?

b. What is the approximate *estimated* time for the 100th unit?

c. Repeat Parts *a* and *b* above with a learning rate of 76% and 85% and compare the results. What can be concluded from the exercise?

13.8 John Sands has kept careful records of the time required to build his company's new automated leaf mulching machine.

Unit Number	Unit Time (Hours)
50	150.2
100	122.5
200	95.2
300	90.1
400	83.2
600	80.2

a. Estimate the rate of improvement.

b. What is the average time for the first 5 units?

c. What is the estimated cumulative average time for 1,200 units? Assuming the total cost is $15.90 per direct labor hour, what is the estimated labor cost to produce 1,200 mulching units? Make all assumptions explicit.

13.9 Consider a company with an expected learning curve of 80% and 943 direct hours required for the first unit, how many direct labor hours do you expect in total for the first 10 hours? How many direct labor hours do you expect for the 100th unit?

13.10 Jan Edwards, the purchasing manager at Highland Hills Manufacturing, Inc., was quoted an estimated time of 143 labor hours to produce the prototype for a new product. The supplier also estimated the learning curve to fall between 92% and 96%.

What percentage decrease should Jan expect in required manufacturing time by the fifth unit?

13.11 Captain Michael Houston is a fighter pilot on the USS *Coral Sea* aircraft carrier. He has prepared the following chart on his landing performance. An excellent grade is a score of 70.

a. What is Captain Houston's expected learning rate? What is his actual learning rate?

b. What is Houston's progress rate based on his first 200 landings?

c. What will his grade be after 500 landings?

d. How many landings will he need to make to reach a score of 70?

Landings (Touch and Go)	Expected Score	Actual Score
25	88.5	88
50	84.1	83
75	81.6	84
100	79.9	80
125	78.6	81
150	77.6	79
175	76.7	80
200	75.9	78
225	75.2	
250	74.7	
275	74.2	
300	73.6	

APPENDIX A: THE ROBINSON–PATMAN ACT—GENERAL PRICE DISCRIMINATION

The Robinson–Patman Act of 1936 is an amendment to Section 2 of the Clayton Act of 1914. Therefore, technically, it should be referred to as the Robinson–Patman Amendment to Section 2 of the Clayton Act. However, everyone, including lawyers, simply refers to it as the Robinson–Patman Act. The act prohibits discrimination in price as well as discrimination in services and allowances. It applies to buyers as well as sellers, though, as will be seen, buyers are shielded to some extent by judicial interpretation of the act as applied to buyers. The main thrust of the act is to prevent a seller from selling the same kind of goods ("goods of like grade and quality") to two or more different buyers at different prices. The neophyte will immediately react by saying, "But what about quantity discounts?" Just because the seller supplies larger quantities to one buyer versus another buyer does not permit the seller to charge the large-volume buyer a lower price. This aspect of the act as well as the many other problems related to it are discussed. The purchasing agent (PA) must be aware of all implications of the Robinson–Patman Act. While the PA may feel concerned only in relation to the liability of the buyer under the act (for inducing a discriminatory price), the buyer also must be aware of the act in relation to the seller's problems in complying with it so that, among other things, the buyer can negotiate intelligently with the seller when the subject of Robinson–Patman enters the negotiations. As usual, we warn the buyer not to be his or her own lawyer in dealing with Robinson–Patman. The focus of this appendix is to alert the PA to legal problems that he or she might encounter in his or her job. The alert PA will know when to contact an attorney for assistance if he or she is aware of the fundamental legal pitfalls that may confront him or her on a regular basis.

Background of the Robinson–Patman Act

Prior to the enactment of Robinson–Patman in 1936, there were a number of highly publicized hearings and reports in relation to large buyers such as chain stores and mail-order houses that were allegedly receiving

discriminatory (lower) prices than their smaller rivals. Using their tremendous purchasing power, the large buyers were placing undue pressure on suppliers with inferior bargaining power to induce discriminatory price concessions. Not only were the smaller buyers paying higher prices, but their sellers, the wholesalers, were seriously affected by the practices of the big buyers. Many wholesalers felt threatened because it appeared that the traditional channel of distribution—manufacturer–wholesaler–retailer—was itself threatened. Therefore, wholesaler groups were extremely active in pursuing a price discrimination amendment that would stop the practices of the large buyers. There is little question that the act was aimed at the elimination of chain stores or, at least, the diminishing of their power. The fact that chain stores and other large buyers have prospered notwithstanding the Robinson–Patman Act does not, in any way, remove the difficulties spawned by the act.

Elements of a Robinson–Patman Violation

Section 2 of the original Clayton Act was divided into six subsections by the Robinson–Patman amendment. Each subsection is surveyed to determine its essential ingredients.

Section 2(a). Price; selection of customers

Section 2(a) is the heart of the act. It requires at least two sales (at least one of which must be in interstate commerce) to be made to two different buyers at different prices. Moreover, the goods sold must be virtually identical goods, that is, "goods of like grade and quality." The price discrimination must cause a reasonable possibility of injury to competition. If these elements are found in a given fact situation, there is a *prima facie* violation of section 2(a), and, unless the respondent (the alleged violator) can justify the price discrimination in one of three ways (to be discussed shortly), there is an absolute violation of the act. The elements just listed—two or more sales of goods of like grade and quality, at least one of which is in interstate commerce, at different prices, to two or more customers, which may injure competition—are often called the "jurisdictional criteria" of the Robinson–Patman Act. If any one of these is missing, *the act does not apply*. Each of these criteria may raise difficult problems. We now explore a few examples to illustrate such problems.

Example 1

The PA enters into a contract to purchase three items for his company: (a) television advertising time, (b) a lease of property for a period of 3 years, and (c) a construction contract involving labor and materials. As to each, the PA subsequently learns that his company was charged a higher price than were other customers who bought under almost identical terms. Does the buyer have a Robinson–Patman complaint?

Analysis: The answer is no. The "goods of like grade and quality" under the Robinson–Patman Act are called "commodities of like grade and quality" and "commodities" include goods, "wares, merchandise and other commodities." Basically, the act applies only to tangible, movable property. Therefore, in the example, (a) is not a commodity since it is intangible; (b) is real (immovable) property and, therefore, not a commodity; and (c) involves tangible movable property (which lawyers call "personal property"), but it is, essentially, a contract for services. The act does not apply.

Example 2

The PA purchases industrial drills for his company that are sold under the brand label of a famous industrial drill maker. After the drills are purchased, the PA learns the identical drills under identical circumstances except for the brand name were sold to a competing buyer at 20% less than the price the PA agreed to pay. When the PA complained, the supplier explained that it always charges 20% less for drills marketed under a nonbrand (private) label. Is there a Robinson–Patman violation?

Analysis: The problem involves whether a difference in brand names (one well-known, highly advertised brand versus an unknown, unadvertised brand) is sufficient to suggest that the goods are *not* "goods of like grade and quality." Of course, if they are not of like grade and quality, the act does not apply. In a famous Supreme Court case, the Court held that differences in brand names do not prevent the goods from being of like grade and quality. The act applies, and unless the supplier can justify the price discrimination in ways discussed shortly, there is a violation.

Note: Insignificant (nonfunctional) physical differences in products sold by the supplier at different prices will not take the transactions out of the "like grade and quality" category. In order for the goods to be *not* of like grade and quality, their physical differences must be more than fanciful.

Example 3

An interstate dairy company, W, processed milk in Ohio. It discriminated in price among certain retailers, but all of the discriminatory prices were charged in Ohio, the same state where the processing occurred. Is this a Robinson–Patman violation?

Analysis: The answer is no. All of the discriminatory sales were made within Ohio—that is, they were all *intrastate*—therefore, the interstate commerce requirement of the act was not met. At least one of the sales involved in the price discrimination must "cross a state line."

Example 4

Dairy Q transported milk from Colorado to New Mexico, where it was processed. It then engaged in discriminatory sales of the milk, all within New Mexico. Does the act apply?

Analysis: Yes. Under the "stream of commerce" doctrine, a court held that milk produced in one state and processed in another does not lose its interstate commerce character. Thus, if a transaction is part of a larger transaction in which there has been interstate activity (crossing state lines), the transaction will be "in commerce" for the purposes of the act.

Note: There are other technical problems with the Robinson–Patman Act's interstate commerce requirement. In general, the Robinson–Patman interstate commerce requirement is narrower (therefore, more difficult to prove) than the "commerce" requirement under the Sherman Act.

Exemptions: Sales to governments and their institutions (U.S. government, state governments, and municipalities) are exempted from the Robinson–Patman Act. The same is true of nonprofit institutions (such as hospitals). However, resales for profit by the institution will bring the transaction within the act.

Example 5

The X, Y, and Z Corporations were manufacturers of frozen dessert pies that were sold through retail stores such as supermarket chains. All three corporations were interstate sellers of goods that sold their frozen pies throughout the country. P was a small pie company in Salt Lake City, Utah, that decided to enter the frozen pie business in competition with X, Y, and Z. P sold its pies at lower prices than the three competitors and sometimes sold at different prices. X, Y, and Z began to engage in a price war with P by undercutting P's price. The price war continued for a few years. At the end, P was in a very strong market position (45% of the Salt Lake City market). P brings a private treble-damage action against X, Y, and Z, charging its competitors with a violation of section 2(a) of the Robinson–Patman Act. What was the result?

Analysis: The U.S. Supreme Court held that P wins. Even though P was undercutting the prices of its competitors, P sold exclusively in intrastate commerce. Moreover, there was a reasonable possibility of injury to competition under the act (one of the requirements is "injury to competition") because X, Y, and Z had been charging higher prices in other states while lowering their prices in Utah, which resulted in an "erosion of the price structure" in Utah. This may have caused P to lose considerable profits, which made it a less-effective competitor with X, Y, and Z. Though P ended up with a substantial market share, this is no defense to price discrimination such as that practiced by the three competitors. What may appear to be a state of healthy price competition on its face may really be, upon further analysis, a situation that creates a reasonable possibility of substantial competitive injury.

Note: The cost-justification defense. One of the three affirmative defenses under the Robinson–Patman Act is the cost-justification defense. This allows the seller to show that its price discrimination is based on *actual cost savings* in dealing with the lower-priced customer as compared with the customer who paid the higher price. Such cost savings must be based (normally) upon distribution and not manufacturing costs—such as the cost of transportation, warehousing, selling expense, advertising, and any other distribution costs. Moreover, the cost

defense can be established only by a refined study of distribution costs, and those costs must be allocated over the particular products and customers involved in the price discrimination. Customer groupings can be used in such cost analyses so long as the customers in the group are homogeneous (i.e., they receive the same distribution services). The cost defense is tricky and difficult to establish. *Moreover, it will not work if the distribution costs simply do not exist*. There is no magic in this defense. If the costs exist to justify the price discrimination, they can be found. However, an expensive cost analysis is doomed to failure if the costs simply do not exist.

Note: The changing-market-conditions defense. The second of three affirmative defenses under Robinson–Patman is called "changing market conditions." This defense is little used but does allow different prices to be charged based upon seasonal price variations, distress goods sales, and the like. The seller can change its price from time to time, but it must change its price for all buyers. It cannot "get cute" and have a "special sale" for a large buyer, only to immediately hike its prices to all other buyers.

Section 2(b). Burden of rebutting prima-facie case of discrimination

Section 2(b) of the Robinson–Patman Act is well known because it establishes the third affirmative defense, "meeting competition in good faith." Essentially, this defense permits the seller to lower its price to one buyer while maintaining higher prices to its other buyers (a price discrimination) if it does so merely to meet the competition of another seller who is threatening to take that buyer away. An example follows.

Example 6

An old customer of the seller informs the seller that the buyer can procure goods for 10% less from another supplier. The seller reasonably believes the old customer and grants the customer a similar discount while maintaining its prices to its other buyers. A new customer informs the seller that it can procure the goods from another supplier at a 10% discount. Again, the seller believes the customer and grants a 10% discount to the new customer while charging other buyers the regular (higher) price. Is the seller violating the Robinson–Patman Act in either or both situations?

Analysis: The seller will use the "meeting competition in good faith" defense and, as to the old customer, assuming the seller had reasonable grounds to believe that the lower price was offered by one of his competitors, will prevail. This is known as "defensive" meeting competition in good faith to *retain* an old customer. Whether the seller can use the same defense as to the new customer, even though it is reasonable to believe the new customer, is questionable. This is called "offensive" meeting competition in good faith to gain a new customer. The courts are currently split on this issue, but the better view seems to be that offensive as well as defensive use of the defense is sound.

Note: How does the seller know that the buyer who wants a lower price is telling the truth in asserting the buyer can get it cheaper elsewhere? In fact, the seller does not know for certain. However, the test generally stated is that the seller must operate in a reasonably prudent fashion in believing or not believing the buyer. The seller should make discreet inquiries, particularly of its own salespeople, in determining the state of the market and whether a competitor (or competitors) is offering similar goods at lower prices. If this careful investigation reveals that such lower prices are being offered, the seller may use the defense. An attorney should be consulted in this area to ascertain that a proper record has been established before the lower prices are offered to certain customers.

Note: Other aspects of the "meeting competition in good faith" defense. There may be many other complexities in using the defense that require the skill of an attorney. One of the troublesome areas is whether the defense may be used to meet an entire pricing schedule (quantity discount schedule) as contrasted with merely meeting one price in an individual sale situation. There is recent case law indicating that, under certain conditions, the defense may be used to

meet the prices charged under a discount schedule of competitors. Again, an attorney's advice is essential before any seller should attempt such action. The buyer should be aware of these problems confronting the seller.

Section 2(c). Payment or acceptance of commission, brokerage, or other compensation

Section 2(c) of the act deals with brokerage payments. It was established to avoid a basic evil known as "phantom brokerage." A genuine, independent broker performs services and is entitled to a legitimate brokerage commission. However, if either the buyer or seller employs a party, calling that party a broker, or that "phantom broker" receives a brokerage commission that he or she merely pays over to his or her employer, this is a violation of section 2(c) of the act.

Section (d). Payment for services or facilities for processing or sale

It shall be unlawful for any person engaged in commerce to pay or contract for the payment of anything of value to or for the benefit of a customer of such person in the course of such commerce as compensation or in consideration for any services or facilities furnished by or through such customer in connection with the processing, handling, sale, or offering for sale of any products or commodities manufactured, sold, or offered for sale by such person, unless such payment or consideration is available on proportionally equal terms to all other customers competing in the distribution of such products or commodities.

Section (e). Furnishing services or facilities for processing, handling, etc.

It shall be unlawful for any person to discriminate in favor of one purchaser against another purchaser or purchasers of a commodity bought for resale, with or without processing, by contracting to furnish or furnishing, or by contributing to the furnishing of, any services or facilities connected with the processing, handling, sale, or offering for sale of such commodity so purchased upon terms not accorded to all purchasers on proportionally equal terms.

Example 7

A manufacturer sells to some retailers directly and to others through distributors. Retailer X purchases the manufacturer's product from a distributor and resells some of it to Retailer Y. Retailer X is a customer of the manufacturer. Retailer Y is not a customer unless the fact that it purchases the manufacturer's product is known to the manufacturer.

Analysis: A genuine, independent broker performs services and is entitled to a legitimate brokerage commission. However, if either the buyer or seller employs a party, calling that party a broker, and that "phantom broker" receives a brokerage commission that he merely pays over to his employer, this is a violation of section 2(c) of the act; the FTC will not be able to successfully prosecute B under section 2(d) or 2(e) because those sections may be interpreted to apply only to sellers and not to buyers. However, though sections 2(d) and 2(e) are technically not available, the FTC may proceed under its very general statute, section 5 of the FTC Act, since the activities of B constitute an "unfair method of competition." Therefore, B will be liable under that act.

Section (f). Knowingly inducing or receiving discriminatory price

Section 2(f) of the Robinson–Patman Act is the most important section of the act for the buyer as it applies to *buyer liability*. It is somewhat ironic that the act was designed to deal with the unfair pressures exerted by large buyers in extracting price concessions from suppliers with inferior bargaining power; yet most of the act [sections 2(a) through 2(e)] says nothing about buyers, at least directly. Section 2(f) is the only section dealing directly with buyers. In essence, section 2(f) states that a buyer that *knowingly* induces a discriminatory price from a seller violates the act in the same way that a price-discriminating seller violates the act under section 2(a). The magic word in this statement is *knowingly*, which requires some explanation.

The most important case interpreting section 2(f) was decided in 1953, *Automatic Canteen Co. of America v. FTC*. In that case, the U.S. Supreme Court suggested

a test for buyer liability under section 2(f) that could be interpreted to make the burden of proving a violation of that section extremely difficult. This, of course, is good for buyers. The language of the Court in the *Canteen* case suggested to some observers, including the FTC, that the party bringing the action against a buyer under this section will have to prove that the seller's price discrimination was not cost-justified. This meant that the FTC (or private party) would have to prove negative cost justification, which is next to impossible. For many years, this interpretation of the Supreme Court's *Canteen* decision was very popular. However, recently, the FTC has suggested another, easier-to-prove test:

(i) The buyer induced or received a more favorable (discriminatory) price than other buyers.

(ii) The buyer knew or should have known that the prices it received were discriminatory.

The second element, (ii), takes care of the "knowingly" requirement in section 2(f). In essence, it suggests that a buyer who knows the industry in which he or she buys should reasonably know whether he or she is getting a better price than competitors are getting or could procure from the supplier. If these two elements are the only two that the FTC or a private plaintiff in a treble-damage action must show, section 2(f) violations are not that difficult to prove, and there will be much more activity under this section than heretofore. However, at the moment, the federal courts of appeal are split as to the proper test to be applied. While some courts take the position that the two elements just listed are sufficient, other courts (in other circuits) have required these two elements *plus a third element:* (iii) the buyer knew or should have known that the price discrimination could not be cost-justified or that it was granted to meet competition. Now, for the complaining party to prove that the buyer *knew or should have known* that the price discrimination could not be cost-justified or that it was granted to meet competition is practically impossible. If this third element is added to the necessary proof for a section 2(f) violation, the buyer, again, is quite safe. However, the buyer should not rely upon this stiff test being applied.

Caution: Buyers, particularly buyers with bargaining power superior to their suppliers, should never induce a lower price that they know (or should know) is a better price than the price that the seller is charging or will charge other customers. If the buyer engages in such a practice, it is more than possible that the buyer will face a Robinson–Patman charge by the FTC or a private plaintiff (such as a competitor of the buyer who paid a higher price). The FTC has recently indicated that it will look hard at buyers who receive low prices to determine whether any section 2(f) violations are evident.

Example 8

The PA knowingly induces a discriminatory price with supplier 1 (S-1). Having been offered this price by S-1, the PA then goes to supplier 2 (S-2), informing S-2 that S-1 has offered the lower price and showing S-2 a copy of the offer. S-2 reasonably believes the PA and, to meet competition in good faith, offers the PA the same low price that S-1 has offered. The PA makes the deal with S-2. Is either S-2 or the buyer liable under the act?

Analysis: The answer is that the buyer is liable and the seller is not, at least according to one FTC case. The S-2 has met competition in good faith, but the buyer (who started the whole process) is not entitled to use that defense. This seems fair, though some language of Supreme Court opinions does not necessarily allow for this result. Yet any buyer who engages in this practice may well find itself without the defense even though the defense will be available to its supplier under the facts of the example.

Functional Discounts

There is one additional defense available under the Robinson–Patman Act. It is often referred to as an "unwritten" defense since there is nothing in the act specifically dealing with it. If a seller charges a wholesaler-buyer a lower price than the seller charges direct-buying retailers, there is price discrimination. However, this "functional discount" is permitted

because of the position occupied by the wholesaler in the chain of distribution. The wholesaler does not compete with retailers and, therefore, there is no possible injury to competition granting the wholesaler a better (discriminatory) price than the price charged retailers.

Caution: If a wholesaler is not a "pure" wholesaler, that is, if it engages in some retailing operations as well as wholesaling operations, the seller may not grant a functional discount to the wholesaler. Since many wholesalers today engage in operations as retailers, sellers must be careful in deciding whether to grant a functional discount to such a buyer. The functional discount concept is *not* based on cost savings. It is often suggested that the reason for permitting such discounts is that the wholesaler (or other middleman) performs valuable functions that save the seller money in dealing with the wholesaler as contrasted with retailers. But that is not the correct analysis. If a wholesaler is a pure wholesaler and receives a lower price than retailers to whom the supplier sells the same goods of like grade and quality, the wholesaler is entitled to the lower price because he or she is a wholesaler, not because of any cost savings to him or her that can be used to cost-justify the price discrimination. The wholesaler does not compete with retailers and, therefore, there is no injury to competition.

Enforcement of the Act and Section 3 of the Act

By informal agreement between the Federal Trade Commission and the Department of Justice, Antitrust Division, the FTC enforces the Robinson–Patman Act except for section 3, which has not yet been discussed. The Antitrust Division could enforce all of the Robinson–Patman Act since it is really an amendment to the Clayton Act. Both the FTC and the Justice Department can enforce Clayton Act violations. Only the Justice Department can enforce Sherman Act violations. Only the FTC can enforce its own act, the Federal Trade Commission Act. Finally, there is another section of the Robinson–Patman Act, section 3, that prohibits blatant kinds of price discrimination such as sales below cost or other predatory discriminatory sales. Violations of section 3 may result in fines of $5,000 or up to one year imprisonment or both. Corporations and individuals are subject to this section. Since section 3 is a criminal section, only the Department of Justice can enforce it.

When the Federal Trade Commission finds a violation of the act, it issues a cease-and-desist order. These orders can be difficult to live with, and each violation of a final FTC order is subject to a civil penalty of up to $5,000, with *each day* of a continuing failure to obey the order constituting a separate offense. The penalty for violating such an order is recoverable by the Department of Justice in a federal court. Of course, the party violating the Robinson–Patman Act (like the other antitrust laws) must be concerned about that terrible calamity—the private treble-damage action. Finally, it should be noted that private parties have a great advantage when they sue for treble damages after the government has won its case against the antitrust violator. The private party is entitled to use the government's case (already won) as its case and only has to prove its damages, which, if successfully proven, are then tripled plus reasonable attorney fees and costs. There is only one stark exception to this favorable effect for private plaintiffs: Section 3 of the Robinson–Patman Act has been interpreted, for various reasons, *not* to be an antitrust law. Therefore, if the government wins a case under section 3, this will not help the private party in his or her treble-damage action. However, as to any other part of the Robinson–Patman Act or the other antitrust laws, the private party (plaintiff) does have this great advantage. The advantage can be removed by the defendant pleading *nolo contendere* in a criminal action (under the Sherman Act) or taking a *consent decree* in a civil antitrust action brought by the government. Since these cases do not proceed to trial, the government has really not established a case that a private party could later use. This is why there are so many pleas of nolo contendere or the taking of consent judgments.

APPENDIX B: UNIT FACTORS FOR PROGRESS FUNCTIONS

% Pivot	70%	72%	74%	76%	78%	80%	81%	82%	83%	84%	Table of *F* Values
5	4.6717	4.1362	3.6743	3.2743	2.9266	2.6232	2.4861	2.3577	2.2374	2.1245	5
10	3.2702	2.9780	2.7190	2.4804	2.2827	2.0986	2.0133	1.9333	1.8570	1.7546	10
15	2.6544	2.4574	2.2799	2.1194	1.9739	1.8418	1.7801	1.7214	1.6653	1.6116	15
20	2.2891	2.1442	2.0120	1.6912	1.7805	1.6789	1.6311	1.5853	1.5413	1.4991	20
25	2.0401	1.9290	1.8262	1.7313	1.6437	1.5625	1.5242	1.4872	1.4516	1.4172	25
30	1.8561	1.7693	1.6871	1.6107	1.5397	1.4734	1.4028	1.4116	1.3822	1.3537	30
35	1.7164	1.6447	1.5778	1.5154	1.4569	1.4021	1.3768	1.3506	1.3261	1.3022	35
40	1.6024	1.5438	1.4889	1.4373	1.3888	1.3431	1.3212	1.3000	1.2793	1.2592	40
45	1.5082	1.4600	1.4146	1.3718	1.3314	1.2731	1.2747	1.2549	1.2394	1.2224	45
50	1.4286	1.3889	1.3514	1.3198	1.2020	1.2500	1.2348	1.2195	1.2048	1.1905	50
55.	1.3602	1.3275	1.2965	1.2671	1.2390	1.2122	1.1993	1.1867	1.1743	1.1623	55
60	1.3006	1.2709	1.2464	1.2242	1.2009	1.1787	1.1889	1.1575	1.1472	1.1371	60
65	1.2482	1.2265	1.2058	1.1860	1.1670	1.1488	1.1399	1.1313	1.1228	1.1144	65
70	1.2015	1.1842	1.1676	1.1517	1.1364	1.1217	1.1149	1.1073	1.1006	1.0939	70
75	1.1595	1.1461	1.1331	1.1206	1.1086	1.0970	1.0914	1.0859	1.0804	1.0750	75
80	1.1217	1.1115	1.1018	1.0924	1.0833	1.0749	1.0708	1.0660	1.0618	1.0577	80
85	1.0872	1.0801	1.0731	1.0665	1.0600	1.0537	1.0908	1.0476	1.0447	1.0417	85
90	1.0557	1.0512	1.0468	1.0426	1.0385	1.0345	1.0325	1.0306	1.0287	1.0269	90
95	1.0267	1.0246	1.0225	1.0205	1.0186	1.0167	1.0157	1.0148	1.0139	1.0130	95
100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100
105	0.9752	0.9771	0.9790	0.9809	0.9827	0.9844	0.9853	0.9861	0.9870	0.9878	105
110	0.9521	0.9558	0.9594	0.9630	0.9664	0.9698	0.9714	0.9731	0.9747	0.9763	110
115	0.9306	0.9359	0.9411	0.9462	0.9511	0.9560	0.9582	0.9608	0.9631	0.9655	115
120	0.9105	0.9172	0.9239	0.9304	0.9367	0.9430	0.9461	0.9491	0.9522	0.9552	120
125	0.8915	0.8997	0.9076	0.9154	0.9231	0.9307	0.9564	0.9381	0.9418	0.9454	125
130	0.8737	0.8831	0.8923	0.9013	0.9103	0.9190	0.9233	0.9276	0.9319	0.9361	130
135	0.8569	0.8674	0.8778	0.8880	0.8980	0.9079	0.9128	0.9177	0.9225	0.9273	135
140	0.8410	0.8526	0.8040	0.8753	0.8864	0.8974	0.9028	0.9082	0.9135	0.9189	140
145	0.8260	0.8386	0.8510	0.8632	0.8753	0.8873	0.8932	0.8991	0.9050	0.9108	145
150	0.8117	0.8252	0.8385	0.8517	0.8647	0.8776	0.8849	0.8904	0.8967	0.9030	150
155	0.7981	0.8125	0.8267	0.8407	0.8546	0.8684	0.8755	0.8821	0.8889	0.8956	155
160	0.7852	0.8000	0.8153	0.8302	0.8450	0.8596	0.8869	0.8741	0.8813	0.8885	160
165	0.7729	0.7888	0.8045	0.8202	0.8357	0.8511	0.8588	0.8664	0.8741	0.8817	165
170	0.7611	0.7777	0.7942	0.8105	0.8268	0.8430	0.8910	0.8591	0.8071	0.8751	170
175	0.7498	0.7871	0.7842	0.8013	0.8183	0.8352	0.8438	0.8520	0.8603	0.8687	175
180	0.7390	0.7569	0.7747	0.7924	0.8100	0.8276	0.8304	0.8451	0.8539	0.8626	180
185	0.7287	0.7471	0.7655	0.7839	0.8021	0.8204	0.8294	0.8385	0.8476	0.8567	185
190	0.7188	0.7378	0.7567	0.7756	0.7945	0.8133	0.8228	0.8322	0.8415	0.8509	190
195	0.7092	0.7287	0.7482	0.7677	0.7871	0.8066	0.8168	0.8260	0.8357	0.8454	195

% Pivot	85%	86%	87%	88%	89%	90%	92%	94%	96%	98%	Table of *F* Values
5	2.0186	1.9191	1.8256	1.7376	1.6548	1.5767	1.4339	1.3066	1.1929	1.0912	5
10	1.7158	1.6904	1.5882	1.5291	1.4727	1.4191	1.3191	1.2282	1.1452	1.0694	10
15	1.5602	1.5110	1.4640	1.4189	13757	1.3342	1.2564	1.1845	1.1182	1.0569	15
20	1.4584	1.4194	1.3818	1.3456	1.3107	1.2772	1.2138	1.1545	1.0994	1.0480	20
25	1.3841	1.3921	1.3212	1.2913	1.2625	1.2346	1.8119	1.1317	1.0851	1.0412	25
30	1.3262	1.2995	1.2737	1.2486	1.2244	1.2008	1.1558	1.1135	1.0735	1.0357	30
35	1.2791	1.2566	1.2348	1.2136	1.1930	1.1730	1.1346	1.0982	1.0638	1.8311	35
40	1.2397	1.2206	1.2021	1.1541	1.1669	1.1494	1.1148	1.0852	1.0554	1.0271	40
45	1.2059	1.1898	1.1740	1.1587	1.1437	1.1290	1.1008	1.0739	1.0482	1.0235	45
50	1.1745	1.1628	1.1494	1.1344	1.1236	1.1111	1.0878	1.0638	1.0417	1.0204	50
55	1.1505	1.1389	1.1276	1.1166	1.1057	1.0951	1.0744	1.0548	1.0358	1.0176	55
60	1.1272	1.1176	1.1081	1.0988	1.0897	1.0807	1.0638	1.0467	1.0305	1.0150	60
65	1.1063	1.0983	1.0904	1.0827	1.0751	1.0677	1.0532	1.0392	1.0257	1.0126	65
70	1.0872	1.0807	1.0743	1.0680	1.0618	1.0557	1.0438	1.0324	1.0212	1.0105	70
75	1.0698	1.0646	1.0595	1.0545	1.0496	1.0447	1.0321	1.0260	1.0171	1.0084	75
80	1.0537	1.0498	1.0459	1.0420	1.0392	1.0345	1.0272	1.0201	1.0132	1.0065	80
85	1.0388	1.0360	1.0332	1.0304	1.0277	1.0250	1.0197	1.0146	1.0096	1.0047	85
90	1.0250	1.0232	1.0214	1.0198	1.0179	1.0101	1.0128	1.0095	1.0062	1.0031	90
95	1.0121	1.0112	1.0104	1.0095	1.0087	1.0078	1.0062	1.0046	1.0030	1.0015	95
100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	100
105	0.9886	0.9894	0.9902	0.9918	0.9918	0.9926	0.9942	0.9957	0.9971	0.9986	105
no	0.9779	0.9795	0.9810	0.9826	0.9841	0.9856	0.9586	0.9915	09944	09972	110
115	0.9678	0.9701	0.9723	0.9746	0.9768	0.9790	0.9832	0.9876	0.9918	0.9959	115
120	0.9582	0.9611	0.9640	0.9669	0.9698	0.9727	0.9788	09839	0.9893	0.9947	120
125	0.9490	0.9526	0.9562	0.9597	0.9632	0.9667	0.9738	0.9803	0.9869	0.9935	125
130	0.9403	0.9445	0.9487	0.9520	0.9569	0.9009	0.9689	0.9769	0.9847	0.9924	130
135	0.9321	0.9368	0.9415	0.9462	0.9508	0.9554	0.9648	0.9736	0.9825	0.9913	135
140	0.9241	0.9294	0.9346	0.9398	0.9450	0.9501	0.9608	0.9704	0.9804	0.9902	140
145	0.9166	0.9223	0.9281	0.9338	0.9394	0.9451	0.9568	09674	0.9784	0.9892	145
150	0.9093	0.9156	0.9218	09280	0.9341	0.9402	0.9524	09645	0.9764	0.9883	150
155	0.9024	0.9091	0.9157	0.9224	09290	0.0356	0.9487	0.9616	0.9745	0.9873	155
160	0.8957	0.9028	0.9099	09170	0.9240	0.9311	0.9450	0.9389	0.9727	0.9864	160
165	0.8892	0.8968	0.9043	0.9118	0.9193	0.9267	0.9415	0.9563	0.9709	09855	165
170	0.8830	0.8910	0.8989	09068	0.9147	0.9225	0.9301	0.9537	0.9692	0.9847	170
175	0.8770	0.8854	0.8937	0.9020	0.9102	0.9185	09340	0.9513	0.9676	09838	175
180	0.8713	0.8000	0.8886	0.8973	0.9059	0.9145	0.9317	0.9489	09660	0.9830	180
185	0.8657	0.8747	0.8937	0.8928	0.9018	0.9107	0.9287	0.9466	09644	0.9822	185
190	0.8603	0.8697	0.8790	0.8884	0.8977	0.9071	0.9257	0.9443	09429	09815	190
195	0.8551	0.8648	0.8744	0.8841	0.8938	0.9035	09228	09421	09614	0.9807	195
200	0.8500	0.8600	0.8700	0.8800	0.8900	0.9000	0.9200	09400	0.9600	0.9800	200
210	0.8403	0.8509	0.8615	0.8721	0.8827	0.8934	09146	0.9359	0.9573	0.9786	210

(*Continued*)

APPENDIX B (Continued)

% Pivot	70%	72%	74%	76%	78%	80%	81%	82%	83%	84%	Table of *F* Values
200	0.7000	0.7200	0.7400	0.7600	0.7800	0.8008	0.8100	0.8200	0.8300	0.8400	200
210	0.6826	0.7035	0.7245	0.7455	0.7665	0.7876	0.7981	0.8086	0.8192	0.8298	210
220	0.6665	0.6802	0.7100	0.7319	0.7532	0.7759	0.7869	0.7980	0.8090	0.8201	220
230	0.6514	0.6739	0.6964	0.7191	0.7419	0.7648	0.7768	0.7879	0.7994	0.8110	230
240	0.6373	0.6604	0.6837	0.7071	0.7307	0.7544	0.7664	0.7783	0.7903	0.8024	240
250	0.6241	0.6477	0.6716	0.6957	0.7201	0.7446	0.7569	0.7693	0.7817	0.7942	250
260	0.6116	0.6358	0,6603	0.6850	0.7100	0.7352	0.7479	0.7607	0.7735	0.7864	260
270	0.5995	0.6245	0.6496	0.6749	0.7004	0.7264	0.7306	0.7525	0.7657	0.7790	270
280	0.5887	0.6139	0.6394	0.6652	0.6914	0.7179	0.7313	0.7447	0.7583	0.7719	280
290	0.5782	0.6037	0.6297	0.6560	0.6827	0.7099	0.7239	0.7373	0.7511	0.7651	290
300	0.5682	0.5941	0.6205	0.6473	0.6745	0.7021	0.7161	0.7302	0.7443	0.7586	300
310	0.5587	0.5850	0.6117	0.6389	0.6666	0.6947	0.7098	0.7234	0.7378	0.7524	310
320	0.5496	0.5742	0.6033	0.6310	0.6591	0.6877	0.7022	0.7160	0.7315	0.7464	320
330	0.5410	0.5679	0.5953	0.6233	0.6518	0.6809	0.6953	0.7105	0.7255	0.7406	330
340	0.5327	0.5399	0.5877	0.6160	0.6449	0.6744	0.6998	0.7044	0.7197	0.7351	340
350	0.5249	0.5523	0.5803	0.6090	0.6382	0.6681	0.6838	0.6986	0.7141	0.7297	350
360	0.5173	0.5449	0.5732	0.6022	0.6318	0.6621	0.6773	0.6930	0.7087	0.7246	360
370	0.5101	0.5379	0.5665	0.5957	0.6256	0.6563	0.6718	0.6876	0.7035	0.7196	370
380	0.5031	0.5312	0.5599	0.5894	0.6197	0.6507	0.6664	0.6823	0.6985	0.7148	380
390	0.4964	0.5247	0.5537	0.5834	0.6139	0.6458	0.6618	0.6773	0.6936	0.7102	390
400	0.4900	0.5184	0.5476	0.5776	0.6084	0.6400	0.6501	0.6724	0.6889	0.7056	400
410	0.4838	0.5124	0.5416	0.5720	0.6030	0.6349	0.6512	0.6677	0.6843	0.7012	410
420	0.4779	0.5066	0.5361	0.5665	0.5079	0.6300	0.6464	0.6631	0.6799	0.6970	420
430	0.4721	0.5009	0.5307	0.5613	0.5928	0.6253	0.6418	0.6586	0.6756	0.6929	430
440	0.4665	0.4955	0.5254	0.5562	0.5880	0.6207	0.6374	0.6543	0.6715	0.6889	440
450	0.4612	0.4903	0.5203	0.5913	0.5832	0.6162	0.6338	0.6501	0.6674	0.6850	450
460	0.4560	0.4852	0.5153	0.5465	0.5787	0.6118	0.6288	0.6460	0.6635	0.6812	460
470	0.4510	0.4803	0.5106	0.5419	0.5742	0.6076	0.6247	0.6421	0.6597	0.6775	470
480	0.4461	0.4755	0.5059	0.5374	0.5699	0.6035	0.6207	0.6382	0.6559	0.6740	480
490	0.4414	0.4709	0.5014	0.5330	0.5657	0.5995	0.6169	0.6344	0.6523	0.4705	490
500	0.4368	0.4664	0.4970	0.5200	0.5616	0.5956	0.6131	0.6308	0.6488	0.6671	500
550	0.4159	0.4458	0.4769	0.5092	0.5428	0.5776	0.5958	0.6138	0.6324	0.6513	550
600	0.3977	0.4278	0.4592	0.4919	0.5261	0.5617	0.5801	0.5987	0.6178	0.6372	600
650	0.3817	0.4118	0.4435	0.4766	0.5112	0.5474	0.5661	0.5851	0.6046	0.6245	650
700	0.3674	0.3976	0.4294	0.4628	0.4978	0.5345	0.5531	0.5729	0.5927	0.6129	700
750	03546	0.3848	0.4167	0.4503	0.4857	0.5227	0.5421	0.5616	0.5818	0.6024	750
800	0.3430	0.3732	0.4052	0.4390	0.4746	0.5120	0.5314	0.5514	0.5718	0.5927	800
850	0.3325	0.3627	0.3947	0.4286	0.4644	0.5021	0.5217	0.5419	0.5625	0.5837	850
900	0,3228	0.3530	0.3850	0.4190	0,4549	0.4929	0.5127	0.5331	0.5540	0.5754	900
950	0.3140	0.3441	03761	0.4101	0.4467	0.4844	0.5044	0.5249	0.5460	0.5676	950
1000	0.3058	0.3398	0.3678	0.4019	0.4381	0.4765	0.4966	0.5172	0.5385	0.5604	1000

% Pivot	85%	86%	87%	88%	89%	90%	92%	94%	96%	98%	Table of *F* Values
220	0.8312	0.8424	0.8535	0.8647	0.8759	0.8871	0.9095	0.9320	0.9546	0.9773	220
230	0.8226	0.8343	0.8459	0.8576	0.8693	0.8811	0.9047	0.9234	0.9521	0.9760	230
240	0.8145	0.8266	0.8387	0.8509	0.8631	0.8754	0.9001	0.9248	0.9498	0.9748	240
250	0.8067	0.8193	0.8319	0.8465	0.8572	0.8700	0.8956	0.9215	0.9475	0.9737	250
260	0.7993	0.8183	0.8253	0.8385	0.8516	0.8648	0.8914	0.9182	0.9453	0.9725	260
270	07923	0.8097	0.8191	0.8326	0.8442	0.8599	0.8874	0.9152	0.9432	0.9715	270
280	0.7855	0.7993	0.8132	0.8271	0.8411	0.8551	0.8835	0.9122	0.9412	0.9704	280
290	0.7791	0.7932	0.8074	0.8217	0.8361	0.8506	0.8708	0.9093	0.9392	0.9694	290
300	0.7729	0.7874	0.8020	0.8166	0.8314	0.8462	0.8762	0.9066	0.9374	0.9685	300
310	0.7670	0.7818	0.7967	0.8117	0.8268	0.8420	0.8720	0.9039	0.9355	0.9676	310
320	0.7613	0.7764	0.7916	0.8070	0.8224	0.8380	0.8694	0.9014	0.9338	0.9667	320
330	0.7559	0.7712	0.7868	0.8024	0.8182	0.8341	0.8662	0.8989	0.9321	0.9658	330
340	0.7506	0.7653	0.7821	0.7980	0.8141	0.8303	0.8631	0.8965	0.9305	0.9650	340
350	0.7455	0.7616	0.7775	0.7937	0.8101	0.8266	0.8601	0.8942	0.9289	0.9641	350
360	0.7406	0.7568	0.7731	0.7896	0.8043	0.8231	0.8572	0.8920	0.9273	0.9634	360
370	0.7359	0.7523	0.7689	0.7856	0.8026	0.8197	0.8544	0.8898	0.9258	0.9626	370
380	0.7313	0.7479	0.7648	0.7818	0.7990	0.8164	0.8517	0.8877	0.9244	0.9618	380
390	0.7268	0.7437	0.7608	0.7781	0.7955	0.8131	0.8490	0.8856	0.9230	0.9611	390
400	0.7225	0.7396	0.7569	0.7744	0.7921	0.8100	0.8464	0.8836	0.9216	0.9604	400
410	0.7184	0.7357	0.7532	0.7709	0.7888	0.8070	0.8439	0.8817	0.9203	0.9587	410
420	0.7143	0.7318	0.7496	0.7675	0.7857	0.8040	0.8415	0.8798	0.9190	0.9590	420
430	0.7104	0.7281	0.7460	0.7642	0.7826	0.8012	0.8391	0.8779	0.9177	0.9584	430
440	0.7065	0.7245	0.7426	0.7609	0.7795	0.7984	0.8368	0.8761	0.9164	0.9577	440
450	0.7028	0.7209	0.7392	0.7578	0.7766	0.7957	0.8345	0.8744	0.9152	0.9571	450
460	0.6992	0.7175	0.7360	0.7547	0.7737	0.7930	0.8323	0,8727	0.9141	0.9565	460
470	0.6957	0.7141	0.7328	0.7517	0.7709	0.7904	0.8302	0.8710	0.9129	0.9539	470
480	0.6923	0.7109	0.7287	0.7488	0.7682	0.7879	0.8281	0.8693	0.9118	0.9553	480
490	0.6889	0.7077	0.7267	0.7460	0.7656	0.7854	0.8263	0.8678	0.9107	0.9547	490
500	0.6857	0.7045	0.7238	0.7432	0.7630	0.7830	0.8240	0.8662	0.9096	0.9542	500
550	0.6705	0.6901	0.7100	0.7303	0.7508	0.7718	0.8146	0.8589	0.9045	0.9513	550
600	0.6570	0.6771	0.6977	0.7187	0.7399	0.7616	0.8061	0.8522	0.8999	0.9491	600
650	0.6448	0.6655	0.6866	0.7081	0.7301	0.7524	0.7984	0.8461	0.8956	0.9469	650
700	0.6337	0.6548	0.6764	0.6985	0.7210	0.7440	0.7918	0.8406	0.8917	0.9449	700
750	0.6235	0.6451	0.6671	0.6896	0.7127	0.7362	0.7848	0.8354	0.8881	0.9430	750
800	0.6141	0.6361	0.6585	0.6815	0.7050	0.7290	0.7787	0.8306	0.8847	0.9412	800
850	0.6055	0.6277	0.6505	0.6739	0.6978	0.7224	0.7731	0.8261	0.8816	0.9395	850
900	0.5974	0.6200	0.6431	0.6668	0.6911	0.7161	0.7678	0.8219	0.8786	0.9380	900
950	0.5899	0.6127	0.6362	0.6602	0.6849	0.7103	0.7628	0.8180	0.8758	0.9345	950
1000	0.5828	0.6059	0.6296	0.6540	0.6790	0.7047	0.7581	0.8142	0.8732	0.9351	1000

APPENDIX C: ESTRADA SYSTEMS

Estrada Systems, located in Bridgeport, California, is a divisional headquarters of the Estrada Corporation. Estrada is a leading Tier-1 automotive supplier of climate control systems. Formerly a part of Ford Motors, Estrada's Ford sales account for nearly 72% of its sales revenue. The assembly plant produces a variety of products, including accumulator dehydrators, compressors, condensers, HVAC modules, evaporators, and heater cores. The Estrada Corporation uses the hybrid purchasing approach to manage its various business units. Buyers are located at each of the Ford divisions, along with purchasing managers and one purchasing director. Located at the firm's headquarters in Michigan are commodity specialists and high-level purchasing executives.

The commodity team has already prequalified and received quotes from four suppliers: Vortex Group Automotive Systems; Prahinski Corporation; Hozak-Zhou; and Hong Kong Automobile Air-Conditioner Accessories Co., Ltd.

Vortex Automotive is a UK-based private limited company. Almost all facilities are QS/ISO 9000 certified; it is Vortex Automotive's goal to achieve ISO 14001 certification on a global basis. Vortex supplies fluid storage, transfer, and delivery systems including brake, fuel, and air-conditioning applications. Vortex employs over 20,000 people in more than 100 facilities and has operations in 29 countries on six continents.

With annual sales exceeding $6 billion, Prahinski Corporation is the world's leading diversified manufacturer of motion and control technologies, providing systematic, precision-engineered solutions for a wide variety of commercial, mobile, industrial, and aerospace markets. The company's products are vital to virtually everything that moves or requires control. This includes the manufacture and processing of raw materials, durable goods, infrastructure development, and all forms of transport. Prahinski is strategically diversified, value-driven, and well positioned for global growth as the industry consolidator and supplier of choice.

In 2001, Hozak-Zhou merged Hozak North America and Zhou Corporation to form Hozak-Zhou North America. The company is well poised to meet the challenges of its domestic and global customers. Worldwide design and production facilities, as well as subsidiaries and joint ventures, deliver common platform modules, with customization as needed. Engineers listen to what consumers want—increased comfort and safety, advanced display and information technology, less noise, improved fuel economy, reduced emissions, durability, recyclables, and more—and provide either an individual component or a complete integrated system or module to meet performance and design expectations.

Hong Kong Automobile Air-Conditioner Accessories Co., Ltd., is the first joint venture that specializes in designing and producing all kinds of modern automobile refrigerant hose assemblies to form a relationship with Estrada Automobile Air Conditioner Systems Co., Ltd.

Problem Statement

Currently, the metallic buyer at Estrada is looking to contract for a tube line and fitting assembly, part #36648622. The tubing is used to hook up the HVAC module to the vehicle. For example, one of these assemblies would hook up the compressor to the condenser, or the transmission to the oil cooler. Annual volume for this part is 95,000 units. There does not seem to be any predetermined market price, possibly due to the high number of parts making up the assembly. The base price is determined only by the lowest bid received, granted there is no suspicion of missing or erroneous information.

The auto industry has felt the effects of the economy's large recession. Before the terrorist attacks, the U.S. economy was already showing signs of stagnation, but the effects of these attacks on consumer confidence was profound and immediate. To bolster sales, the U.S. automotive industry (with Ford leading the charge) began a campaign of heavy discounting in the form of 0% financing and huge cash-back incentive programs. At the same time, the industry began cutting capacity to bring supply in line with decreased demand. But the combination of price war incentives and production cuts was a dangerous duo. Incentives ceased to be effective when the loss in revenue per vehicle was not made up for in volume; thus, volume was difficult to attain

if production was significantly reduced. Recently, the Japanese have become an even bigger threat as Toyota is poised to replace DaimlerChrysler (now Chrysler) as one of the Big Three automakers. Now more than ever, strategic purchasing and price/cost analysis are necessary components in choosing quality products at a competitive price.

The purchasing manager received four quotes in response to the 15 RFQs disseminated. Estrada's selection alternatives are as follows: perform a price/cost analysis, award the contract to the previous supplier, or award the contract to the lowest bidder.

Assumptions

A_1: All suppliers are prequalified. Criteria for this include the following:

- Financial health
- Management expertise
- Manufacturing capacity

A_2: Prices don't change with capacity; the first part costs the same as the millionth part.

A_3: Cost is composed of two components: variable and fixed costs.

A_4: Prices are good for one year.

Alternatives

- Estrada Thermal Systems has the option of using cost management through the price/cost analysis method; this will help to improve the suppliers' prices and the ability to choose suppliers.
- Stay with the current supplier, Hozak-Zhou.
- Choose the supplier based on cost—no price/cost analysis.

Economic Alternatives

The auto industry is currently facing an all-time-low market. In this instance, it would be reasonable for the buyer at Estrada to choose the lowest-cost bid.

Choosing the supplier based on these criteria alone would help the buyer save time; however, this may not always be the best alternative. For total costs, refer to Figures 13.7 through 13.11.

Analysis

The first option is to use the price/cost analysis. The cost standard concept is the idea of creating baseline, idealized "best-of-the-best" values across an industry of the lowest-cost values for each cost component. Estrada must attempt to develop and use such a standard to choose suppliers who fit that standard the closest and to use that standard to help the suppliers achieve better

FIGURE 13.7
Hong Kong AAA

	Initial		After Negotiations		Savings	Standard
Material	$7.09		$7.09		$—	
Labor	$0.40		$0.40		$—	
Burden	$0.84		$0.84		$—	
SG&A	$0.83	10% (% of total cost)	$0.75	9% (% of total cost)	$0.08	PH
Profit	$0.46	5% (% of total cost)	$0.45	5% (% of total cost)	$0.01	
Selling price	$9.62		$9.53		$0.09	
Annual volume	95,000		95,000			
Annual cost	$913,900		$905,350		$8,550	
Set up cost	$100,000		$100,000			
Total cost	$1,013,900		$1,005,350		$8,550	

FIGURE 13.8
Vortex

	Initial		After Negotiations		Savings	Standard
Material	$5.67		$5.67		$—	
Labor	$1.60		$1.60		$—	
Burden	$1.26		$1.26		$—	
SG&A	$1.05	(12.30% of Total cost)	$0.77	(9.00% of Total Cost)	$0.28	PH
Profit	$0.80	(9.40% of Total cost)	$0.43	(5.02% of Total cost)	$0.37	Hong Kong
Selling price	$10.38		$9.53		$0.85	
Annual volume	95,000		95,000			
Annual cost	$986,100		$905,360		$80,740	
Setup cost	$500,000.00		$500,000.00			
Total cost	$$1,486,100		$1,405,360		$80,740	

FIGURE 13.9
Prahinski

	Initial		After Negotiations		Savings	Standard
Material	$5.08		$5.08		$—	
Labor	$0.16		$0.16		$—	
Burden	$4.46		$1.26		$3.20	
SG&A	$0.87	(9% of Total Cost)	$0.54	(9% of Total Cost)	$0.33	TI
Profit	$0.54	(5.50% of Total Cost)	$0.49	(5.02% Total Cost)	$0.05	
Selling price	$11.11		$7.53		$3.58	
Annual volume	95,000		95,000			
Annual cost	$1,055,450		$715,350		$340,100	
Setup cost	$—		$—		$—	
Total cost	$1,055,450		$715,350		$340,100	

FIGURE 13.10
Hozak-Zhou

	Initial		After Negotiations		Savings	Standard
Material	$7.27		$7.27		$—	
Labor	$2.09		$2.09		$—	
Burden	$2.10		$1.26		$0.84	TI
SG&A	$1.41	(12.30% of Total cost)	$0.96	(9.00% of Total Cost)	$0.45	PH
Profit	$0.58	(5.10 % of Total cost)	$0.54	(5.10% % of Total cost)	$0.04	
Selling price	$13.45		$12.12		$1.33	
Annual volume	95,000		95,000			
Annual cost	$1,277,750.00		$1,151,400.00		$126,350.00	
Setup cost	$—		$—		$—	
Total cost	$1,277,750.00		$1,151,400.00		$126,350.00	

costs. Furthermore, the cost standard can be used in price negotiations to identify the best possible price or for planning purposes where suppliers are involved in decreasing costs to baseline levels.

Primary to the cost of the part is TMC, or the total manufacturing cost, which is made up of three distinct elements: direct material cost, direct labor cost, and burden (overhead). Burden can be broken down further into fixed and variable costs.

Examining Figures 13.7 through 13.11, it becomes clear that leading the pack in overall low selling cost is Hong Kong AAA, with $9.62. Next is Vortex Automotive with $10.38, third is Prahinski with $11.11, and finally the highest price is Hozak-Zhou with $13.45. These prices represent a wide range, with the base price from Hong Kong AAA being only 71% of Hozak-Zhou's price.

The breakdowns of the total manufacturing costs are then evaluated. The material costs for each supplier are shown first (see, e.g., Figures 13.7 and 13.8). Hozak-Zhou's material costs are by far the highest, at $7.27. Although it is the incumbent supplier, Hozak-Zhou is asking for a $2 increase from last year's price due to an increase in its material purchases. Close behind is Hong Kong AAA at $7.09. Coming in much lower, Vortex Automotive's costs are $5.67, and, finally, Prahinski is at $5.08. Prahinski's cost is 70% of Hozak-Zhou's cost.

Next, the labor cost is considered. Here, the geographical location of the plants plays a big part in the direct labor costs that go into making the HVAC hose assembly. The two North American suppliers, Hozak-Zhou and Vortex Automotive, have $2.09 and $1.60 direct labor costs, respectively. This comprises 16% and 18%, respectively, of their overall selling price. By comparison, the two offshore suppliers, Hong Kong AAA and Prahinski, have labor costs of $0.40 and $0.16. Hong Kong AAA's and Prahinski's labor percentages are only 1% and 3%, respectively, of the overall part price.

The burden component is the final element of the total manufacturing cost. Burden represents nondirect costs such as taxes, depreciation, rent, utilities, maintenance, repair, and other things that keep the manufacturing process running but aren't directly used

in making the product. There are two parts of burden—variable and fixed—that relate to each product made. With variable cost, Vortex Automotive keeps costs down at $0.40. The other manufacturers are much higher. For example, Hong Kong AAA is at $0.75, Hozak-Zhou is at $2.03, and Prahinski is at a very high $2.90.

As far as fixed costs go, Hozak-Zhou had the lowest costs, with $0.06. Hong Kong AAA is very close with $0.09. The other two suppliers, Vortex Automotive and Prahinski, are much higher, by orders of magnitude. The fixed costs for Vortex Automotive are $0.86, with Prahinski at $1.56.

To summarize, Hong Kong AAA's total burden is $0.84, Vortex Automotive's is $1.26, and Hozak-Zhou's burden is $2.09 while Prahinski's total burden is $4.46. Some of the information that supports these data can help explain the widely differing burden costs. One reason why Hong Kong AAA's burden is so low is because the company is based in China, and the Chinese government subsidizes tooling and machinery costs. In addition, the company has easy access to cheap labor resources. As for Hozak-Zhou, part #36648622 is constructed on machinery used to create other parts, meaning it already has a capital investment not directly related to the HVAC hose assembly. For Prahinski, the company has a large investment in automated equipment, capital investments, and perishable tooling. Moreover, Vortex Automotive has some of the same costs as Prahinski, but not to the same degree.

A high difference in burden cost is attributed to two additional components. For example, each company may have different procedures for filling out the same forms and may attribute different costs to burden. Second, suppliers may try to hide additional costs within the burden figures to elevate their selling price.

Other remaining costs to consider outside of total manufacturing costs are sales, general, and administrative (SG&A) costs and profit, where "pure profit" is made from the sale of each part. Hong Kong AAA has the lowest SG&A costs with $0.83. Next is Prahinski with $0.87. Following up are Vortex Automotive at $1.05 and Hozak-Zhou at $1.41. In terms of profit, Hong Kong AAA was again the lowest, with a profit of $0.46. This was about 5% of its total price. Prahinski was second with $0.54; this was 5.13% of its total item price. Hozak-Zhou was at $0.66, which totaled 5.5% of its final price. Last was Vortex Automotive, which earned $0.80 of profit on each sale, which reflected 9.40% of its total item price.

After analyzing the data, we developed a cost standard that Estrada can use for this particular product. The lowest overall materials cost is $5.08. The lowest labor cost is $0.15, while the baseline burden is made up of a fixed cost of $0.06 and a variable cost of $0.10, for a total baseline burden of $0.16. Finally, the lowest SG&A cost in the industry was $0.83, while the lowest profit per sale was $0.46.

The second option would be to award the contract to Hozak-Zhou, the company that supplied the parts in the past.

One option that Estrada has is to pick the supplier that could provide the lowest cost per unit. A supplier should never be chosen based solely on price. Contracts awarded only on this basis place the supplier in control; this could lead to bad deals and supplier advantages in the long run. Furthermore, the buyer loses the option of negotiation and therefore loses the power of leveraging a buy to its lowest possible cost.

Benefits for choosing this alternative include improving the suppliers' competitive position, while Estrada increases profitability and cost flow, reduces total cost, and develops commodity expertise.

The goal for Estrada should be to focus on cost management. Cost management is a way of evaluating the supplier's material, labor, and burden (overhead) costs.

Cost management allows buyers to work with the suppliers to identify different areas needing improvement. One issue of importance is to have the supplier produce its respective product as efficiently as possible. Estrada customers expect the company to deliver top-quality parts on time, every time; customers assume that the quality is there and that Estrada ensures continuous improvement. The concept of meeting quality, continuous improvement, and customer expectation is limited by choosing the supplier based on cost alone. The end may result in high risk for the company as customers show dissatisfaction and the image of the company is portrayed negatively. A buyer risks this when all aspects of a supplier are not assessed.

Recommendations

The cost standard approach versus the other two alternatives would provide the overall best solution for Estrada. Now that the supplier cost elements have been analyzed, Estrada needs to use these cost standards in future negotiations. This is an essential step for an assembly with such a large annual purchase value (APV). It is apparent that all the suppliers have both competitive

and noncompetitive cost elements. The cost standard approach must be used to negotiate costs using the other suppliers as benchmark comparisons. Negotiable elements include SG&A, burden, and profit. The two lowest-quoted suppliers should be used as the baseline for negotiating the various cost components. The best cost components for negotiation are SG&A, overhead burden, and profit. Direct labor and direct material costs are less likely to be significantly different. However, in the current outsourcing environment, labor may be significantly lower for offshore suppliers. The analysis must consist of a comparison between the upper bound of the quoted prices and a realistic lower bound that may be achieved through the negotiation process. The setup costs involved in switching suppliers also must be accounted for. The price/cost analysis is given in the next section.

Implementation

Hong Kong, although the lowest initial bid, had very little room for possible negotiations. The material costs between the suppliers should have very little variation. Unless Hong Kong can buy the materials at a competitive price, it will never be able to compete in the market. However, labor and burden costs were very competitive and provide a good base for comparisons with the three remaining suppliers.

Vortex Automotive, our second-lowest bidder, had a couple of areas that could be leveraged during negotiations. Unfortunately, these were not areas that contained high costs. Vortex was competitive in the regions of material, labor, and burden. We believe Vortex had margin for negotiation in the areas of SG&A and profit. Its 12.3% was among the highest markups and was most likely an area where Vortex was hiding profits. Here, we used Prahinski as the standard for SG&A at 9%. Vortex, by far, had the highest profit margin among the four suppliers. Therefore, it was not unreasonable to use Hong Kong as the benchmark at 5.02%. This process yielded a $0.72 per-unit savings, moderately impressive considering the annual volume. But where Vortex throws itself out of competition was its extremely high setup cost of $500,000. Obviously, it needed a complete restructuring of its operations in order to handle this. Although annual savings opportunities of about $80,740 were discovered, its total cost was not close to being competitive.

Prahinski, by far, was identified as having the greatest negotiation opportunities. Prahinski appeared to be very competitive in materials, labor, SG&A, and profit. The company was the cost standard for three of the five cost elements, but it was easy to see where Prahinski was hiding profits from the initial quote. Its burden cost of $4.46 was almost double that of the next-lowest competitor. The standard chosen for burden costs was $1.26 from Vortex Automotive. The reasoning behind this is because of the similarity in automation capabilities of the two suppliers. Prahinski understands how to compete and leverage in many areas. It seems as though the company was hoping to hide additional profits in burden costs.

We see great potential in negotiations with Prahinski because it required no setup costs. We have found that Prahinski built this part on the equipment it used for another part, which gave it great advantage. We discovered more than $340,000 in opportunities based on its original quote. Also, Prahinski's total cost of $715,350 per year was the lowest of the four.

Hozak-Zhou was the incumbent supplier for this part. Unfortunately, it was asking for around a $2 increase from its previously contracted price. Most of these costs stemmed from an increase in material costs. Hozak-Zhou quoted the highest material costs of any competing supplier. Despite the price increase, there were still opportunities to bring down the price through burden and SG&A. Burden could possibly be benchmarked by Vortex's initial quote of $1.26. Hozak-Zhou's SG&A markup was the highest of the four at 12.3%. We believed a more competitive number of 9% would put Hozak-Zhou at Prahinski's standard. In addition, Hozak-Zhou had an advantage because it was the previous supplier of the part and would not incur future setup costs if awarded the contract. Total savings of $126,350.00 have been identified.

Figure 13.11 shows the extrapolated cost and potential savings over the 4-year life of the program.

As stated previously, the analysis above should be done before going into negotiations. This analysis would help to find the two suppliers with the lowest potential price. Although we suggest pursuing only two suppliers for negotiations, we believe it would be highly beneficial to use all four suppliers as sources of benchmark comparisons. With a high APV item such as this, it is important to use every piece of leverage available.

It is recommended that Estrada select Hong Kong Automobile and Prahinski as the two suppliers with which it should enter negotiations. Their total costs are $2,861,400 and $2,861,440, respectively. We would first approach Hong

FIGURE 13.11
The Program's Costs and Savings

(a) Costs

Year	Hong Kong	Vortex	Prahinski	Hozak-Zhou
1	$1,005,350	$1,405,360	$715,350	$1,151,400.00
2	$905,360	$905,360	$715,350	$1,151,400.00
3	$905,360	$905,360	$715,350	$1,151,400.00
4	$905,360	$905,360	$715,350	$1,151,400.00
Total cost	$3,721,430	$4,121,440	$2,861,400	$4,605,600.00

(b) Savings

Year	Hong Kong	Vortex	Prahinski	Hozak-Zhou
1	$8550	$80,740	$340,100	$126,350.00
2	$8550	$80,740	$340,100	$126,350.00
3	$8550	$80,740	$340,100	$126,350.00
4	$8550	$80,740	$340,100	$126,350.00
Total savings	34,200	$322,960	$1,360,400	$505,400

Kong at the negotiations table since it is the lowest original bidder. Hong Kong, despite its high material costs, is very competitive. The area of concern that needs to be addressed is SG&A. Hong Kong quoted 10%; however, Prahinski set the standard at 9%. If there was resistance, Estrada should simply ask to see the people involved to prove the quote. Hong Kong's high material costs are basically nonnegotiable. Although the standard for material is $5.08, there was not much that could be negotiated because Hong Kong does not buy at high volumes or have the purchasing power to command those prices. It would be to Estrada's advantage to investigate deeper into the supplier's material purchases to help it stay competitive.

Estrada should approach Prahinski next. The area that must be addressed at the negotiations table is burden costs. Prahinski, like Hong Kong, is very competitive in most cost elements. Prahinski is aware of how efficient it is, and it can easily hide profits in its burden cost. Although we know it cannot compete with a lowly automated Hong Kong, we believe it would not be unreasonable to negotiate Prahinski down to Vortex's standard of $1.26. Prahinski most likely will defend its burden quote. If this situation were to arise, Estrada can respond in two ways. First, Estrada should tell Prahinski it is very uncompetitive based on an industry standard, in this case Vortex's. Then Estrada should ask to see the machines that would be used for production. These tactics should be enough to help bring down the burden costs.[1]

[1]The author expresses appreciation to Jacob Estrada and Jasmin Lee for their contributions to this case. Names and data have been disguised.

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Bargaining and Negotiations

14

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According to Mike, to be a great purchaser, you must be a great negotiator. Mike explains that a purchasing agent is measured on price variance. In other words, this is the difference in what the cost was and what the cost is now with savings. He has a goal to save at least 10% annually. An example at Meade Systems is the cost negotiated from its catalog printer. In 2019, it cost $4.86 for each of 100,000 catalogs. Currently the cost is $4.37, and the quality has dramatically increased. This is a savings of $16,000 a year. Inexperienced buyers may not be aware that costs also can be negotiated with companies such as UPS or FedEx if a large volume of shipping is done. Meade Systems uses both FedEx and UPS for inbound and outbound deliveries; therefore, it was able to negotiate better prices.

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

14.1 Compare distributive and integrative bargaining.

14.2 Explain the psychological bargaining framework.

14.3 Discuss the economic bargaining framework.

14.4 Illustrate the effects of both economic and psychological aspects on the outcome of bargaining situations.

14.5 Demonstrate how to plan for a formal negotiation.

14.6 Describe a richer conceptual model for buyer–seller interactions.

INTRODUCTION

This chapter examines the important human interactions called *bargaining* and *negotiation*. Economics and psychology provide important concepts and variables that, when combined, produce favorable insights into bargaining and negotiations. Whenever the terms of a sales transaction are determined, or a business deal is settled, bargaining is likely to have occurred. In a sense, everyone becomes a bargainer at one time or another. Bargaining occurs between all forms of human groupings including individuals, groups, organizations, and countries. The condition under which bargaining takes place is that two or more parties have divergent interests or goals and communication between the parties is possible. Three additional conditions also must exist for bargaining to occur (Chertkoff & Esser, 1976): (1) Mutual compromise must be possible. If one of the parties must choose between total victory and complete loss, no bargaining occurs. Bargaining situations require intermediate solutions for the parties involved. (2) The possibility must exist for provisional offers to be made by those involved in the situation. (3) The provisional offers must not determine the outcome of the situation until the terms are accepted by all parties. A bargaining situation can then be defined as an interaction where parties with certain disagreements confer and exchange ideas about a possible solution until a compromise is reached or the bargaining is terminated. This definition of bargaining is referred to as explicit bargaining.

In this chapter, we only consider the kind of bargaining that occurs between two parties who possess resources the other desires. While bargaining often occurs in what has been referred to as multi-opponent bargaining situations—where a consumer visits several dealerships when shopping for a new automobile or where an industrial buyer negotiates a new purchase with several alternative suppliers—this is not the main focus of this chapter. Instead, the emphasis is on bargaining in a "bilateral monopoly" system. This does not rule out the influence of others on the two bargainers such as their constituencies, but it does limit the bargaining to only two parties.

DISTRIBUTIVE VERSUS INTEGRATIVE BARGAINING

LO 14.1 Compare distributive and integrative bargaining.

Two-party bargaining can be divided into two types: distributive and integrative.

Distributive Bargaining

Distributive bargaining The total gains from the situation must be divided between the two parties involved, and each party usually wants as much as it can get.

Game theory The science of strategy, or near optimal decision-making of independent and competing decision-makers in a strategic setting.

Varying sum The profits (and/or losses) of the respective bargainers, when added together, need not always equal the same fixed amount.

The parties in **distributive bargaining** are in basic conflict and competition because of a clash of goals. The more one party gets, the less the other gets. That is, the total gains from the situation must be "distributed" between the two parties involved, and each party usually wants as much as it can get. However, if either party is too greedy, an agreement will not be reached. In dealing with distributive bargaining, the influence of both parties must be considered. Discussion, understanding, and agreements are vital to distributive bargaining. By the very nature of the situation, cooperation is important. Without some degree of cooperation, either party can block trading and reduce individual gain to zero. Distributive bargaining can therefore be modeled and examined by using **game theory**. A two-party, varying-sum, or zero-sum schedule is suitable depending on the payoff schedule involved. In a varying-sum schedule bargaining situation, the profits (and/or losses) of the respective bargainers, when added together, need not always equal the same fixed amount, thus the term **varying sum**.

While the payoff schedules are usually inversely related—if one gains, the other must lose—there can be some situations where both parties realize a gain (or loss) not in direct proportion to what happens to the other bargainer.

In the **zero-sum bargaining** situation, the profits (and/or losses) of the respective bargainers always sum to the same fixed amount. The term *zero sum* stands for the fact that what one bargainer gains, the other loses, and the gains (and/or losses) net out to be zero. Both of these situations readily exist in the business environment. The varying-sum schedule is often found in customer service situations where the supplier is at or above the 90% service level. To go from the 90% level to the 95% level, a gain of only 5% improvement for the customer often can mean a doubling of the costs to the supplier to attain that increased level. The zero-sum schedule is usually found in retail situations where the merchant's costs are relatively fixed. The less the consumer pays for a product, the less profit there is for the retailer almost on a dollar-for-dollar basis.

Zero-sum bargaining The profits (and/or losses) of the respective bargainers always sum to the same fixed amount.

Integrative Bargaining

Integrative bargaining exists where there are areas of mutual concern and complementary interests. The situation is a varying-sum schedule such that, by working together, both parties can increase the total profits available to be divided between them. This is often the case between manufacturers and distributors because of the existence of an ultimate consumer. If the ultimate consumer can be persuaded to pay more for a product, there is more to be divided between the manufacturer and the distributor. At this point, we are tempted to generalize that integrative bargaining is more common to *industrial markets* and interactions while distributive bargaining is more common to *consumer markets* and interactions.

Integrative bargaining Two parties with areas of mutual concern and complementary interests.

The Bargaining Model

In most bargaining situations, there is usually a preliminary discussion, called *negotiation*. The word **negotiation** is derived from Latin and in civil law means "trading on deliberations leading to an agreement." The modeling approach to bargaining is to determine what contract, that is, agreed joint strategy, might or should be reached. The bargaining model offers an agreement (solution). Others however, have felt the similarities of definition are so strong that the terms *bargaining* and *negotiation* can be used interchangeably, even though occasional distinction is made between the terms.

Negotiation The process by which a buyer and seller reach an agreement on the terms and conditions regarding the purchase of materials, equipment, or goods.

A model of a bargaining problem calls for an asymmetric form of analysis and both a normative focus on one's own behavior and a predictive view of one's opponent. The bargainer needs to determine how he or she as a decision-maker *ought* to behave in light of his or her analysis of how his or her opponent *might* behave. And, of course, as the decision-maker analyzes the problem, he or she should bear in mind that the opponent is also thinking how the decision-maker is thinking, and so on. The minimum necessary variables for a model of the overall bargaining process include both the decision-makers and the opponent's initial offers, desired outcomes, maximum level of concession (zero profit level), and rate of concession.

Two parties can bargain over price; the seller usually wants the price to be high, while the buyer wants the price to be low. The seller is often working under a profit-maximization strategy, and the buyer is more interested in minimizing cost. Sometimes the resource in contention may be time. The building contractor wants more time; the future owner wants the building completed in less time.

The distributive bargaining situation has been most fully explored by psychologists. The results of this research are a myriad of small laboratory studies that have not generated a

general theory of bargaining or a comprehensive model to incorporate the many isolated findings. Economists, on the other hand, have seen distributive bargaining as a problem that only involves two parties dividing fixed resources with no opportunity for any outside influence of third parties. Economists, therefore, have seen the solution to distributive bargaining as indeterminable and left its exploration to others. Economists have spent most of their efforts in examining *integrative* bargaining situations.

PSYCHOLOGICAL BARGAINING FRAMEWORK

LO 14.2 Explain the psychological bargaining framework.

The findings by psychologists can be categorized under six areas, each representing a major factor assumed to affect bargaining. These six factors are explained here and examples of each are provided:

1. *General bargaining predispositions.* Individual differences in bargaining predispositions may affect bargaining behavior. For example, bargainers may have a cooperative or a competitive general orientation.
2. *Payoff system.* Payoffs result from various aspects of the negotiated agreement. For example, certain terms may yield a specific amount of profit, or there may be a bonus for attaining a specified agreement, or the time spent in bargaining may involve certain costs.
3. *Social relationship with the opponent.* This factor refers to the social relationship existing between the bargainers. Examples are degree of friendship or differences in status or power.
4. *Social relationship with significant others.* This factor refers to the relationships of the bargainers to significant others not participating directly in the bargaining. Examples of significant others are the bargaining constituents or a mediator.
5. *Situational factors.* The physical and social setting of the bargaining may have an effect. Is the bargaining being conducted in the home territory of one of the bargainers or on neutral ground? What, if any, is the seating arrangement?
6. *Bargaining strategy.* This factor includes the specific actions of the bargainer during bargaining. How extreme is his or her opening? Does he or she concede frequently or infrequently?

Payoff system and bargaining strategy are highly relevant at this point in the chapter and worth exploring further at this time. Later, using a conceptual model, the other four areas will be brought together and applied to buyer–seller negotiations and bargaining.

Payoff System

The actual payoff system that bargainers face in an interaction must certainly be a major determinant of bargaining behavior. Several factors related to the payoff system have been studied. They include the following:

1. The amount that has to be exceeded if the bargainer is to realize a profit
2. The cost of time spent in bargaining

3. The cost of failure to reach agreement
4. Added benefits achieved by obtaining a specific threshold value
5. Qualitative or quantitative variations in the general level of payoff values
6. Whether payoffs are based solely on one's own profit schedule or are based, in whole or in part, on the degree to which one's profits exceed those of others
7. Whether conflict is **constant-sum** or varying-sum
8. Penalties the bargaining opponent (or perhaps a third party) is likely to impose for failure to yield

Constant sum
A situation where payoffs add up to a constant figure for any outcome. One player's payoff is the same for any outcome.

A discussion of these factors and the research findings follows. Only directly pertinent findings are presented. There is a voluminous amount of research on bargaining, a great deal of which is only tangential to this discussion.

Breakeven Point

Various names have been used to describe the amount that must be exceeded in the bargaining interaction to obtain a profit: maximum concession point, breakeven point, zero-profit point, minimum necessary share, resistance point, or minimum disposition. However, it has been argued that the value in natural settings, including business, is frequently uncertain. The bargaining that takes place is often an attempt to convince the other person that he or she can profitably accept a lower value than the one he or she maintains is necessary. This is true in most business situations where future profits are being negotiated. Without knowledge of future costs and revenues, the breakeven point would remain uncertain.

A bargainer's resistance to making concessions is positively correlated to both the time required to make a further concession and the probability of withdrawing from the negotiations. The level of resistance also is assumed to be related to the minimum necessary share. As a bargainer concedes toward his or her minimum necessary share, the bargainer's resistance should increase. It also can be predicted that for a given offer, the higher the minimum necessary share, the greater the resistance.

Time Pressure

The amount of time left before bargaining must be concluded also is believed to have a significant impact on bargaining behavior. Consider the situation in many labor–management negotiations. If the contract is not successfully renegotiated prior to the expiration of the existing contract, a labor walkout may occur. In cases of buyer–seller negotiating, time pressure may be created by the buyer's imminent need for the product or service, the length of delivery time possibly being extended by long negotiations. Sellers may realize time pressure by quotas for sales that must be accomplished in set time periods. The greater the time pressure, the faster the concession making. Time pressure in psychological experiments has been exerted in various ways:

1. High or low probability that the present round of offers would be the last
2. Warning that time was almost up

3. Number of offers remaining before penalties for additional offers
4. Cost of each of the trial offers

More rapid yielding under greater time pressure may reflect the desire of bargainers to avoid either the undesirable costs associated with making offers or zero profit (which results from no agreement).

Cost of No Agreement

In most of the psychological research, the majority of experiments have been structured so that the alternatives of reaching an agreement and its possible terms are usually preferable to no agreement. Warning the subjects that the end of negotiations is imminent often produces extremely rapid concession making, so uniformly rapid, in fact, that any differences in levels of toughness prior to the warning may be obliterated. This is not necessarily true in buyer–seller negotiations as they can usually be resumed in some future time period and other buyers or sellers exist for future interactions.

Multiple Bargaining Interactions

Personal selling The sales personnel promote the product through their attitude, appearance, and specialist product knowledge; especially important when interviewing for a job.

In most psychological research, participants are given the goal of maximizing their own gain; however, they also may be interested in outperforming the other bargainers. In **personal selling** situations where the same salesperson often negotiates with the same buyer, this may be an important issue. The question is, "What is the effect of being bested on a previous bargaining encounter?" How will this translate into bargaining strategy on subsequent interactions with the same opponent? It appears that in the second encounter, those who had failed on the first encounter bargain in a tougher manner than those who had succeeded.

In conclusion, any theoretical mode of bargaining must include assumptions about the payoff system under which the bargainers are operating. The breakeven point, the cost of time spent in bargaining, the cost of failure to reach an agreement, time pressure, the effect of previous bargaining outcomes, and other factors all have an effect on bargaining behavior and need to be incorporated into the bargaining process. A large amount of psychological research has examined the effect of the payoff system on bargaining. Some of this research has direct implications for buyer–seller interactions. When buyers and sellers are negotiating over future profits, outcomes may have a wider variance than when the payoff is known with certainty. Resistance to making concessions is related to time pressure, breakeven point, the cost of no agreement, and perhaps previous bargaining outcomes.

Bargaining Strategy

Usually a tougher bargaining strategy—one using a more extreme opening position, fewer concessions, and/or smaller concessions—will result in failure to reach an agreement. There appear to be exceptions to such a conclusion, however. Never making a concession may be responded to by the other side in a similar fashion, leading to little or no convergence in the bargaining interaction. When time allotted to bargaining (or that which is left) is very short and when not reaching an agreement is clearly disadvantageous, toughness may be a poor strategy because it could result in no agreement. Also, when bargaining is deadlocked, toughness is counterproductive. Excessive toughness in bargaining could be a particularly bad strategy in buyer–seller interactions where future interactions are expected. If one party

always chooses a tough stance, the other party will develop a similar approach to the bargaining interaction. This could result in high transaction costs, lack of future agreements, and, where possible, replacement of the bargaining opponent.

The best strategy is to give the other side the impression that one is tough but fair. A strategy of always reciprocating both the frequency and the magnitude of the other bargainer's concessions was found to be more effective in obtaining concessions from the other bargainer than strategies involving less reciprocation. Conceding only in response to a concession by the other side gives the impression that one is strong, while always reciprocating a concession gives the impression that one is fair. Dispositions attributed to the other party in a bargaining situation are crucial in mediating yielding. If you give a little, I will give a little and vice versa. Concession begets concession and reciprocal concessions can lead to reaching agreement. This leads to the general conclusion that every agreement ought to lie somewhere between the two starting points of the bargainers. Obviously, some agreements are closer to one bargainer's starting position than the other's because of tough or skillful bargaining tactics. A problem, however, is what the other party thinks of his or her opponent's reasons for tough negotiation, particularly if there are to be other instances of bargaining between the two parties.

In conclusion, giving a bargaining opponent the impression that tough bargaining is because of one's payoff system and that one is firm but fair is the best strategy. This will lead to greater yielding on the part of the other party in the bargaining interaction. Another important aspect of the perceived bargaining strategy deals with whether the opponent attributes the need for the level of toughness in bargaining to the opponent or to the opponent's constituency. If the level of toughness is because of the opponent's constituency, it may be beneficial for the bargainer to directly contact members of the constituency and deal with their expectations before returning to the negotiations. An example of this in an industrial setting occurs when a salesperson must contact other members of the "buying center" before continuing negotiations with a purchasing manager who is under pressure from his or her constituency to obtain a "very low price."

ECONOMIC BARGAINING FRAMEWORK

LO 14.3 Discuss the economic bargaining framework.

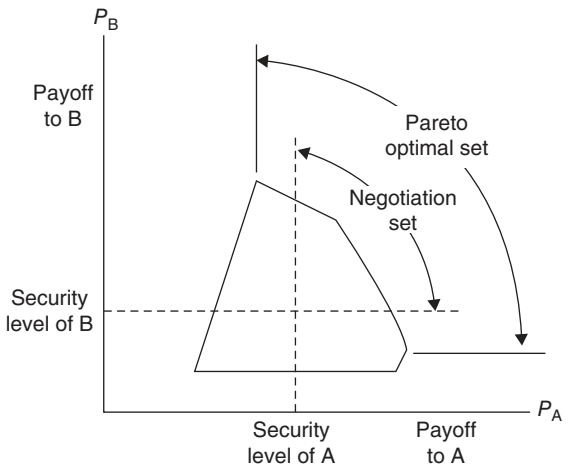
While most of the empirical research to date has been in distributive bargaining and done by psychologists, most of the work done on integrative bargaining has been of the theoretical nature and accomplished by economists.

In the Nash solution, the bargaining problem is conceived in the usual game theoretic terms (Nash, 1950). He considers as relevant data only the utilities that each alternative point of agreement provides to the players.

Nash originally took the position that his model constituted a positive theory and that it would describe actual bargaining outcomes, but it is now much more common to give a normative interpretation to the analysis and to treat the Nash solution as a "desirable" outcome of the bargaining process.

The Nash solution assumes individual utilities are not comparable. It is of a normative nature and assumes away such features as bargaining ability. The Nash solution to the bargaining problem suggests a method of *fair division*. It suggests a way of dividing joint profits that is "fair" in the sense that a referee or judge "should" follow it, if called on to settle a division between two corporations.

FIGURE 14.1
Pareto Optimal



Pareto optimal An economic situation when the circumstances of one individual cannot be made better without making the situation worse for another individual.

The contract should be **Pareto optimal** (see Figure 14.1). However, some points on the Pareto optimal joint strategy curve leave a player worse off than if he or she had not made an agreement. The subset of Pareto optimal joint strategies offering each player at least his or her security level is called the *negotiation set* (contract curve).

A Pareto optimal solution requires a contract with a specific quantity of goods, calculable from the economic model. This quantity maximizes joint profit. Assuming both players agree on the Pareto optimal quantity of goods, there remains the division of the joint profit between the players. This is determined by the price the distributor agrees to pay the manufacturer and the manufacturer accepts. The unit price in a Pareto optimal contract can vary anywhere between the two limiting prices, the higher of which would give all the joint profit to the manufacturer and the lower of which would give all the joint profit to the distributor.

The actual subset of contract quantities varies around the Pareto optimum; the more complete the information each had about the other, the less the variability of different pairs of bargainers around the Pareto optimum. The tendency in this situation is to split the joint profit evenly between the buyer and the seller. This seems to agree with all proposed theories yielding a specific Pareto optimal strategy (when utility is linear with money). For example, the only reasonable status quo point seems to be no deal, in which case the Nash solution requires a 50–50 split of the profits. Neither player can enforce a relative advantage over the other; this also leads to an even split. One problem here is that the subjects are not in direct contact with each other; therefore, psychological aspects are not a part of the process.

Experimentation with the Nash model has proven to be useful in predicting the actual outcomes of buyer–seller negotiations (Neslin & Greenhalgh, 1983). The experimental results suggest that an understanding of any conflict present prior to the actual bargaining is key for predicting the actual outcome. It also was found that management must accurately communicate its preferences to the negotiators because the negotiators' preferences strongly affect the outcome. Weakness in bargaining skills also has an effect on the outcome of bargaining situations according to their findings. While the outcomes of the bargaining situations were distributed around the Nash solution, other psychological variables or individual differences affected the actual outcome.

Economic theory can help predict the approximate outcome of bargaining situations, but psychological conditions will cause the true solution to vary around the predicted outcome point. A combined economic/psychological approach will help provide the truest solution and best approach to understanding bargaining and negotiation situations and their outcomes.

AN EXPERIMENT IN DISTRIBUTIVE BARGAINING

LO 14.4 Illustrate the effects of both economic and psychological aspects on the outcome of bargaining situations.

To better illustrate the effects of both economic and psychological aspects on the outcome of bargaining situations, it is necessary to turn to a field experiment in distributive bargaining. The experiment examines the effect of contingency compensation on both buyers and sellers. It also allows speculation about the difference in the power systems of buyers and sellers and how they affect the outcome of bargaining situations.

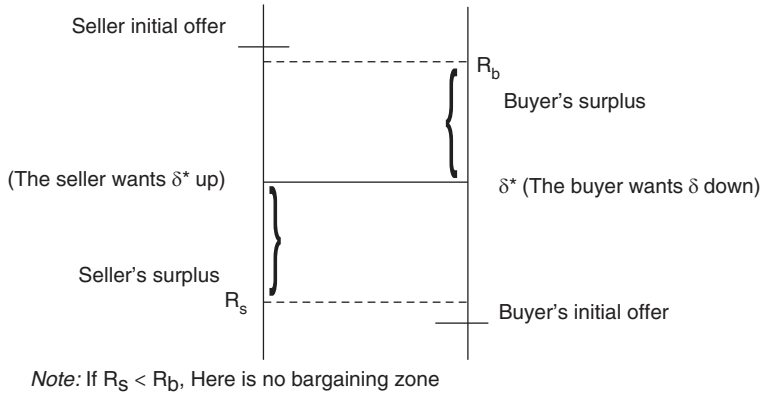
Consider the following sales situation where an agreement has to be reached on the specifications of the product to be bought and the money to be paid. Both the seller and the buyer can make concessions. To simplify matters, also assume the following bargaining conditions:

1. Only one deal is being negotiated.
2. The bargainers are honorable people.
3. The decisions made are binding.
4. No arbitration or third party is available to assist bargainers.
5. Any party can break off the negotiation and continue as before.
6. The setting and language are not important.

Sellers and buyers tend to have conflicting bargaining goals. The aim of a selling organization is to instill in its salespeople the objective of influencing the buyer's actions to the advantage of the seller. This goal is effectively communicated and reinforced by the seller's compensation system. Salespeople are often compensated based on salary plus commission, making their earnings directly contingent on some measure of selling effectiveness. Logic dictates a similar objective for the buying organization. Since purchases represent costs to the buyers, professional buyers are encouraged to reduce costs. The seller's reservation price (Rs) is usually his or her minimum selling price for any final deal, δ^*. This price includes the total costs plus an expected profit margin. The buyer's reservation price (Rb) represents the maximum amount that he or she is willing to pay for any final deal, δ^*. To pay more than the reservation price, Rb, the buyer would be better off with no agreement (see Figure 14.2).

If $Rs < Rb$, the bargaining zone is the interval from Rs to Rb. Suppose the final deal is some value of δ^* where δ^* is between Rs and Rb. The buyer's marginal gain in value is $Rb - \delta^*$, and the seller's marginal dollar gain is $\delta^* - Rs$. At first glance, it appears that a final deal is easily obtained if a bargaining zone exists. This is not really the case simply because the buyer and seller might not agree to settle for an even division of the bargaining zone value. The bargainers generally do not know the exact size of the bargaining zone, $Rb - Rs$. Each party usually knows his or her reservation price but has only probabilistic information on the other party's reservation price. Each party must assess the other party's reservation price. The negotiation process is used to

FIGURE 14.2
Distributive Bargaining Model



uncover the other party's (buyer's) reservation price. At the same time, the seller may often lead the buyer to think that his or her reservation price is higher than it really is.

A simple bargaining example is presented to illustrate concession behavior for distributive bargaining. The instructions for the example follow: A bargaining experiment run at the Ohio State University informed the sellers they had been hired to represent an individual who wished to sell an office building (McFillen, Reck, & Benton, 1983). Because of the owner's financial situation, the building could be sold for no less than $100,000, *Rs*. The buyers were told they had been hired to represent a person who wished to purchase an office building, but the potential buyer could afford to pay no more than $150,000, *Rb*. A bargaining zone exists because *Rs* < *Rb*. The bargaining game was designed such that no party had a relative advantage over the other due to either the urgency of settlement or the possession of more complete information. The time limit for the game was 25 minutes. Half of the sellers were told they would be contingently compensated and they would be rewarded in cash in proportion to the final negotiated price of the building. In their instructions, they were told they would receive $1 for each $5,000 by which the final price exceeded the $100,000 minimum required by the owner, up to a maximum of $10. The participants in this study would actually be allowed to keep this money as an incentive to make the bargaining more extrinsically involving. If no agreement was reached, the contingently compensated sellers would receive no commission. The remaining half of the sellers were told they would be paid $10 for having represented the owner during the negotiations, regardless of whether a sale was negotiated. Similarly, half of the buyers were told they actually would be compensated according to the final agreed-upon price. They were informed they would receive $1 in cash for each $5,000 by which the final price was lower than the $150,000 maximum that the potential purchasers could pay, up to a maximum of $10. No agreement therefore meant no money for the contingently compensated buyer. The remaining half of the buyers were told they would receive $10 for having represented the potential purchaser in the negotiations, regardless of the outcome of the negotiations. These instructions constituted the contingent and noncontingent reward conditions. No buyer or seller knew whether the opposing negotiator was or was not being contingently rewarded.

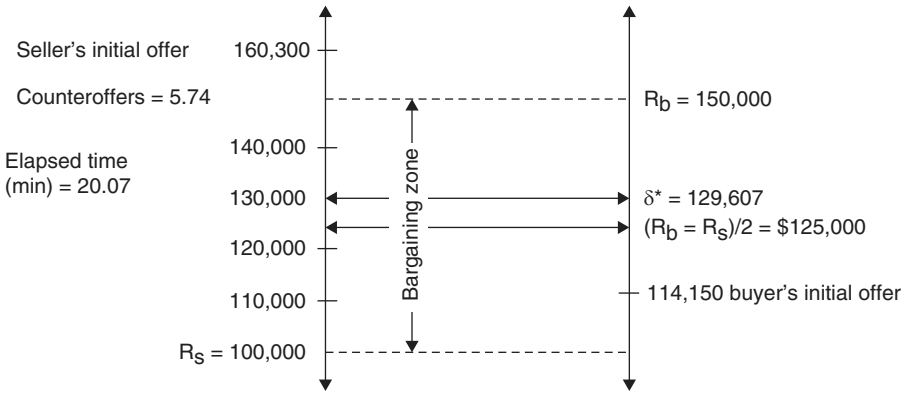
The results yielded a number of interesting findings. First, the initial offer from the buyer was always consistently above the seller's reservation price. This case will result in an agreement favorable to the seller in each situation.

Second, the results suggest that the way a negotiator is paid will affect significantly the process and outcome of the negotiations. As shown in Figure 14.3a–d, the effects of contingent rewards are to shift the seller's marginal surplus upward and the buyer's marginal value downward. When only one party is contingently rewarded, the effect is to shift the settlement in that party's favor. When both parties are contingently rewarded, the result is a much longer and more difficult negotiation process.

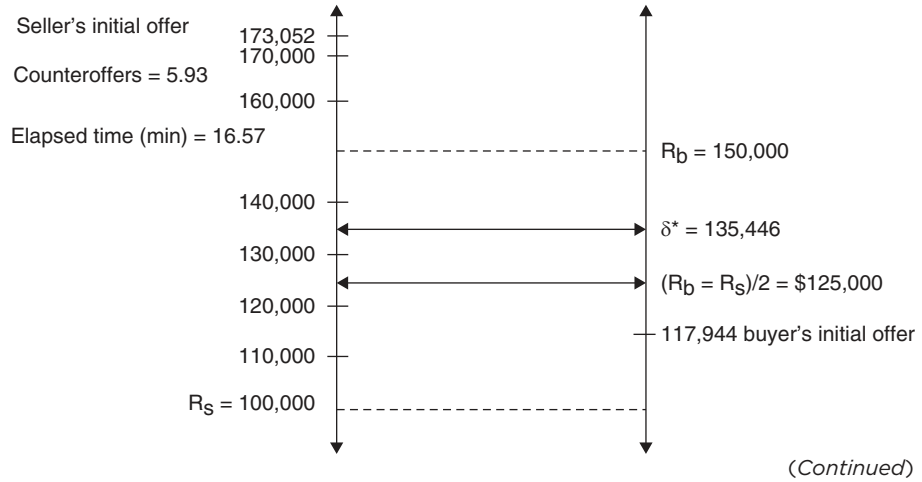
This study, like much of the bargaining research, focused exclusively on price as the relevant criterion. While this is not always true of bargaining situations, the results of this study have three specific implications for understanding bargaining and negotiations and help to merge economic considerations with psychological variables. First, contingent rewards make a difference in negotiation outcomes. The reward practices that exist today in purchasing put the buying organization at a distinct disadvantage. Although the sales activity is essentially a mirror image of the buying activity, sales organizations have developed reward systems that motivate their personnel through compensation; purchasing organizations, for the most part, have not.

FIGURE 14.3A–D
Distributive Bargaining Example

(a) Seller contingent/buyer contingent



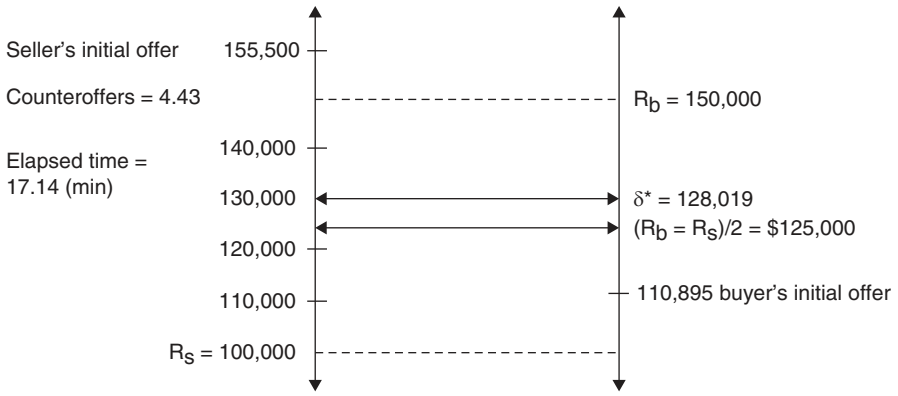
(b) Seller contingent/buyer noncontingent



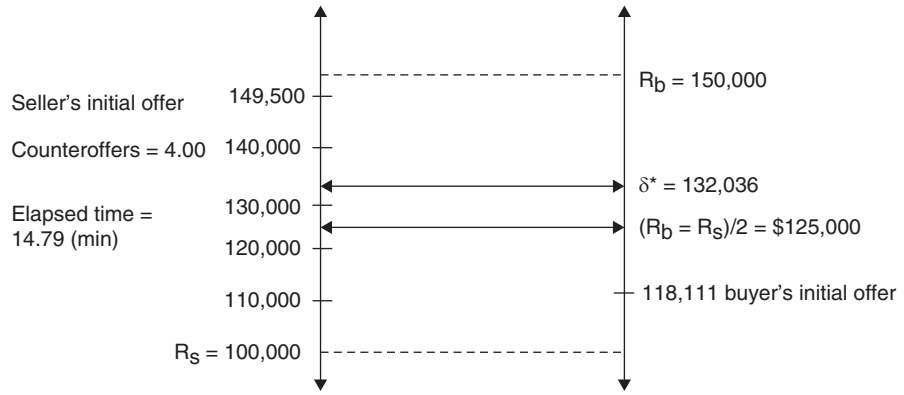
(*Continued*)

FIGURE 14.3A–D (Continued)

(c) Seller noncontingent/buyer contingent



(d) Seller noncontingent/buyer noncontingent



Second, purchasing organizations need to be aware of the salesperson's reward system. By knowing about the contingencies created for sellers, the buying organization can develop competing contingencies for its personnel where the efforts would have the greatest benefit. A purchasing representative also can take advantage of the seller's own motivation to maximize some element of the negotiation by seeking important concessions on other elements of the negotiation.

The third implication is that management must develop stronger contingencies to encourage purchasing effectiveness. This can be done by concentrating on the areas of purchasing that are most critical, recognizing the most important variables involved in the negotiations for any given purchase, and improving performance appraisal processes to reflect purchasing effectiveness in relation to the reward system.

PLANNING FOR A FORMAL NEGOTIATION

LO 14.5 Demonstrate how to plan for a formal negotiation.

Preparation is the most important phase of any negotiation. Some of the most skilled negotiators will occasionally fail to prepare. The negotiations process is a science. When you have not done the necessary planning analysis and review, you will walk away from the negotiation table

with regret. A detailed checklist can help you avoid this scenario by helping you think through your position, the other party's position, and what might happen when you get together.

Planning (Seller's Perspective)

The most important planning activity for a seller is to submit the most responsive request for proposal (RFP) or request for quote (RFQ). The seller's proposal should be based on a thorough conceptual and economic analysis. If this phase in the planning process is nonresponsive, the negotiations will not be conducted. The seller cannot alter the proposal after it is submitted. On the other hand, until an agreement is signed, the buyer can change his or her mind. There is always a chance of rejection no matter how strong the seller's initial RFP. At the same time, no matter how weak a competing proposal, it still has a probability of acceptance no matter how remote. As an example, Custer-Battle, a security firm contracted by the U.S. government to provide security for commercial aviation at the Baghdad Airport, arrived in Iraq immediately after the ground war looking for work. According to published reports, Custer-Battle scribbled a contract on a sheet of notebook paper and was given $15 million as a down payment on the same day.

There are standard procedures for processing RFPs. After receipt of the initial proposals, the proposals should be screened for responsiveness in terms of technical quality, if requested; managerial capability; financial stability; experience on similar projects; and other relevant criteria. If the buyer chooses to negotiate with multiple bidders, the buyer should not reveal a supplier's prices to the competing firms. It is, however, allowable for the buyer to inform the supplier if the supplier's prices are too high. The buyer should maintain strict confidentiality after the proposals are received. No information regarding the identification of the participating bidders or the number of proposals should be disseminated to anyone not officially involved in the selection process. In most significant governmental RFPs, a mandatory prebid meeting is required. At this meeting, each bidder has the opportunity to ask clarification questions and size up the competition. In cases where a seller is the sole source, the seller is assured in most cases that negotiations will eventually occur. When there is more than one bidder, the seller is not assured an opportunity to negotiate. The seller should use creative ways to determine if his or her proposal is being considered. The manner in which the buyer acknowledges the seller is a strong indication of the seller's chances for success.

If the seller believes the proposal is not being considered, immediate troubleshooting steps should begin. If the problem is the technical approach, there is little he or she can do to reverse the situation. But if the proposal is technically sound, the differences may be the cost proposal. Whether the seller should reduce the cost should be based solely on the selling firm's cost structure. Finally, if both the technical approach and the cost proposal are acceptable, the problem is probably political.

The negotiation planning activities should be driven by the proposal. The proposal is never complete in terms of various cost components. Questions on overhead rates should be anticipated. The negotiating team should analyze the competitor's strengths and weaknesses. The selling team should also analyze their proposal from the buyer's point of view. The seller should then evaluate his or her own strengths and weaknesses. The seller's bargaining strengths depend on the following:

1. The seller's current capacity
2. The probability of being the successful bidder

3. The seller's deadline
4. The status of the seller

Price is not always the major selection criterion. The quality of the technical proposal and the seller's managerial team can easily become the controlling criteria. The seller also should determine the buyer's pricing behavior in terms of fixed price versus cost-plus contracts.

The first step in the seller's plan is to determine the objectives of the negotiations. Each of the components of the negotiations should be evaluated for the best-case scenario and alternative courses of action. The seller should make an opening statement using effective visual aids. PowerPoint presentations and handouts should be used for formal negotiations. The seller should conduct several mock presentations for complex high-dollar proposals. The author was involved in a mock presentation involving a public relations coach that lasted more than 3 weeks.

Planning (Buyer's Perspective)

The planning process for the buyer is consistent with the seller's planning process. The buyer's strengths are driven by the number of sellers in the market, the number of buyers in the market, knowledge of the item or service, the cost breakdown (if applicable), and the level of preparation. The buyer must carefully analyze all of the information submitted by the seller. The buyer also can select specific items from the seller's proposal to negotiate. The buyer also must evaluate the seller's strengths and weaknesses. The buyer must be thoroughly prepared for each and every negotiation. Data collection is the first step in the preparation process. The next step involves establishing the negotiations' objectives, strategies, and tactics.

Time is clearly the most important shortcoming in the preparation process for the buyer. The seller has prepared numerous proposals for a variety of customers. On the other hand, buyers must spend many hours studying numerous proposals. Buyers usually have heavy workloads and sometimes are unprepared for negotiation sessions.

Once the buyer has a complete understanding of what he or she is buying, a thorough price/cost analysis should be performed using the seller's cost data. The buyer cannot be an effective negotiator without the price analysis. The only reasonable way to reduce the price proposal is convincing the seller through data analysis. It is not reasonable to ask for price reductions without a price/cost analysis. For detailed information on pricing, price/cost analysis, and learning curves, see Chapter 13.

Prior to the negotiations, the negotiations' objectives should be established. The buyer should establish specific direct cost dollar amounts and profit limits. It is not enough to set as an objective to negotiate a percentage improvement from the seller's original price proposal. The buyer should never reveal its objectives to the seller. The ultimate objective of the buyer should be to develop a reasonable contract price. The buyer also must be flexible in selecting the type of contract (fixed cost or cost-plus) that will be appropriate for a specific spend. The negotiations' objectives also should use a data-driven approach to determine minimum and maximum pricing strategies. Of course, the buyer's minimum and maximum strategies should be listed, as shown in Tables 14.1 and 14.2.

TABLE 14.1
Minimum and Maximum Negotiation Planning Strategies

Minimum and Maximum Strategies	Objective	Minimum	Maximum
Direct labor hours	80	75	100
Labor rates	$10.00	$8.95	$11.00
Direct material	$40.00	$32.00	$45.00
Material costs per unit	$4.00	$3.20	$4.50

TABLE 14.2
Cost Minimization Planning Objectives for Negotiations

	Objective	Minimum	Maximum	Seller's Proposal	Comments
Direct labor cost (DLC)	$2.88	$2.50	$4.00	$3.44	Higher than base
Direct material cost (DMC)	$4.24	$4.24	$4.08	$4.48	Higher than base
Tooling cost (TC)	$1.04	$1.04	$2.32	$1.92	Higher than base
Manufacturing overhead (MO)	$2.96 (103% of DLC)	$2.57 (103% of DLC)	$3.04 (76% of DLC)	$5.16 (150% of DLC)	Higher than base
General and administration expenses	$0.64 (6% of TC)	$0.621 (6% of TC)	$0.26 (2% of TC)	$0.752 (5% of TC)	Higher than base
Total cost	$11.76	$10.35	$13.44	$15.00	Higher than base
Profit	$0.56 (5% of TC)	$0.518 (5% of TC)	$1.20 (9% of TC)	$15.752 (10% of TC)	Higher than base
Selling price	$12.32	$11.48	$14.90	$17.33	Higher than base

The buyer must determine the points of difference between the seller's proposal and the buyer's difference objective (base). For a more detailed example, see Appendix C of Chapter 13. The buyer's bargaining strengths are the following:

1. The number of bidders
2. The urgency of the buyer's needs
3. The length of time before agreement
4. The status of the buyer

There are many surprises in the business world. One way to minimize these surprises is to gain more systematic knowledge through the negotiations process. In today's competitive business environment, pricing is usually the biggest factor in the negotiations process. Industrial purchasing uses the negotiations process extensively for capital equipment purchases, annual blanket orders, systems contracts, change orders, penalties, price changes, and many other situations. As stated earlier, price is usually the major negotiating factor simply because delivery, quality, and adequate quantities should be the minimum expectation from the supply source. The procedure for a formal negotiation is addressed next.

Procedure

1. *Team.* Select the team, if needed. You may need the cost accountant and certain engineers. Select the chief negotiator.
2. *Objectives.* Determine objectives, such as a win-win outcome for both parties.
3. *Preparation.* Prepare a price/cost analysis look at comparative bids; perform a supplier visit; look at vendor rating-evaluation records; perform a value analysis; look at contract terms, industry price trends, new product ideas, survey data, and test reports. Prepare a proposal analysis: determine questions, get input from ultimate users, establish criteria, and get information on past purchase volume from the supplier.
4. *Bargaining strength.* Determine bargaining strength—be honest.
5. *Plan.* Develop the plan: the agenda, place, time, min-max positions. Is this a reorder? Establish your authority.
6. *Strategy.* Set your strategy based on a list of obtainable objectives—goals.
7. *Tactics on how to achieve the strategy.* Start with the easy issues. Set the tone; establish rapport; prepare questions and decide who asks; determine when to recess or ask for a new proposal; have several responses. Establish rules such as "never reveal your maximum on items such as price," no games, no dishonesty, no psychological tricks (this is business, not a card game). Give when it is proper, reasonable, and so forth. Determine roles for each team member. Use a cost analysis to check labor rate and time; have the facts at hand.
8. *Follow-up.* Conduct a postnegotiation review and follow-up. Develop the action plan based on your agreement. Critique team member performance.

Tips

1. Read, study, and tear apart the supplier's proposal.
2. Be persuasive, not conceited.
3. Stress tact for all team members.
4. Stress listening.
5. Prepare questions in writing on 3 x 5 cards, and so on.
6. Record—take notes.
7. Assign roles and practice.
8. Write down the plan.
9. Have reasonable objectives, positions.
10. Be firm but fair; give when you make a mistake.
11. Have expert assistance on the team.
12. Admit when you make a mistake or "don't know." Recess and find out.
13. Be honest. Do not give competitor prices. Do not guess about volume requirements.

14. Develop patience.
15. Recess and review; change your position?
16. Don't play psychologist or "big man" or "big woman."
17. Background data are the key to cost and production methods. You must know how the product is made to be a good negotiator. You must know the terms. Visit the supplier's plant, other users.
18. Learn from your mistakes.
19. Learn the personalities of the supplier's team. Use the knowledge to establish rapport. Capitalize on their weakness such as lack of cost data.
20. Try to stay on the offensive yet get them to talk—then listen!
21. Remember you are *not* negotiating with the cold-war Russians. You want the supplier to win also for a long-term, mutually rewarding relationship.

AN INTERGRATED MODEL OF THE BUYER-SELLER INTERACTION

LO 14.6 Describe a richer conceptual model for buyer-seller interactions.

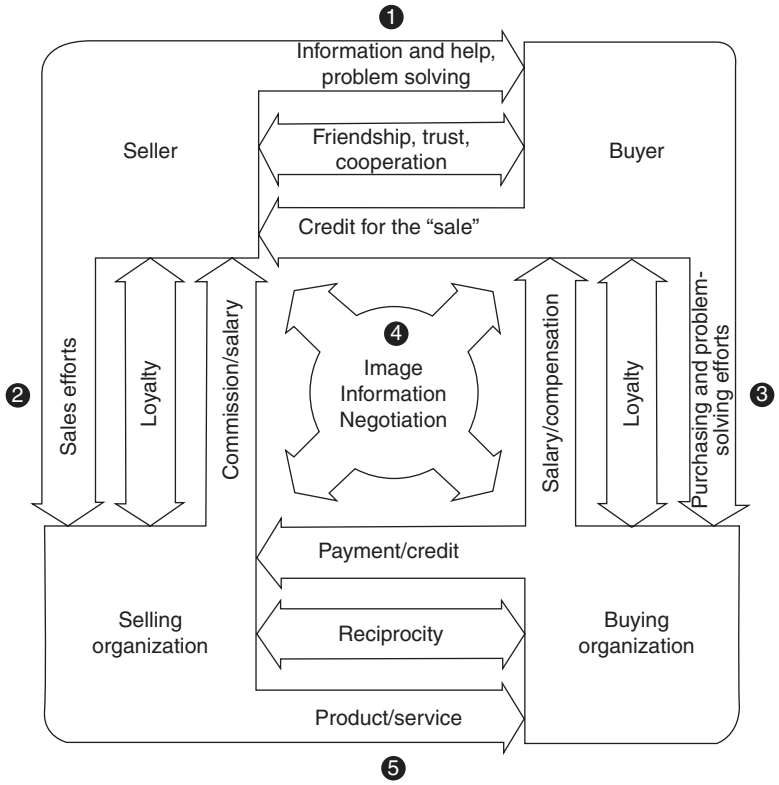
What should be clear by now in the chapter is that, while both economics and psychology offer useful insight into bargaining and negotiation, a richer conceptual model of the buyer–seller interaction is necessary. This model needs to capture both the economic and psychological aspects of the bargaining situation. To this end, an exchange model of buyer–seller interactions is proposed.

The buyer–seller interactions exchange model given in Figure 14.4 captures both the economic aspects and the surrounding psychological variables of the bargaining situation. It allows for the effects of constituents for both the buyer and seller and permits contingency compensation for either side of the bargaining dyad. The model is built on the relationships inherent in a bargaining situation and illustrates at least five major types of relations that can be affected by any bargaining interaction.

1. The buyer–seller relationship might be an exchange of information and help in problem-solving on the part of the seller for credit for the specific "sale" given by the buyer. Cooperation, trust, and mutual liking are variables that can develop in a positive interaction between buyer and seller. The parties in the sales/purchasing relationship usually share some values and have mutual interests. Each may want something the other has and can give or in some way be dependent. This mutuality of interests can take the form of strategic alliances, coalitions, contract purchasing agreements, partnerships, or other relationships.

   Conflict between the buyer and seller also may be a common variable. Just how conflict or disagreement over issues is resolved is a key issue for continued investigation. In situations where a long-term relationship between parties is desired, mutual problem-solving may be the appropriate conflict resolution mode. In other situations of a deteriorated nature or where a "one time only" sale is sought, fraud and chicanery may be exchanged for future distrust.

FIGURE 14.4
Exchanges in Buyer–Seller Interactions



Source: Johnson & Benton (1988). Adapted from Bonoma and Johnston (1978).

The dyadic relationship will invariably exhibit social influence attempts by the seller and the buyer. These social influence attempts can involve a number of strategies including the use of promises, threats, warnings, recommendations, and/or the control of information or other cues.

2. The seller exchanges sales efforts with the selling organization for money in the form of a commission or salary. Often there are side payments such as a trip to the Bahamas for meeting a special sales quota. Recognition and praise also often are exchanged for loyalty. This dyadic relationship has received a considerable amount of research effort. Sales territory allocation, compensation systems, sales force motivation, and sales force selection and management are all aspects of this particular dyad in the model.
3. The buyer exchanges his or her talents and abilities at buying and problem-solving within his or her organization for money, usually a salary. However, buyers are sometimes rewarded in the form of a percentage of the volume of purchases, or from a cost-savings perspective. The status that an organization awards the buyer and that buyer's efforts and feelings of loyalty toward the organization are further examples of exchanges that take place between the buyer and selling organization dyad. If the rewards the buying organization is willing to exchange with the buyer seem insufficient to the buyer, he or she may look elsewhere for more rewarding

exchanges, such as by moving to another organization, or seek to increase the rewards that accrue by accepting benefits from interested sellers.

4. Images of the buying organization are held by the seller while the buyer harbors feelings and images about the selling organization. The images held by the buyer and other members of the buying organization have been examined frequently in the literature. However, the images held by the seller have received little attention. It would make sense to examine these perceptions because they determine what type of marketing approach or product characteristics the seller will emphasize to the buyer. Dyadic relations depend on the individual actions and purposive behavior of the parties involved. The seller and the buyer both have plans, goals, set ways of behaving, and intentions they hope to satisfy. Sometimes these are the subject of negotiation. Invariably, they set restrictions on what is acceptable in an exchange and serve as the starting point for the interaction process. Clearly each one's image of the other helps to establish these boundaries of the purchasing interaction.
5. The primary economic exchange occurs between the buying and selling organizations where the product service is exchanged for money or credit. Reciprocal trade relations or some form of agreement may develop between the two organizations. The supply and demand parameters of each individual bargaining situation dictate what type of interaction develops between buying and selling organizations.

Under this conceptual approach, most purchases are better viewed as negotiated settlements between all those individuals involved internally in the buying organization and those external to it (i.e., intermediate marketers, competing sellers, the government, and the general public). These interactions lead to a purchase decision that is truly some social result of those interactive forces rather than any individual response. The outcome of these interactions also has economic and psychological consequences.

SUMMARY

LO 14.1 Compare distributive and integrative bargaining.

Two-party bargaining can be divided into two types: distributive and integrative. The parties in distributive bargaining are in basic conflict and competition because of a clash of goals: The more one party gets, the less the other gets. That is, the total gains from the situation must be "distributed" between the two parties involved, and each party usually wants as much as it can get.

Integrative bargaining exists where there are areas of mutual concern and complementary interests. The situation is a varying-sum schedule such that, by working together, both parties can increase the total profits available to be divided between them. This is often the case between manufacturers and distributors because of the existence of an ultimate consumer.

LO 14.2 Explain the psychological bargaining framework.

The findings by psychologists can be categorized under six areas, each representing a major factor assumed to affect bargaining. These six factors are explained here and examples of each are provided:

1. *General bargaining predispositions.* Individual differences in bargaining predispositions may affect bargaining behavior.
2. *Payoff system.* Payoffs result from various aspects of the negotiated agreement.
3. *Social relationship with the opponent.* This factor refers to the social relationship existing between the bargainers.
4. *Social relationship with significant others.* This factor refers to the relationships of the bargainers to

significant others not participating directly in the bargaining.

5. *Situational factors.* The physical and social setting of the bargaining may have an effect. Is the bargaining being conducted in the home territory of one of the bargainers or on neutral ground? What, if any, is the seating arrangement?
6. *Bargaining strategy.* This factor includes the specific actions of the bargainer during bargaining.

The best strategy is to give the other side the impression that one is tough but fair. A strategy of always reciprocating both the frequency and the magnitude of the other bargainer's concessions was found to be more effective in obtaining concessions from the other bargainer than strategies involving less reciprocation. Conceding only in response to a concession by the other side gives the impression that one is strong, while always reciprocating a concession gives the impression that one is fair. Dispositions attributed to the other party in a bargaining situation are crucial in mediating yielding. If you give a little, I will give a little and vice versa.

LO 14.3 Discuss the economic bargaining framework.

Nash originally took the position that his model constituted a positive theory and that it would describe actual bargaining outcomes, but it is now much more common to give a normative interpretation to the analysis and to treat the Nash solution as a "desirable" outcome of the bargaining process between two corporations.

LO 14.4 Illustrate the effects of both economic and psychological aspects on the outcome of bargaining situations.

To better illustrate the effects of both economic and psychological aspects on the outcome of bargaining situations, it is necessary to turn to a field experiment in distributive bargaining. The experiment examines the effect of contingency compensation on both buyers and sellers. It also allows speculation about the difference in the power systems of buyers and sellers and how they affect the outcome of bargaining situations. Sellers and buyers tend to have conflicting bargaining goals. The aim of a selling organization is to instill in its salespeople the objective of influencing the buyer's actions to the advantage of the seller.

LO 14.5 Demonstrate how to plan for a formal negotiation.

The most important planning activity for a seller is to submit the most responsive request for proposal (RFP) or request for quote (RFQ). The seller's proposal should be based on a thorough conceptual and economic analysis. If this phase in the planning process is nonresponsive, the negotiations will not be conducted. The seller cannot alter the proposal after it is submitted. On the other hand, until an agreement is signed, the buyer can change his or her mind. There is always a chance of rejection no matter how strong the seller's initial RFP. At the same time, no matter how weak a competing proposal, it still has a probability of acceptance no matter how remote.

LO 14.6 Describe a richer conceptual model for buyer–seller interactions.

The buyer–seller interactions exchange model given in Figure 14.4 captures both the economic aspects and the surrounding psychological variables of the bargaining situation. It allows for the effects of constituents for both the buyer and seller and permits contingency compensation for either side of the bargaining dyad. The model is built on the relationships inherent in a bargaining situation and illustrates at least five major types of relations that can be affected by any bargaining interaction.

KEY TERMS

Constant sum 335
Distributive bargaining 332
Game theory 332
Integrative bargaining 333
Negotiation 333
Pareto optimal 338
Personal selling 336
Varying sum 332
Zero-sum bargaining 333

DISCUSSION QUESTIONS

1. Explain how learning curve analysis is used in the negotiation process.
2. When and how is negotiation used, and what can be negotiated?
3. How do you prepare for negotiation?
4. What is meant by distributive bargaining? What is meant by integrative bargaining?
5. What is meant by psychological bargaining? What are the psychological bargaining factors?
6. Discuss the various payoff systems.
7. Discuss the characteristics of economic bargaining.

SUGGESTED CASES

Case 1: AMD Construction Company: Negotiating the Old-Fashioned Way

Case 6: Carter Systems Canada, Inc.

Case 28: Tom & Jerry (T&J) Construction, Inc.

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PART V

Special Purchasing Applications

15 Purchasing Transportation Services

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

15.1 Explain the trade-offs between cost, reliability, and speed in determining which mode of transportation to purchase.

15.2 Compare purchasing examples in differing market segments.

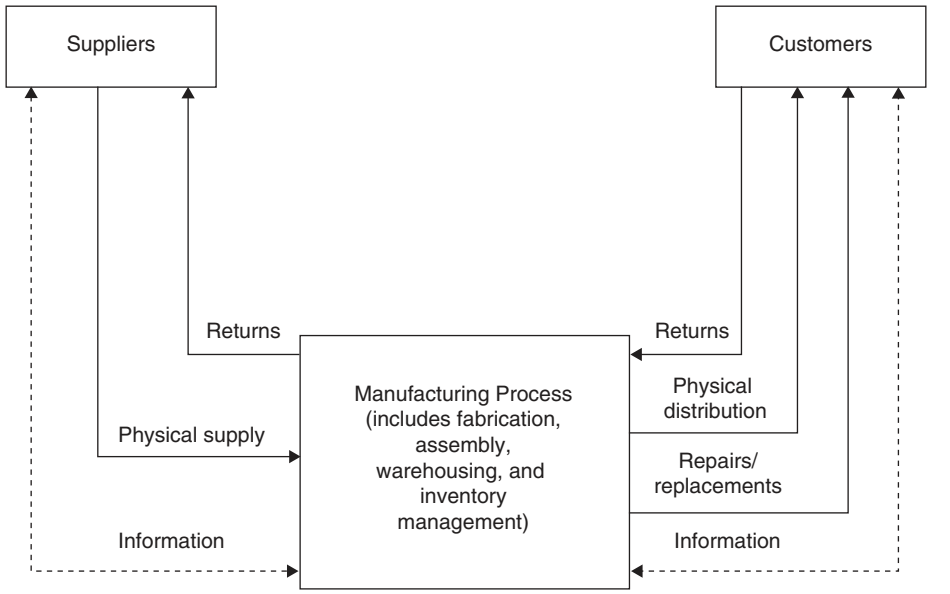
15.3 State the relationship of NAFTA to imports and exports between the United States and Canada and Mexico.

Jones, Inc., manufacturers a varied line of industrial equipment and installations throughout the United States. Over the last 10 years the company has gradually been increasing the size and weight of many of its installations in order to meet customer requirements. The traffic manager must now make a decision on whether to continue to ship via over-the-road trucking or rail.

INTRODUCTION

Supply managers usually manage the flows of information and physical supply from the supplier to the ultimate customer. As illustrated in the purchasing transportation network of a typical manufacturing firm shown in Figure 15.1, the systems flows are impressive. In traditional systems,

FIGURE 15.1
Purchasing Transportation Network



inventory management is a manufacturing activity. However, many Fortune 500 firms have moved to just-in-time (JIT) manufacturing, which involves scheduling receipts from suppliers so that deliveries occur just as the supplies are needed in the manufacturing process. They then produce the end product by the customer's ship date. The transportation activity associated with the traditional manufacturing process is one of the most expensive components of most manufacturing firms. With JIT systems, the transportation costs are magnified. Some of the transportation costs include such activities as selecting the mode of transportation to be used in moving a particular shipment.

Freight and transportation costs are significant for manufacturers. The frequency, product type, and size of shipments can have a significant impact on these costs. The freight and transportation services category typically includes larger volume and more frequent shipments, not suitable for UPS or FedEx. Service providers in this business offer the following shipping service and modes:

- Inbound/outbound freight
- LTL (less than truckload) shipments
- TL (truckload) shipments
- Rail
- Air
- Truck
- Ocean cargo
- Intermodal transportation (ocean, rail, truck)

Inbound freight costs are usually a component of materials costs (e.g., F.O.B. delivered). Freight movement buying is complex, simply because there are so many alternatives. Many buying arrangements are brokered through many levels of unknown middlemen. Most of the brokers have no risk. Loads are often quoted before assets are acquired. Therefore, the markup is as high as 30% to 40%. There are many opportunities for purchasing professionals to leverage inbound and outbound freight costs by developing expertise in-house or partnering with a freight management service provider.

In 2019, transportation revenues were approximately $2.5 trillion. As can be seen in Table 15.1, the U.S. gross domestic product (GDP) attributed to transportation revenue is 8.7%. Over-the-road transportation accounted for approximately 80% of the total transportation costs. In other words, a large share of the expenditures was associated with moving products from the manufacturing facility to the ultimate consumer. There are more than 50,000 private trucking fleets in the United States.

TABLE 15.1
U.S. Surface Transportation Trade With Canada (Millions of Current U.S. Dollars)

Mode		May 2018	April 2019	May 2019	Percentage Change, April 2019–May 2019	Percentage Change, May 2018–May 2019
All surface modes	Imports	24,808	23,632	25,571	–4.7	3.1
	Exports	20,941	19,832	20,293	–5.3	–3.1
	Total	45,749	43,463	45,864	–5.0	0.3
Truck	Imports	13,990	13,041	13,928	–6.8	–0.4
	Exports	16,934	15,798	16,429	–6.7	–3.0
	Total	30,924	28,839	30,357	–6.7	–1.8
Rail	Imports	5,709	5,306	5,654	–7.1	–1.0
	Exports	3,115	3,178	3,122	2.0	0.2
	Total	8,825	8,483	8,776	–3.9	–0.6
Pipeline	Imports	5,108	5,286	5,989	3.5	17.2
	Exports	892	856	743	–4.1	–16.7
	Total	6,001	6,141	6,731	2.3	12.2
Vessel	Imports	1,809	1,493	1,621	–17.4	–10.4
	Exports	1,381	1,440	1,371	4.2	–0.8
	Total	3,190	2,933	2,991	–8.1	–6.2
Air	Imports	1,062	970	1,077	–8.7	1.4
	Exports	1,469	1,491	1,491	1.5	1.5
	Total	2,531	2,461	2,568	–2.8	1.5

Source: BTS TransBorder Freight Data.

TRANSPORTATION'S ROLE IN PURCHASING

LO 15.1 Explain the trade-offs between cost, reliability, and speed in determining which mode of transportation to purchase.

Transportation is often the most costly and time-consuming component of purchasing management. Its planning is also critical in meeting manufacturing and customer delivery scheduling requirements. **Transportation** involves facilitating the movements of raw materials and component parts from suppliers through the firm's manufacturing process to the ultimate customers. The management of the purchasing/transportation interface is complex and requires the buying organization to gain knowledge of basic transportation decision-making activities. The major activities are presented further in this section.

Transportation Facilitating the movements of raw materials and component parts from suppliers through the firm's manufacturing process to the ultimate customers.

Mode Selection

The initial decision requires the buying firm to select the appropriate shipment mode. Each of the modes has specific operating and cost characteristics, and the buying professional must weigh them in selecting the most appropriate transportation mode. The most basic selection decision is the trade-off between cost, reliability, and speed. The cost of shipment is usually tied to the speed of the mode. In certain situations when speed is critical, the cost of shipment becomes less important. However, under more normal operating conditions, the mode's record of on-time deliveries and service quality are more important measures of effectiveness.

In many cases, most Fortune 500 firms use a variety of transportation modes depending on their aggregate transportation needs. The "model split" is usually determined by time pressures, the product mix, the final shipment destination, and competitive market forces. The various courier choice characteristics are given in Table 15.2 and Table 15.3. The most recent statistical data for modal freight activity in the United States are presented in Table 15.4. As can be seen in the tables, freight activity for all single modes, plus mail and truck and rail multimodal freight, increased in value between 2007 and 2012. However, measured in tons and ton-miles, commodity flows decreased in the same period. The numbers on ton-mile commodity flows indicate an increase in commodity flows by water and air, combined with a decrease in surface transportation modes. Recall that the period from 2007 to 2012 included the global financial crisis, which was associated with decreased freight volumes in many parts of the world. The Commodity Flow Survey is conducted every 5 years; the 2017 report will be released in July 2020.

There are a variety of modes of transportation to choose from ranging from rail to air to ocean cargo as well as others or combinations of these. The purchasing manager must understand the trade-offs between cost, reliability, and speed when making decisions about what mode of transportation to purchase.

Rail

The railroads provide service over an extensive physical network comprised of nearly 140,000 miles of track and 100,000 bridges. As can be seen in Tables 15.2, 15.3, and 15.4, the rail mode ranks second (after truck) in terms of tons and ton-miles. The rail service also includes more than 26,000 Class I locomotives and more than 300,000 Class I freight cars. The total operating revenue for Class I railroads in 2017 was approximately $70 billion.

TABLE 15.2

Shipment Characteristics by Mode of Transportation for the United States: 2012 and 2007.*

	Value			Tons			Ton-miles			Average Miles per Shipment		
Mode of Transportation	2012 (Million Dollars)	2007 (Million Dollars)	Percentage Change	2012 (Thousands)	2007 (Thousands)	Percentage Change	2012 (Thousands)	2007 (Thousands)	Percentage Change	2012 (Thousands)	2007 (Thousands)	Percentage change
Total	**13,852,143**	**11,684,872**	**18.5**	**11,299,409**	**12,543,425**	**–9.9**	**2,969,506**	**3,344,658**	**–11.2**	**630**	**619**	**1.8**
Single Modes	**11,900,364**	**9,539,037**	**24.8**	**10,905,518**	**1,698,128**	**–6.8**	**2,697,418**	**2,894,251**	**–6.8**	**262**	**234**	**12.0**
Truck	10,132,229	8,335,789	21.6	8,060,166	8,778,713	–8.2	1,247,717	1,342,104	–7.0	227	206	10.2
For-hire truck	6,504,636	4,955,700	31.3	4,298,693	4,075,136	5.5	1,050,942	1,055,646	–0.4	508	599	–15.2
Private truck	3,627,592	3,380,090	7.3	3,761,472	4,703,576	–20.0	196,775	286,457	–31.3	58	57	1.8
Rail	473,070	436,420	8.4	1,628,537	1,861,307	–12.5	1,211,481	1,344,040	–9.9	805	728	10.6
Water	301,554	114,905	162.4	575,996	403,639	42.7	192,866	157,314	22.6	908	520	74.6
Shallow draft	218,927	91,004	140.6	424,542	343,307	23.7	118,742	117,473	1.1	275	144	91.0
Great Lakes	424	S	S	31,403	17,792	76.5	10,959	6,887	59.1	347	657	–47.2
Deep draft	59,878	23,058	159.7	72,987	42,540	71.6	22,130	32,954	–32.8	1,157	923	25.4
Multiple waterways	22,325	X	X	47,064	X	X	41,035	X	X	1,034	X	X
Air (includes trucks and air)	450,575	252,276	78.6	4,845	3,611	34.2	5,810	4,510	28.8	1,295	1,304	–0.7
Pipeline	542,936	399,646	35.9	635,975	650,859	–2.3	S	S	S	S	S	S
Multiple Modes	**1,950,753**	**1,866,723**	**4.5**	**357,047**	**573,729**	**–37.8**	**271,832**	**416,642**	**–34.8**	**922**	**975**	**–5.4**
Parcel U.S. Postal Service or courier	1,688,242	1,561,874	8.1	28,490	33,900	–16.0	22,716	27,961	–18.8	922	975	–5.4

Truck and rail	224,833	187,248	20.1	213,814	225,589	−5.2	169,524	196,772	−13.8	988	1,007	−1.9
Truck and water	29,035	58,389	−50.3	56,720	145,521	−61.0	48,568	98,396	−50.6	1,562	1,429	9.3
Rail and water	7,976	13,892	−42.6	55,570	54,878	1.3	29,170	47,111	−38.1	1,073	1,928	−44.3
Other multiple modes	668	45,320	−98.5	2,452	113,841	−97.8	1,853	46,402	−96.0	S	1,182	S
Other Modes	**1,026**	**279,113**	**−99.6**	**36,844**	**271,567**	**−86.4**	**256**	**33,764**	**−99.2**	**S**	**116**	**S**

*Estimates are based on data from the 2012 and 2007 Commodity Flow Surveys. Because of rounding, estimates may not be additive.

S = Withheld because estimate did not meet publication standards.

X = Not applicable

Ton-miles estimates are based on estimated distances traveled along a modeled transportation network.

Truck as a single mode includes shipments that were made by only private truck or only for-hire truck.

Estimates for pipeline exclude shipments of crude petroleum (SCTG 16)

Note: Value-of-shipments estimates have not been adjusted for price changes. Appendix B tables provide estimated measures of sampling variability. The introduction and appendices give information on confidentiality protection, sampling error, nonsampling error, sample design, and definitions. Links to this information on the Internet may be found at www.census.gov/econ/cfs.

Source: BTS TransBorder Freight Data

TABLE 15.3

Shipment Characteristics by Mode of Transportation for the United States: 2012.*

	Value		Tons		Ton-Miles			
Mode of Transportation	**2012 (Million Dollars)**	**Percentage of Total**	**2012 (Thousands)**	**Percentage of Total**	**2012 (Thousands)**	**Percentage of Total**	**Average Miles per Shipment**	**Percentage of Total**
Total	**13,852,143**	**100.0**	**11,299,409**	**100.0**	**2,969,506**	**100.0**	**630**	1.225917
Single Modes	**11,900,364**	**85.9**	**10,905,518**	**96.5**	**2,697,418**	**90.8**	**262**	1.091224
Truck	10,132,229	73.1	8,060,166	71.3	1,247,717	42.0	227	1.257074
For-hire truck	6,504,636	47.0	4,298,693	38.0	1,050,942	35.4	508	1.513166

(*Continued*)

TABLE 15.3 (Continued)

Private truck	3,627,592	26.2	3,761,472	33.3	196,775	6.6	58	0.964408
Rail	473,070	3.4	1,628,537	14.4	1,211,481	40.8	805	0.290488
Water	301,554	2.2	575,996	5.1	192,866	6.5	908	0.523535
Shallow draft	218,927	1.6	424,542	3.8	118,742	4.0	275	0.515678
Great Lakes	424	0.0	31,403	0.3	10,959	0.4	347	0.013502
Deep draft	59,878	0.4	72,987	0.6	22,130	0.7	1,157	0.820393
Multiple waterways	22,325	0.2	47,064	0.4	41,035	1.4	1,034	0.474354
Air (includes trucks and air)	450,575	3.3	4,845	0.0	5,810	0.2	1,295	92.99794
Pipeline	542,936	3.9	635,975	5.6	S	S	S	0.853707
Multiple Modes	**1,950,753**	**14.1**	**357,047**	**3.2**	**271,832**	**9.2**	**922**	5.463575
Parcel U.S. Postal Service or courier	1,688,242	12.2	28,490	0.3	22,716	0.8	922	59.25735
Truck and rail	224,833	1.6	213,814	1.9	169,524	5.7	988	1.051535
Truck and water	29,035	0.2	56,720	0.5	48,568	1.6	1,562	0.511901
Rail and water	7,976	0.1	55,570	0.5	29,170	1.0	1,073	0.143531
Other multiple modes	668	0.0	2,452	0.0	1,853	0.1	S	0.272431
Other modes	**1,026**	**0.0**	**36,844**	**0.3**	**256**	**0.0**	**S**	0.027847

*Estimates are based on data from the 2012 Commodity Flow Survey. Because of rounding, estimates may not be additive.

S = Withheld because estimate did not meet publication standards.

Ton-miles estimates are based on estimated distances traveled along a modeled transportation network.

Truck as a single mode includes shipments that were made by only private truck or only for-hire truck.

Estimates for pipeline exclude shipments of crude petroleum (SCTG 16)

Note: Value-of-shipments estimates have not been adjusted for price changes. Appendix B tables provide estimated measures of sampling variability. The introduction and appendices give information on confidentiality protection, sampling error, nonsampling error, sample design, and definitions. Links to this information on the Internet may be found at www.census.gov/econ/cfs.

Source: BTS TransBorder Freight Data

TABLE 15.4

Transportation Shipping Modes: 2012

Mode of Transportation	Value 2012 (Million Dollars)	Tons 2012 (Thousands)	Ton-Miles 2012 (Thousands)
Total	**13,852,143**	**11,299,409**	**2,969,506**
Single Modes	**11,900,364**	**10,905,518**	**2,697,418**
Truck	10,132,229	8,060,166	1,247,717
For-hire truck	6,504,636	4,298,693	1,050,942
Private truck	3,627,592	3,761,472	196,775
Rail	473,070	1,628,537	1,211,481
Water	301,554	575,996	192,866
Shallow draft	218,927	424,542	118,742
Great Lakes	424	31,403	10,959
Deep draft	59,878	72,987	22,130
Multiple waterways	22,325	47,064	41,035
Air (includes trucks and air)	450,575	4,845	5,810
Pipeline	542,936	635,975	S
Multiple Modes	**1,950,753**	**357,047**	**271,832**
Parcel U.S. Postal Service or courier	1,688,242	28,490	22,716
Truck and rail	224,833	213,814	169,524
Truck and water	29,035	56,720	48,568
Rail and water	7,976	55,570	29,170
Other multiple modes	668	2,452	1,853
Other Modes	**1,026**	**36,844**	**256**

S = Withheld because estimate did not meet publication standards.

Ton-miles estimates are based on estimated distances traveled along a modeled transportation network.

Truck as a single mode includes shipments that were made by only private truck or only for-hire truck.

Estimates for pipeline exclude shipments of crude petroleum (SCTG 16).

Note: Value-of-shipments estimates have not been adjusted for price changes. Appendix B tables provide estimated measures of sampling variability. The introduction and appendices give information on confidentiality protection, sampling error, nonsampling error, sample design, and definitions. Links to this information on the Internet may be found at www.census.gov/econ/cfs.

Source: BTS TransBorder Freight Data

Non-Class I railroads are short line and regional railroads. The seven Class I railroads are listed in Table 15.5. Two Canadian railroads that also operate significant tracks in the United States are included with this group. The seven Class I railroads account for approximately 69% of U.S. freight rail mileage, 90% of employees, and 94% of revenue. Close to 600 freight railroads operate in the United States; most have limited operations.

TABLE 15.5
Class I Freight

BNSF Railway
CSX Transportation
Grand Trunk Corporation
Kansas City Southern Railway
Norfolk Southern Combined Railroad Subsidiaries
Soo Line Railroad
Union Pacific Railroad
CN Canadian National Railway
CP Canadian Pacific Railway

Source: Federal Railroad Administration.

The total cost structure of the railroad industry is characterized by high fixed costs. However, nearly two thirds of the railroads' fixed costs are unrelated to volume. The railroad industry possesses a *theoretical* pricing advantage over alternative competitive modes. Specifically, rail transportation pricing is less flexible. Rail transportation is generally less expensive than air and truck modes. Rail cargo is usually shipped from terminal to terminal; therefore, flexibility is not an attribute. Products shipped via rail include coal, corn, wheat, soybeans, fertilizers, plastic resins, chemicals, building materials, lumber, autos and auto parts, animal feed, food products, steel, crude oil and liquefied natural gas, paper products, and iron ore and scrap metal.

Burlington Northern, CSX, the Norfolk Southern, and the Southern Pacific generate 80% of the total railroad operating revenues in a typical year. There are also more than 520 regional and local railroads. The majority of the regional railroads have limited operations. The Class I railroads in the United States also account for approximately 75% of the total ton-mileage operated, 90% of railroad employment, and 90% of the operating revenues.

Intermodal

Deregulation has allowed the railroad carriers to integrate into other modes of transportation. CSX–Sea Land Corporation, Union Pacific–Overnight (trucking), and Norfolk Southern–North American Van Lines (trucking) are the most significant intermodal firms.

Rail intermodal volumes have grown rapidly from 5.6 million containers and trailers in 1990, to 9 million in 2000, to 11.1 million in 2010. In 2018, a record annual volume of 14.5 million units was reached. Intermodal shipping now accounts for approximately 24% of revenue for major U.S. railroads, well ahead of coal, which historically was the largest source of revenue. Most bulk commodities are initially shipped by rail and later shifted to motor carriers.

The railroad industry exhibits a high degree of collaboration. An example of this is the TTX Company, which is jointly owned by the biggest North American railroads. TTX owns a pool of over 165,000 railcars, which it leases to railroads. Pooling allows railroads to share railcars with one another, reducing waste from switching out and returning empty cars.

It is not unusual for several railroads serving different regions to enter into interchange agreements that allow the shipper to contract only with the originating carrier. However, the interchange process itself is time-consuming and tends to slow service.

Truck

Trucking is a huge industry. In 2018, the trucking industry generated nearly $800 billion in revenue and moved 11.49 billion tons of freight. Most trucking companies are small: 91.3% of fleets operate 6 or fewer trucks, and 97.4% operate 20 or fewer. Products commonly shipped by truck include clothing, furniture, machines, food, paper products, electronics, building materials, and vehicles. Perishable consumer goods such as fresh meats, dairy products, and baked goods are shipped by truck.

General commodity carriers usually specialize in either **truckload (TL)** or **less-than-truckload (LTL) shipments**. TL shipments are defined as loads in excess of 10,000 pounds. LTL businesses handle small shipments below 10,000 pounds. Because of the flow pattern of these shipments, each shipment is handled several times, and labor costs are higher. Major trucking companies sometimes offer a broad portfolio of services. For example, Schneider offers regional and long-haul truckload, expedited, dedicated, bulk, intermodal, final mile, LTL, brokerage, cross-docking, supply chain management, and port logistics services. UPS, FedEx, and DHL are the major parcel delivery services. Each has extensive multimodal capabilities and owns aircraft, as well as trucks, to enable fast delivery. Parcel delivery companies have benefited from the growth in e-commerce.

Truckload (TL) shipment Shipments are defined as loads in excess of 10,000 pounds.

Less-than-truckload (LTL) shipment Handle small shipments below 10,000 pounds.

Private trucking fleets are another important segment of the U.S. trucking industry. Some of the world's biggest shippers, including Walmart and Amazon, own and operate substantial fleets of their own. A recent study revealed that one third of all manufacturers, 75% of producers of construction materials, and 55% of food processors own private fleets.

There are approximately 3.5 million truck drivers in the United States of America today. An emerging development in the trucking industry is the advent of autonomous vehicles. Texas legalized driverless vehicles and platooning trucks in 2017 and has since become a hotbed for testing autonomous vehicles for shipping freight. Autonomous fleets of vehicles are already operating in relatively controlled environments such as mining. Intercity transportation can be seen as an intermediary level of complexity between those contexts and urban driving.

The primary advantages of this mode are flexibility and versatility. The truck mode is the only transportation mode that can be used to ship from point to point. The competition in the trucking industry is fierce, so to be successful, a carrier must provide the shipper with high service and low costs.

Finally, there are more than 50,000 private trucking fleets in the United States. Most of the privately owned trucking companies handle local and intercity truck tonnage.

Motor Carrier Services

Realizing that most shippers are interested in more than transportation, some carriers have formed third-party logistics enterprises. UPS, Yellow Freight, and Roadway Express have expanded into this market.

Just-in-time manufacturing also has resulted in a significant operating change in the general commodity carriers. Many of the firms have invested in new technology to foster better coordination with their customers. In addition, several of America's largest motor carriers have diversified into international operations.

The average revenue per intercity ton-mile realized by motor carriers was $6 in 2007. The average rail revenue was 29.9 cents per ton-mile. These average prices are misleading when selecting one mode over another. However, it is safe to suggest that, in general, truck rates

are lower than rail rates on small shipments and on high-valued commodities. In contrast, in long-haul volume movements of bulk commodities, motor carriers are typically unable to quote rail-competitive rates. The rate difference is only one dimension of a complex selection problem. For the most part, most of the rate competition is *within* the TL markets, but there is also rate competition *within* the LTL market.

There is also strong rate competition between owner-operators engaged in exempt commodity movements and railroads. Most of the owner-operators compete on a cost basis. The various levels of competition between owner-operators clearly show that they do not understand their cost structure. Irrational owner-operators will eventually go bankrupt.

Air

Annual revenue for the U.S. domestic air cargo industry was $43.6 billion in 2017. The express carrier share of the market was 62.3%. Scheduled freight traffic was 15.3%, and scheduled mail accounted for 17.6%. The remaining 4.7% of the market consisted of charter operations. Major categories moving as air freight include computer components, electronics, and fashion goods.

Integrated air cargo companies have air service–related support and handle air cargo from origin to destination. The companies with a significant presence in this market were also mentioned in the trucking section; they include FedEx, UPS, and DHL. Amazon entered the air cargo industry in 2016 and rapidly expanded its fleet to 50 planes, with plans already in place to acquire more.

Fuel is a major cost factor in air cargo operations. Traditionally, only premium and emergency goods are shipped via air because of its high costs. E-commerce customers have proven willing to pay a premium for the convenience of fast delivery. Table 15.3 shows that the value per ton of air cargo far exceeds that of any other transportation mode.

With the movement toward high customer service, air cargo has become an integral strategic weapon for firms that compete on a fast-delivery, low-inventory strategy. The average revenues per ton-mile of air cargo carriers in 2009 were $55.93 versus $6.21 for trucking and 33 cents for rail. The difference is even more impressive for the small package traffic handled by FedEx or UPS. The revenues per ton-mile for FedEx and UPS are approximately $1.11. For the most part, the competition in this mode is between UPS and FedEx.

Water Carriers

Water carriers are classified into several categories: (1) inland (such as rivers and canals), (2) lakes, (3) coastal and intercostal, and (4) international deep sea. The first two categories combined include about 350 establishments (single-location companies and units of multilocation companies) with total annual revenue of $7 billion. That figure excludes the transportation of cargo on the Great Lakes–St. Lawrence Seaway System. There are 19 U.S. ports and 21 Canadian ports in the Great Lakes–St. Lawrence region. About 158 million tons valued at more than $15 billion moved through this system in 2017.

There are 40,000 vessels operating in U.S. coastways and inland trades; most are non-self-propelled barges. Approximately one hundred are large (1,000 gross tons or more), privately owned, self-propelled oceangoing vessels engaged in domestic U.S. trade.

There has been substantial consolidation in the global container shipping industry. Three large alliances have emerged: 2M, the Alliance, and the Ocean Alliance now account for 93% of traffic on East-West lanes.

American water carriers compete directly with rail and pipelines. In 2009, the revenue per ton-mile was 73 cents. Rates for ocean shipping are more commonly discussed in dollars per twenty-foot equivalent unit (TEU). Major commodities shipped by water include semiprocessed materials, fuel, oil, coal, chemicals, and minerals. Water carriers are an excellent transportation shipping mode for low-valued bulk commodities in large quantities when speed is not a critical criterion.

Pipelines

Pipelines are used to transport low-value, nonperishable products such as oil, diesel fuel, jet fuel, kerosene, natural gas, and carbon dioxide. The United States has more than 2.6 million miles of pipelines. Pipelines often sell some of their capacity under long-term contracts at discounted prices, and some of their capacity at higher "spot market" rates. Oil pipeline rates are sometimes referred to as "tariffs" and tend to be quoted in cents per barrel, which makes it easy for the pipelines' customers (who are themselves paid in dollars per barrel) to make marketing decisions.

A comparison of each of these transportation modes is shown in Table 15.4.

The United States had relatively lower prices for transportation goods and services in 2014 than did 15 out of 25 Organisation for Economic Co-operation and Development (OECD) countries (see Table 15.6). However, the nation's top two overall merchandise trade partners, Canada and Mexico, had lower relative prices in 2014 than did the United States. Prices in Japan and the United Kingdom—both major U.S. trade partners—were much higher than in the United States. Half of the OECD countries that had less-expensive transportation goods and services than the United States are developing and transitional economies.

TABLE 15.6

Relative Prices for Transportation for Goods and Services for the United States and Selected Major Trade Partners: 2014

Table		Purchasing Power Parities (U.S. = 1.00)			
Time		2014			
Unit		National currency per U.S. dollar			
Countries	Gross Domestic Product	Actual Individual Consumption	Transport	Personal Transport Equipment	Transport/Individual Consumption
Luxembourg	0.884	1.03	0.95	0.898	0.92
United States	1	1	1	1	1.00
Switzerland	1.28	1.42	1.46	1.21	1.03
Australia	1.45	1.49	1.57	1.24	1.05
Canada	1.23	1.27	1.37	1.09	1.08
New Zealand	1.44	1.45	1.61	1.59	1.11
Ireland	0.819	0.952	1.12	1.05	1.18
OECD - Total	0.971	0.987	1.17	1.11	1.19

(*Continued*)

TABLE 15.6 (Continued)

Sweden	8.73	9.27	11.3	8.76	1.22
Japan	103	101	125	112	1.24
United Kingdom	0.698	0.759	0.944	0.798	1.24
Korea	872	894	1121	1183	1.25
Israel	3.94	4.31	5.44	6.25	1.26
Norway	9.28	10	12.7	12.1	1.27
Denmark	7.33	7.87	10.1	10.6	1.28
Belgium	0.8	0.83	1.08	0.984	1.30
Finland	0.907	0.937	1.22	1.08	1.30
Austria	0.799	0.832	1.1	0.977	1.32
France	0.808	0.808	1.08	0.979	1.34
Italy	0.74	0.782	1.05	0.938	1.34
Cyprus	0.68	0.701	0.954	0.848	1.36
Chile	367	372	507	568	1.36
Iceland	139	146	201	177	1.38
Euro area (19 countries)	0.752	0.773	1.07	0.957	1.38
Spain	0.662	0.706	0.982	0.976	1.39
Mexico	8.05	8.18	11.4	13.8	1.39
Netherlands	0.809	0.853	1.19	1.09	1.40
European Union (28 countries)	0.737	0.762	1.07	0.957	1.40
Germany	0.769	0.773	1.11	0.926	1.44
Greece	0.611	0.638	0.948	0.869	1.49
Malta	0.586	0.614	0.931	0.972	1.52
Slovenia	0.591	0.621	0.942	0.829	1.52
Estonia	0.527	0.533	0.842	0.82	1.58
Portugal	0.579	0.613	0.978	1.08	1.60
Latvia	0.498	0.503	0.806	0.817	1.60
Czech Republic	12.7	12.2	19.6	19.2	1.61
Slovak Republic	0.485	0.483	0.801	0.796	1.66
Russia	21	19.3	32.7	40.6	1.69
Croatia	3.54	3.63	6.69	6.35	1.84
Lithuania	1.53	1.5	2.83	2.88	1.89
Poland	1.77	1.68	3.18	3.33	1.89
North Macedonia	19	19.7	39	49.8	1.98
Hungary	129	126	253	247	2.01
Turkey	1.1	1.14	2.3	2.99	2.02
Romania	1.63	1.61	3.3	3.63	2.05
Bosnia and Herzegovina	0.687	0.721	1.5	1.55	2.08
Montenegro	0.362	0.376	0.788	0.82	2.10
Bulgaria	0.661	0.636	1.37	1.53	2.15
Serbia	39.8	40.6	88.5	92.5	2.18
Albania	42.9	44.2	96.5	105	2.18

Source: OECD, https://stats.oecd.org/Index.aspx?querytype=view&queryname=168#

Carrier Selection

The choice of transportation mode is the most important element in distribution management. Selecting the incorrect transportation mode can easily jeopardize a firm's operational efficiency because it may lead to higher costs and lower service levels. Carrier selection requires careful research and numerous economic tradeoffs. Transportation costs consist of all direct costs associated with the movement of a product from one location to another. To identify the significance of the mode choice, one needs to determine the total supply costs. Total supply chain costs can vary from 1% (for heavy equipment) to approximately 35% (for perishable food products) of the recommended selling price for the specific item or product.

The most important criteria to consider for carrier selection are competitive rates, customer service, transit time reliability, pickup and delivery service, availability of equipment, loss and damage claims, electronic data interchange (EDI), geographic coverage, problem resolution, insurance coverage, and billing accuracy.

The most recent trend in the selection process is to reduce the number of carriers. The shipper gains a competitive advantage over the carrier that usually results in lower costs and higher service levels. **Core carriers** are a set of carriers that a shipper organization has identified as business partners that execute on mutually agreed performance and price commitments.

Core carriers A set of carriers that a shipper organization has identified as business partners that execute on mutually agreed performance and price commitments.

After the appropriate transportation mode is selected, the specific carrier within the mode must be determined. In specific markets, there may be a large variety of carriers to choose from. There also may be variation in the prices and quality of service. Depending on the shipper's needs, type of shipment, and quantities, the shipper may choose to use one shipper or multiple shippers. Using multiple shippers is perhaps better than using a single shipper. By diversifying the shipments, the shipper will achieve better prices and higher service quality. When more than one carrier is used, evaluation of the carrier is easier.

Carrier Evaluation

Once a specific carrier selection is made, the buyer must routinely evaluate the performance in terms of consistency and quality of service. Some of the performance measures should include on-time deliveries, loss and damage claims, and billing accuracy. Remember, the primary objective of the buying/shipping firm is to provide for cost-effective continuous operation of the business by ensuring the availability of goods and services. In a competitive environment, the transportation function must provide delivery of undamaged goods on time and at a reasonable price. The general consensus is that on-time delivery and price are the key competitive criteria.

Rate Determination

Submitting rate quotations to shippers involves a complex process. The complexity is the result of the millions of different commodities that are shipped but also the numerous origins and destinations over which these commodities might move, as well as alternative routes that might be used in moving between any two specific origin-destination combinations.

Numerous factors are included in rate determination for a particular commodity. These factors include the following:

1. Shipping weight per cubic foot
2. Liability for damage
3. Perishability

4. Liability for damage to other commodities being transported
5. Liability for spontaneous combustion or explosion
6. Susceptibility to theft
7. Value per pound in comparison with other articles
8. Ease or difficulty in loading and unloading
9. Excessive weight
10. Excessive length
11. Care or attention necessary in loading and transporting
12. Trade conditions
13. Value of service
14. Competition with other commodities transported
15. Quantity offered as a single consignment

This list of factors is compounded by the specific commodity being shipped. The basic steps involved in the determination of the applicable rates are as follows: (1) use the classification to look up the commodity being shipped and determine its rating, (2) select the appropriate tariff and determine the rate basis number that applies to the origin-destination combination of the shipment, and (3) cross-reference the rating and the rate base number in the section of the tariff that gives class rates in cents per 100 pounds shipped. The steps in the shipping process are given in Table 15.7.

Rate Negotiation

Deregulation has given carriers more pricing freedom; negotiating skills have become important for both carriers and shippers. Carriers must become more aware of their costs and resulting pricing strategy. Shippers also must become experts at buying transportation services. Deregulation requires that both the carrier and the shipper become better managers.

TABLE 15.7
Steps in the Shipping Process

Step 1: Request quotes
Step 2: Choose the quote that you prefer
Step 3: Prepare necessary documents for the shipping process
Step 4: Confirm the shipment details
Step 5: Book your freight
Step 6: Pay with credit card or via bank account
Step 7: Shipment passes through customs inspection at port of entry
Step 8: Receive and pay the bill for customs duties and taxes
Step 9: Receive the shipment

In many instances, the negotiation process in transportation has become more formalized. The larger shippers usually send out a formal request for proposals for how carriers would handle the company's traffic in specific markets. The negotiation process should be based on a win-win strategy.

Negotiation is a management process that involves planning, analysis, and reviewing. Negotiation activities are influenced by the characteristics of the current business environment, the organization, and the individuals. The environmental factors include competition, technology, and legislation. Of all the environmental factors, competition is the most important factor that the shipper controls. Competition influences the relationship between carriers and shippers. At the carrier level, there is direct competition between various carriers within a specific transportation mode. On the other hand, as competition increases in the shippers' market, increases or decreases of demand influence the level and costs of transportation services. Depending on the competitive environmental factors, the negotiators gain or lose power. For a more detailed discussion on negotiations, see Chapter 14.

The business climate between shippers and carriers offers an *a priori* assessment of the power dependence relationship. Bargaining activities involve face-to-face meetings between the shipper and carrier. The shipper's negotiator usually prefers meeting at the shipper's office. A day is set aside to handle all of the bidders one after another in rapid-fire fashion. This method allows the shipper to control the surroundings of the bargaining activities and gives it the ability to use power ploys as manipulative tools.

Technology also influences the transportation negotiation process. Computer technology offers shippers real-time information related to shipment tracking, equipment availability in various locations, and the ability to compare base pricing.

Shippers and carriers also must observe antitrust restrictions. They must consider the implications of legal constraints on each movement under the final contractual agreement. Moreover, most carriers demand fuel increase allowances within the terms of the contractual agreement. For a more detailed discussion on contracts, see Chapter 3.

Third-Party Relationships

Third-party logistic relationship organizations are businesses that outsource elements of its distribution, warehousing, and fulfillment services. Buyers face several challenges to transfer logistics activities to a third party. The decision must include all of the parties affected by the third-party relationship. In some cases, the third-party logistics decision is made in the finance department and not at the operations and logistics level in the shippers' firm. Third parties are traditionally approached by either the transportation manager or the purchasing department. Because of the complexity of third-party relationships, many firms have organized transportation councils composed of individuals representing the transportation function across several sites or operating divisions. These councils combine their freight to simplify the negotiations process with third parties as well as attempt to lower freight costs. This systemwide negotiation approach has resulted in firms using fewer third parties and spending less on transportation.

In developing a negotiation strategy, the shipper must identify the type of relationship desired with the third party. As with any other buying situation, the shipper must establish a set of desires (costs) and demands (services) expected from the carrier. The first step is to prequalify a set of carriers that will be offered an opportunity to be considered as a third-party provider. Only those third parties that can meet certain minimum service levels will be offered an opportunity to negotiate.

If the shipper only requires standard third-party service but desires a longer-term relationship, the bidding process is appropriate. The shipper must carefully identify and communicate to the third-party base all data needed to describe the shipper's business and service requirements. Data must be accurate, complete, and timely because they will be used by the third party as a base for its proposal. To properly evaluate bids from several third-party providers, it is important that the bids be presented in a common format. Once a relationship between a shipper and a third party is established, an agreement, the third-party contract, should be executed by the shipper and the third party.

The scope of the operation section of the contract must be detailed and specific. Activities such as vehicle spotting, loading, and unloading should be assigned as the responsibility of one of the parties. The performance measures should be part of the agreement. Specific performance measures are transit time, pickup/delivery reliability, damage and rates, and billing accuracy. Many firms require certain indemnification clauses to be included with any third-party agreement with suppliers. The indemnification clause protects the shipper from liability caused by the action or lack of action by the third party on issues not under the control of the supplier.

Freight Consolidation

As the size of a shipment increases, the transportation charge per unit of weight will fall. To take advantage of these rate economies, the shipper should attempt to consolidate shipments. Instead of shipping each day, the shipments are accumulated for several days and then shipped.

Documentation/Tracing/Claims

Shipping documentation such as the "bill of lading," defined shortly, must be prepared. This serves as the basic contract between the carrier and the shipper and specifies the commodities and quantities shipped, routing, rates, and carrier liability.

Sometimes shipments must be traced with the carrier. Bar coding is usually used to track down a shipment. Loss and damage claims are a reality of life, even when dealing with highly efficient carriers. This process is time-consuming and frustrating.

Terms and Condition of Transportation Purchasing

The terms and conditions that must be considered during transportation purchasing include freight terms, terms of sale/purchase, and bill of lading.

Freight Terms

Freight terms are concerned with the item weight, the amount of charges and taxes, and whether the bill is collect or prepaid. If the bill is prepaid, the shipper pays the shipping charges. If the bill is collect, the consignee pays the shipping charges. The freight terms associated with the payment arrangements between shippers and carriers are usually misunderstood. Freight terms outline the responsibilities of the shipper and the carrier. The following definitions must be understood before entering into an agreement:

1. *Prepaid* means that the shipper owns the freight.
2. *Collect* means that the consignee owns the freight.

3. *Prepaid/collect beyond* means that a shipper prepays a portion of the freight and the consignee is responsible for the balance of the payment.
4. *Third party* establishes that neither the consignor nor the consignee owns the payment process function. The legal payment function may or may not belong to the third party. The obligation is determined from the parties indicated on the bill of lading contract. Unless the payment party is a party to the bill of lading contract, it has no responsibility for payment and no legal obligation.
5. *Prepay and add* means that the shipper advances the charges to the carrier and then bills the beneficiary an amount that approximates or equals the actual freight charges.

Terms of Sale/Purchase

The terms and conditions, together with the order, constitute an offer by the buyer. The buyer agrees to purchase the materials, subject to all agreed-on terms. Specifically, the terms of sale or purchase are used to identify the passage of title and are usually expressed by an **F.O.B.** designation: F.O.B. origin or F.O.B. destination.

1. **F.O.B. origin** means that the title to the merchandise passes at the time and place of pickup.
2. **F.O.B. destination** means that the title to the merchandise passes at the time and place of delivery.

Bills of Lading

Bills of lading convey the freight terms and act as both a contract for carriage and a receipt for delivery.

1. Order notify bills of lading are negotiable and are similar to letters of credit.
2. Sales/purchase orders convey the passage of title and are legal documents.

F.O.B. A delivery term meaning "free on board" at a named place. The named place is where merchandise title passes from the seller to the purchaser. This is an important, and often negotiated, aspect of the purchase agreement because whoever holds title in transit is responsible for damages and losses and the filing of claims.

F.O.B. origin A delivery term that places liability with the purchaser once the freight leaves the dock, but the vendor is going to pay the shipping costs.

F.O.B. destination Title of merchandise passes to the purchaser at the time of delivery; however, transportation and freight charges are prepaid by the vendor and added to the invoice.

Bills of lading A transport company's contract and receipt for materials and equipment; agreement to transport from one location to another and to deliver to a designated individual or party.

THREE TRANSPORTATION PURCHASING EXAMPLES

LO 15.2 Compare purchasing examples in differing market segments.

To see how three unique segments of the economy accomplish the purchasing of transportation services, three company transportation executives were surveyed, at Ross Labs, Consolidated Stores, and Copeland Inc. (Since the time of the interviews, each of the firms has also experimented with reverse auctions.)

Ross Laboratories

Ross Product Division was founded in 1903 by Harry Moore and Stanley Ross under the name of Moore's and Ross Milk Company in Columbus, Ohio. They were the first to operate the old stand-and-drive milk truck. They were also the first to deliver milk in glass bottles to homes. In 1924 the partners made an innovative move by producing and marketing milk-based infant formula, and in 1959 the company introduced Similac with Iron infant formula.

In 1964, the company was renamed Ross Laboratories and merged with the world's largest health care company, Abbott Laboratories. Today the Ross Labs Product Division has its headquarters in Columbus, Ohio, with facilities in Ohio, Arizona, Michigan, and Virginia.

Transportation Purchasing at Ross Labs

The core carriers for Ross's transportation needs are KLLM, Martin, ROCOR, FWC, Gasel, Consolidated Freightways, UPS, and FedEx. Ross's carrier selection criteria consist of the following:

1. Service level
2. Equipment base
3. Systems capabilities
4. Cost containment and reduction programs
5. Financial stability
6. Nature of client base
7. Organizational structure
8. Regional versus national focus
9. Rates
10. Accessories
11. Accident record
12. Driver turnover

The Ross Pricing Process

The executive in charge of purchasing transportation services stated that for Ross to negotiate effectively, it must understand the cost drivers associated with each potential transportation mode. The carriers' proposals cannot be analyzed effectively if the carriers' cost drivers are unknown. The competitive bidding process is used exclusively for third-party carrier relationships.

Ideally, the competitive bidding process is usually more objective and will lead to lower prices. A detailed agreement is executed following the competitive bidding process.

Consolidated (Big Lots) Stores

Consolidated Stores is the nation's largest broad line closeout retailer with annual sales over $3 billion and more than 1,400 stores nationwide. In 2004, all of the store names were changed to Big Lots, Inc. The company has more than 23,000 employees at stores in 46 states. Annual sales in 2018 were $5.2 billion. Distribution centers are located in Columbus, Ohio; Montgomery, Alabama; Rancho Cucamonga, California; and Tremont, Pennsylvania.

Transportation Purchasing at Consolidated Stores

The core carriers for the distribution centers' needs are UPS, BNSF, CSX, NS, and KCS rail lines along with stack train operators such as Mitsui, Pacer, and K-line. The stack train

operators use railroad tracks, ramps, and trains. The core trucking companies are J. B. Hunt and Warner. The core drayage carriers are Total Express, BTT, We R Drayage, Golden Eagle, and Pacer Cartage. Finally, the core steamship carriers are Trailer Bridge, Crowley, Navieras, Sea Star, CSX Lines, Maesk Seal, Mitsui, Yang Ming, Hanjin, Hyundai, and P&O Nedloyd.

According to the executive in charge of purchasing transportation services, Consolidated's carrier selection criteria consist of the following:

1. Prequalification of the carrier
2. Service (transit and schedule)
3. Capacity (equipment and power availability)
4. Rate (price plus accessories)
5. Relationship (integrity, trust, and problem resolution process)

The Consolidated Pricing Process

Both electronic and conventional competitive systems are used at Consolidated. Electronic bidding is conducted via the Internet. The manual bids are conducted via requests for proposals. The bidders are required to fill in a standard spreadsheet and e-mail it to Consolidated before the deadline. The negotiation process is different for each of the transportation modes.

Consolidated attempts to secure all negotiated contracts during the lowest point in the business cycle prior to the heavy cycle. Motor carrier (drayage and highway) agreements are the easiest to negotiate because Consolidated knows their costs and the responsibilities are simplistic. Rail carriers are usually firm with their pricing structure and are not usually interested in long-term relationships. The pricing variance between competitors is insignificant. The steam line carriers are the most difficult carriers with which to negotiate. They take the attitude that if you did not need them, then why are you talking to them? Most of Consolidated's contracts range between 1 and 5 years.

Copeland Inc.

Copeland was founded in 1921 by Edmund Copeland in Detroit, Michigan. Copeland manufactures scroll compressors for commercial air conditioning. The company has more than 8,000 employees and gross sales of $15.5 billion. Copeland manufactures its products in 11 countries throughout North America, Europe, and Asia.

Transportation Purchasing at Copeland

Copeland currently maintains contracts with 4 major steamship lines, 18 LTL motor carriers, 4 TL carriers, and 3 multimode carriers.

According to the executive in charge of purchasing transportation services, Copeland's carrier selection criteria consist of the following priorities:

1. Service standards
2. Geographic coverage
3. Experience
4. Price

5. Financial stability
6. Nature of client base
7. Relationship with management

The Copeland Pricing Process

The basic contract is the same for both LTL and TL carriers. However, the specific negotiating techniques are different. In the case of TL traffic, price is negotiated on lines for which the carrier is strongest. The result is usually lower cost and higher service. On the other hand, LTL traffic is negotiated based on frequency and size of shipment organized locally or regionally. The competitive quoting process at Copeland is as follows:

1. Set service criteria and expectations
2. Prequalify eligible bidders
3. Communicate with qualified bidders (expectations, values, and objectives)
4. Set the rules of engagement
5. Analyze the RFQ responses
6. Select the best service provider
7. Award contract
8. Implement program

The carriers are cautioned to submit their best pricing package first. Copeland does not like to bargain. It seeks quick win-win solutions. Carriers who do not follow the appropriate guidelines are quickly eliminated from the selection process.

THE IMPACT OF THE NORTH AMERICAN FREE TRADE AGREEMENT (NAFTA) ON DOMESTIC TRANSPORTATION

LO 15.3 State the relationship of NAFTA to imports and exports between the United States and Canada and Mexico.

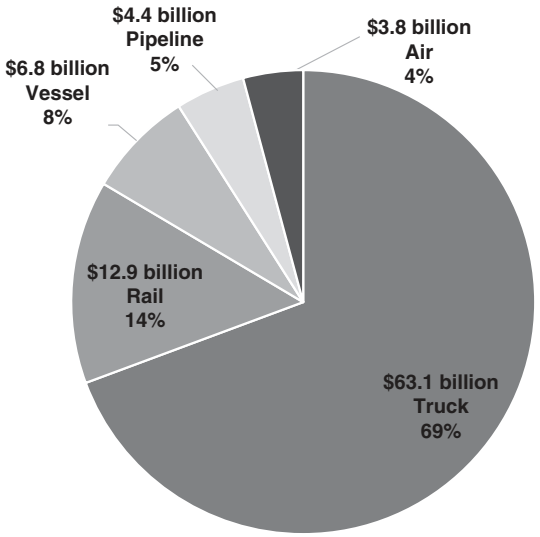
Canada and Mexico are second and third (behind China) in terms of trade with the United States. Surface transportation is substantial between the United States and its NAFTA partners. This is unlikely to change under the new U.S.–Mexico–Canada Agreement (USMCA), which was recently negotiated to replace NAFTA. As was seen in Chapter 10, imports and exports with both countries increased year-over-year from May 2017 to May 2018. **Surface transportation** includes freight movements by truck, rail, pipeline, mail, Foreign Trade Zones, and other modes of transport other than water and air. As can be seen in Figure 15.2, approximately 88% of trade with Canada and Mexico moved over land in January 2019. About 8% moved by vessel (i.e., water), and 4% moved by air.

Surface transportation Freight movements by truck, rail, pipeline, mail, Foreign Trade Zones, and other modes of transport other than water and air.

U.S. trade by surface transportation with Mexico has increased at a faster pace than trade with Canada. U.S.–Canada and U.S.–Mexico surface transportation trade in May 2019 both increased compared to the year prior. U.S.–Canada surface trade reached $45.86 billion, a 0.3% increase, while U.S.–Mexico surface trade reached $45.46 billion, a 5.9% increase. For trade statistics by transportation mode, see Table 15.1 for Canada and Table 15.8 for Mexico.

FIGURE 15.2

North American Freight by Mode, July 2012



Source: Bureau of Transportation Statistics, TransBorder Frieght Data

TABLE 15.8

U.S. Surface Transportation Trade With Mexico (Millions of Current U.S. Dollars)

Mode		May 2018	April 2019	May 2019	Percentage Change, April 2019–May 2019	Percentage Change, May 2018–May 2019
All surface modes	Imports	25,295	25,923	27,860	2.5%	10.1%
	Exports	18,560	17,839	18,598	−3.9	0.2
	Total	43,854	43,762	46,458	−0.2	5.9
Truck	Imports	21,508	21,317	23,081	−0.9	7.3
	Exports	15,455	14,945	15,483	−3.3	0.2
	Total	36,963	36,262	38,564	−1.9	4.3
Rail	Imports	3,775	4,597	4,774	21.8	26.5
	Exports	2,718	2,545	2,711	−6.4	−0.3
	Total	6,493	7,142	7,485	10.0	15.3
Pipeline	Imports	12	9	6	−24.2	−49.4
	Exports	386	349	404	−9.7	4.5
	Total	398	358	410	−10.2	2.9
Vessel	Imports	2,493	3,224	3,019	29.4	21.1
	Exports	2,442	2,722	2,370	11.5	−2.9
	Total	4,934	5,947	5,390	20.5	9.2
Air	Imports	638	575	530	−10.0	−16.9
	Exports	808	780	773	−3.5	−4.3
	Total	1,446	1,354	1,303	−6.4	−9.9

Source: BTS TransBorder Freight Data.

TABLE 15.9

Top Five Commodities Transported Between the United States and Canada by All Surface Modes of Transportation, May 2019 (Millions of Current U.S. Dollars)

Commodities	Exports	Imports	Total
Mineral fuels; oils and waxes	2,245	8,666	10,911
Vehicles other than railway	4,852	4,947	9,799
Computer-related machinery and parts	3,995	2,057	6,052
Electrical machinery; equipment and parts	2,043	640	2,683
Special classification provisions	890	1,593	2,483

Source: BTS TransBorder Freight Data.

TABLE 15.10

Top Five Commodities Transported Between the United States and Mexico by All Surface Modes of Transportation, May 2019 (Millions of Current U.S. Dollars)

Commodities	Exports	Imports	Total
Vehicles other than railway	2,035	9,011	11,046
Computer-related machinery and parts	4,146	6,101	10,247
Electrical machinery; equipment and parts	3,543	5,547	9,090
Mineral fuels; oils and waxes	2,610	1,096	3,706
Measuring and testing instruments	665	1,469	2,134

Source: BTS TransBorder Freight Data.

The top commodity category transported between the United States and Canada by surface modes of transportation in May 2019 was oil and gas, valued at nearly $11 billion (see Table 15.9). Trade in oil and gas moves across the border in both directions, with imports coming from western Canada and exports going to eastern Canada. The top commodity category transported between the United States and Mexico by surface modes of transportation in May 2019 was vehicles, with over $11 billion in trade (see Table 15.10). The top commodity transported between the United States and Mexico by surface modes of transportation in May 2019 was electrical machinery with $6.7 billion in trade (see Table 15.10).

SUMMARY

LO 15.1 Explain the trade-offs between cost, reliability, and speed in determining which mode of transportation to purchase.

Transportation is often the most costly and time-consuming component of purchasing management. Its planning is also critical in meeting manufacturing and customer delivery scheduling requirements. The management of the purchasing/transportation interface is complex and requires the buying organization to gain knowledge of basic transportation decision-making activities.

Each of the modes has specific operating and cost characteristics, and the buying professional must weigh them in selecting the most appropriate transportation

mode. The most basic selection decision is the trade-off between cost, reliability, and speed. The cost of shipment is usually tied to the speed of the mode. In certain situations when speed is critical, the cost of shipment becomes less important. The rail mode has the largest share of ton-miles in the United States. Most bulk commodities are initially shipped by rail and later shifted to motor carriers. Rail transportation is generally less expensive than air and truck modes. Rail cargo is usually shipped from terminal to terminal; therefore, flexibility is not an attribute. The primary products shipped via rail are lumber, iron, steel, coal, automobiles, grains, and chemicals.

LO 15.2 Compare purchasing examples in differing market segments.

We learned how three unique segments of the economy accomplish the purchasing of transportation services. Three company transportation executives were surveyed—Ross Labratories, Consolidated Stores, and Copeland Inc. The general consensus is that on-time delivery and price are the key competitive criteria.

LO 15.3 State the relationship of NAFTA to imports and exports between the United States and Canada and Mexico.

Canada and Mexico are second and third (behind China) in terms of trade with the United States. Surface transportation is substantial between the United States and its NAFTA partners. This is unlikely to change under the new U.S.–Mexico–Canada Agreement (USMCA), which was recently negotiated to replace NAFTA. U.S. trade by surface transportation with Mexico has increased at a faster pace than trade with Canada. U.S.–Canada and U.S.–Mexico surface transportation trade in May 2019 both increased compared to the year prior.

KEY TERMS

Bills of lading 371
Core carriers 367
F.O.B. 371
F.O.B. destination 371
F.O.B. origin 371
Less-than-truckload shipment 363
Surface transportation 374
Transportation 357
Truckload (TL) shipment 363

DISCUSSION QUESTIONS

1. What is transportation's role in purchasing?
2. List the alternative transportation modes. Give examples of each mode.
3. What transportation mode is most appropriate for shipping furniture from North Carolina to Texas? What is the most appropriate mode for shipping pharmaceuticals from Columbus, Ohio, to Los Angeles?
4. What are the important carrier selection criteria? What factors should be considered?
5. What factors are considered when rating freight? How are rate negotiations conducted?
6. Why is the negotiation process critical to purchasing transportation services?
7. What is meant by the term *third-party relationship*?
8. What is meant by freight terms?
9. What is a bill of lading?
10. What does F.O.B. mean?

SUGGESTED CASES

Case 23: Pendleton Construction, Inc.

Case 24: Philadelphia Aircraft Equipment, Inc.

16 Equipment Acquisition and Disposal

LEARNING OBJECTIVES

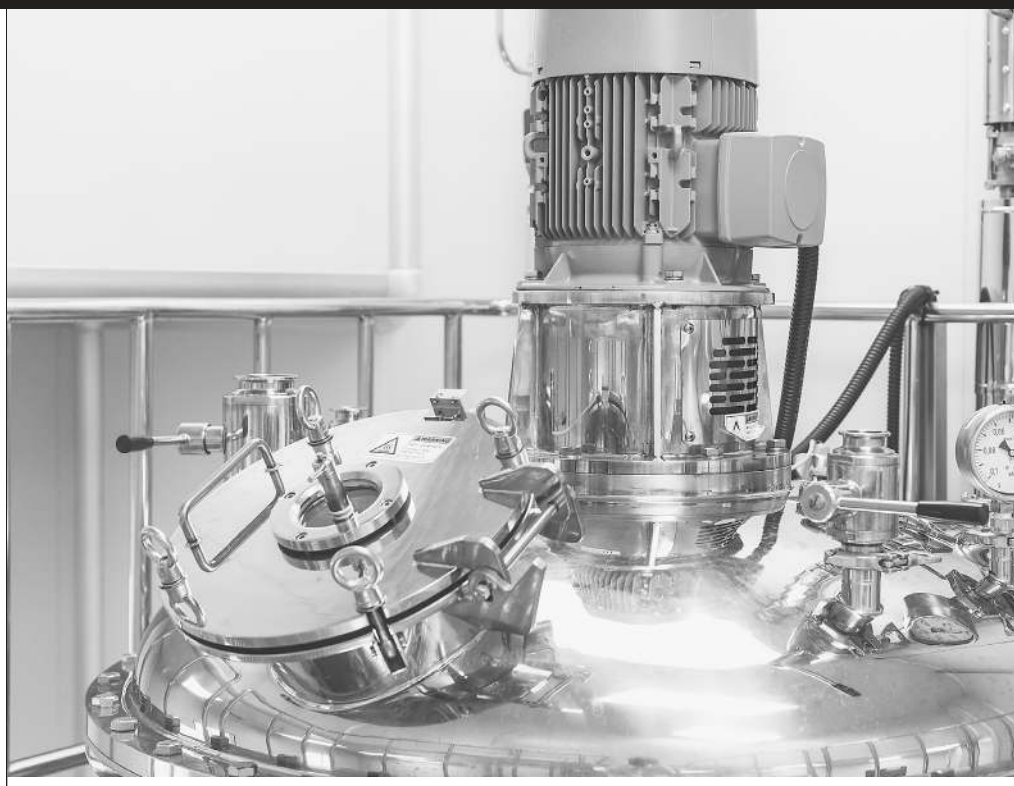
Upon completion of this chapter, the reader should be able to:

16.1 Explain the process involved in purchasing capital equipment including cash analysis and methods of economic evaluation.

16.2 Name some strategies currently used to dispose of capital equipment.

16.3 Discuss the advantages and disadvantages of purchasing new versus used equipment.

16.4 Demonstrate how to analyze a lease-versus-purchase decision.



Sean O'Bannon lost his foreman job in a manufacturing company. The company was a casualty of the COVID-19 pandemic. After carefully investigating several alternatives, Sean decided that the best course of action was to acquire a tri-axle dump truck and start a trucking company. According to Sean, the trucking business was recession proof because of the increased highway funding in Texas. The truck Sean selected has a useful life of 5 years and costs $120,000. City View Bank of Dallas is willing to loan Sean $100,000 at 5% interest and requires a down payment of $20,000 and annual payments of $20,762, which are due at the end of each of the next 5 years. The bank would require Sean to sign a 5-year maintenance contract with the dealership. The maintenance contract requires $5,000 payments at the end of each year. Sean was concerned about the down payment and the annual maintenance contract.

The truck dealership countered with a 3-year lease with an option to buy after 3 years for $36,000. The dealership structured the lease with a $35,299 payment due at the end of each year. The maintenance is included in the annual lease payment. Assume Sean will be able to work the truck for its entire life. Should Sean lease or borrow and purchase the truck?

.....

INTRODUCTION

The acquisition of capital equipment is a major decision in most firms. The capital acquisition decision has a significant effect on numerous aspects of the firm's financial health. The tax-planning process is also a significant component of this decision. Most high-value capital equipment purchases are usually processed at the vice president level and above. However, the purchasing professional serves a critical role in the acquisition process. In most large organizations, there is usually an expert equipment buyer with expertise in a particular industry. Most of the equipment costs are pegged to industry norms. Sometimes it is more cost-effective to buy the equipment at an auction than some of the more traditional sources. The purchasing department should be familiar with these sources and continuously look for opportunities.

The acquisition of capital equipment involves the allocation and commitment of funds. These investments usually require significant expenditures and are made with the expectation that the returns will be extended over several years. The timing of these capital acquisition decisions is critical to the financial health of a firm. However, once capital investment decisions are made, they are not easily reversible.

THE CAPITAL EQUIPMENT ACQUISITION PROCESS

LO 16.1 Explain the process involved in purchasing capital equipment including cash analysis and methods of economic evaluation.

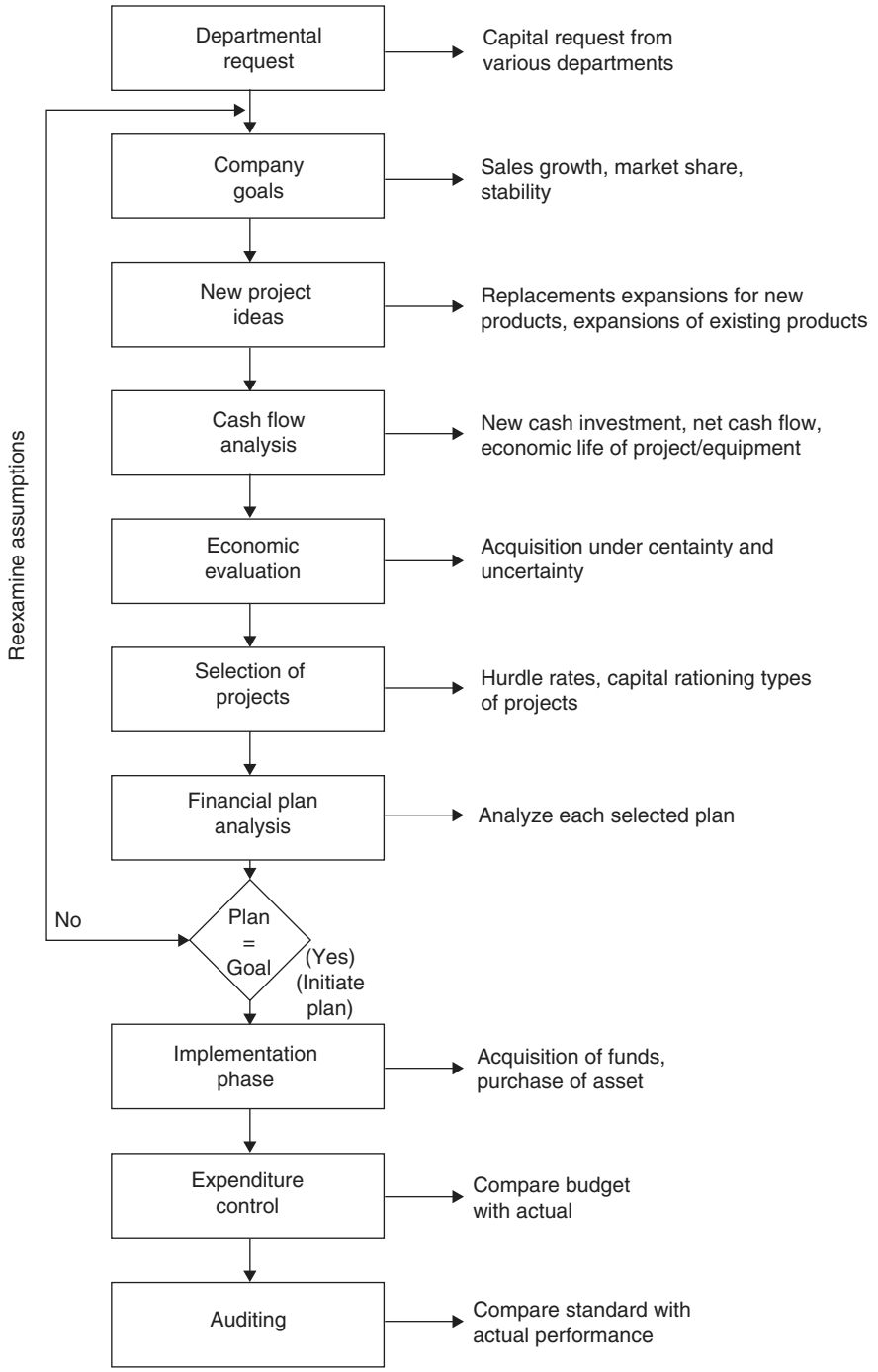
In Figure 16.1, a generic capital equipment acquisition process is presented. Depending on the industrial and economic environments, the process may be slightly altered. Long-term investment decisions are usually driven by the tax effect of acquiring equipment now rather than later. There are numerous steps in the acquisition process. Each cross-functional step is a subsystem of the entire process, which is closely related to a variety of other subsystems. A Department of Defense information technology example is given in Appendix A.

Department Requisition

The capital acquisition process is initiated with a department requesting equipment replacements and expansions. The request is then measured against the organization's goals. This step requires the authorization of the plant manager, the superintendent, or the executive in charge of the department.

The requisition process is sometimes initiated by a "wish list," low-cost projection, or special appropriation for major acquisitions. Sometimes firms place a monetary limit on acquisition that can be made without special approval. As an example, IBM places a limit of $25,000 for general acquisitions. Capital purchases in excess of $25,000 require the plant manager's or superintendent's approval. Typical policies might allow a department to purchase ventilators,

FIGURE 16.1
The Equipment Acquisition Process



computer hardware, or a compressor in the regular course of business, whereas a request for an automobile, tractor, or MRI machine would have to first be recommended by the plant manager, superintendent, or hospital administrator. This process has a built-in control mechanism.

Company Goals and Objectives

The next step in the process is to compare the acquisition request with the overall long-run objectives of the firm. These objectives will be the basis for evaluating proposals for new equipment and making selections. The objectives of the company are important because the purchase of any major equipment will probably affect the capacity and methods of the company for many years in the future. Company goals may be slightly different across organizations, but all *for-profit* organizations must eventually maximize profitability.

New Project Ideas

In any progressive firm, the various departments usually provide a continuous stream of attractive capital equipment opportunities. Each manager for the requesting department must spend many hours brainstorming, analyzing, and carefully planning for equipment needs. The classification of the various capital equipment requests must be based on certain common characteristics. Although equipment classification varies from company to company, capital projects are frequently grouped according to the following categories:

- Replacements
- Expansion (new products)
- Expansion (existing products)
- Other (heating system for plant)
- Other (new construction)
- Other (renovation)

The replacement of old equipment is usually motivated by a need to increase quality, reduce operating expense, and provide more efficiency. The company can easily do an in-depth cost savings and efficiency study. Companies on a growth pattern fueled by technology acquire new equipment to expand into a newly introduced product line. Investment in capital equipment for expansion purposes should increase incremental revenue. Sometimes firms are interested in expanding the output of existing product lines, which is usually an alternative to replacing the current equipment. Expanding existing equipment is also a way to increase output. The other categories of capital investment revolve around the plant, facilities, and construction. As an example, the capital acquisition process for construction projects must follow a well-designed process of specification, construction bid process, contractor selection, and the actual construction phase. This process is guided by well-defined planning and scheduling methods. The construction acquisition team usually includes personnel from engineering, finance, management, and purchasing. As can be seen, this is an excellent example of a cross-functional purchasing strategy.

Cash-Flow Analysis

If a capital equipment request survives the new project ideas step, cash-flow estimates must be considered for each capital investment idea. The after-tax cash inflows and outflows

of each capital project alternative must be evaluated on an incremental cash-flow basis. Three criteria should apply to the cash-flow analysis:

- The net cash investment
- The net cash flow
- The economic life of the project

In other words, we must consider net cash outlays and the total implementation costs. Net cash flows are net economic benefits generated by an investment project. The net incremental cash flows should be measured. The economic life of the project versus the physical life of the project also must be considered.

The U.S. Department of Defense uses a concept called "life cycle costing." Life cycle costing is a method used to evaluate alternative capital acquisitions based on the total cost of the equipment over the expected life of the product. The total cost components are given here:

1. Research
2. Development
3. Production
4. Operation
5. Maintenance

There are numerous testimonials regarding the use of life cycle costing for both capital equipment and systems acquisition. Consider a trucking firm that currently spends an average of $363 per month to maintain each vehicle. Recently the firm purchased 10 trucks by competitive bidding using the life cycle costing concept. The average monthly maintenance cost for the new trucks is $195 per unit for the life of the vehicles. The total operating costs also will have a significant effect on the capital acquisition. Productivity, dependability, and durability are the principal operating variables that must be investigated.

Economic Evaluation

With cash-flow data in hand, the company can begin the formal process of evaluating capital equipment or projects. The five most commonly used methods for an economic evaluation of individual projects are payback, average rate of return, net present value, internal rate of return, and profitability index. Each of these methods measures the financial performance of each of the capital projects. There should be a predetermined required rate of return. To illustrate the concept of economic evaluation, consider the following example.

Suppose a hospital considering investing in a new heart pump assumes the complete stream of estimated after-tax cash flows (EATCF) is as follows:

Year	0	1	2	3	4
EATCF ($)	–$100,000	$40,000	$40,000	$30,000	$30,000

These data will be used to illustrate the five economic evaluation criteria.

Payback

Payback is the best-known investment criterion. Payback is the number of years it takes to repay the initial investment. Using the previous example, we find the following:

Payback = $40,000 (Year 1) + $40,000 (Year 2) + $20,000 (0.67 of Year 3) = 2.67 years given that the cash flows are constant and positive.

Suppose the maximum payback period is set equal to 3 years. Then, in the example problem, the project is a candidate for acceptance. On the other hand, if the standard payback period was 2 years, the project would be rejected.

Average Rate of Return

The average rate of return is the average cash flow after tax divided by the initial investment:

Average rate of return = ARR (EATCF/Economic life)/Initial investment

ARR = [(40,000 + 40,000 + 30,000 + 30,000)/4]/100,000

= 35%

If ARR > the required ARR, accept project.

If ARR < the required ARR, reject project.

This method ignores timing of the cash flows. What if most of the $140,000 in the example problem was all lumped into one year? The ARR would still be 35%. The ARR is the most popular evaluation criterion used today.

Net Present Value

The net present value recognizes that a dollar today is worth more than a dollar tomorrow, simply because the dollar today can be invested to start earning interest immediately. Net present value (NPV) is concerned with netting the initial investment, which is negative, and the present value of the subsequent EATCF, most of which are usually positive.

$$\text{NPV} = \sum_{t=0}^{m} \frac{\text{EATCF}}{(1+k)^t}$$

where

k = Project's required rate of return

m = Number of periods

For the example problem

$$\text{NPV} = \sum -100{,}000 + \frac{40{,}000}{1+k} + \frac{40{,}000}{(1+k)^2} + \frac{30{,}000}{(1+k)^3} + \frac{30{,}000}{(1+k)^4}$$

Year	0	1	2	3	4
EATCF	<$100,000	$40,000	$40,000	$30,000	$30,000
Discount factor	1.000	0.909	0.826	0.751	0.583
Present value	–$100,000	$36,360	$33,040	$22,530	$20,490

$$k = 10\%$$

NPV = -$100,000 + $36,360 + $33,040 + $22,530 + $20,490 = $12,420

The investment decision is as follows:

If NPV > 0, accept project.

If NPV < 0, reject project.

Notice that the difference between the ARR and NPV methods is the timing of the various EATCF cash flows. In other words, if the EATCF increases, the project becomes increasingly more attractive.

Internal Rate of Return

The internal rate of return rule (IRR) is to accept the investment project if the opportunity cost of capital is less than the internal rate of return. If the cost of capital is equal to the IRR, the project has zero NPV. On the other hand, if the cost of capital is greater than the IRR, the project has a negative NPV. The IRR will give the same answer as the NPV. The IRR is defined as the discount rate that will make the NPV of the project equal zero.

$$\sum_{t=0}^{m} \frac{\text{EATCF}}{(1+\text{IRR})^t} = 0$$

As an example, find

$$\sum -100{,}000 + \frac{40{,}000}{(1+\text{IRR})^1} + \frac{40{,}000}{(1+\text{IRR})^2} + \frac{30{,}000}{(1+\text{IRR})^3} + \frac{30{,}000}{(1+\text{IRR})^4} = 0$$

For a discount rate of 20%, the NPV = -$7,060.

Using a trial-and-error approach, the IRR can be determined. If the EATCF was $40,000 for each of the 4 years, the IRR would be approximately 22%. Since the EATCF for the last 2 years is $30,000 per year, the discount rate should be decreased. We calculated a negative NPV of -$7,060 at a 20% discount rate; thus, we must lower the discount rate, say to 16%. At a 16% discount rate the NPV = $2.26 Thus, the IRR is approximately 16%.

If IRR > k, accept project.

If IRR < k, reject project.

where

k = Project's required rate of return

m = Number of periods

If it is assumed that the cost of capital is 10%, the project will be accepted.

Profitability Index

The profitability index (PI) is defined as the present value of future flows divided by the initial investment:

$$\text{PI} = \left[\sum_{t=1}^{m} \frac{\text{EATCF}_t}{(1+k)^t}\right] \Big/ \text{Initial investment}$$

Since the future cash flows are typically positive,

$$\begin{aligned}\text{PI} &= \left[\frac{40,000}{1.10} + \frac{40,000}{(1.10)^2} + \frac{30,000}{(1.10)^3} + \frac{40,000}{(1.10)^4}\right] \Big/ 100,000 \\ &= (36,360 + 33,040 + 22,530 + 20,490) / 100,000 \\ &= 110,243 / 100,000 = 1.12\end{aligned}$$

The decision rule is as follows:

If PI >1, accept project (*ceteris paribus*).

If PI <1, reject the project (*ceteris paribus*).

Like the NPV and IRR methods, the PI method accounts for timing.

Selection of Projects

The final selection is usually based on the accept-reject decision. The **hurdle rate** may be based on the cost of capital, the opportunity cost, and other conceptual standards. As in any case, each proposal must compete for limited funds. The evaluations discussed earlier are summarized in Figure 16.2.

Hurdle rate The minimum rate of return on a project or investment required by a manager.

Financial Plan Analysis

At this stage, a comprehensive comparison of the selected alternatives is performed. The planned project selections are then measured against the initial company goals and objectives. Capital equipment acquisitions can be financed in a variety of ways. For the purpose of the purchasing professional, two methods are considered: traditional loans and leases. The leasing method has become very popular in the last 20 years and can be used to finance nearly any kind of fixed asset. The lease-versus-purchase decision usually requires many considerations. Some of these considerations are listed here.

FIGURE 16.2
Capital Acquisition Evaluation Methods

Method	Good Features	Bad Features
payback	Easily understood Easy to calculate Provides a crude risk screen	Doesn't account for the time value of money of prepayback cash flows Completely ignores past-payback cash flow
ARR	Easily understood Easy to calculate Considers past-payback cash flow	Doesn't account for the time value of money of prepayback cash flows
NPV	Relatively easy to calculate Best method for mutually exclusive ranking problems Tied for the best method for accept-reject decision problems(with P)	Hard to understood May not work well in capital rationing problems
IRR	Easily understood Easy to calculate Works okay on simple accept-reject problems Tied for best method for accept-reject decision problem(with NPV)	Can be tedious to calculate May not work well on nonsimple accept-reject, problems(multiple rates), mutually exclusive choices, or capital rationing problems
PI	Relatively easy to calculate Best method for one-period capital rationing problems Tied for best method for accept-reject decision problem(with NPV)	Hard to understand May not work well in some mutually exclusive choice situations

- *Tax effect.* Lease payments are expenses that can be written off against income immediately. Loans are depreciated over a longer period of time. One major advantage of leases over loans is the impact leases have on land use. When a firm leases land for its operations, it can easily deduct the lease expense from the income burden. Purchased land, on the other hand, cannot be deducted from tax obligations.
- *Effects on future financing.* Leasing versus purchasing also can free up cash needed for other purposes or alternative projects. There is also a positive balance sheet effect of leasing simply because the lease is not considered a debt or an asset. A leasing arrangement can actually increase a firm's borrowing capacity. Most loans require the borrower to place a reasonable down payment. Leases generally do not require an initial down payment, beyond the first and last monthly payments.
- *Risk of obsolescence.* In the case of fast-moving technology, it is possible for the lessee to shift the risk level to the lessor. Technology-focused medical equipment is a good example of the risk of obsolescence.
- *Salvage value.* The lessor is responsible for the salvage value of the leased assets. If expected salvage value is high for leased equipment, the cost of ownership to the lessee may be lower. In this case, the lessee should write a contract that will enable it to buy the fixed asset at the end of the lease term.

- *Maintenance.* In most lease agreements, the responsibilities and risks for each party are spelled out in detail. If the lessor assumes the costs of maintenance, insurance, and taxes, it will usually pass the expense to the lessee in the form of increased lease payments.
- *Discount rate.* The after-tax borrowing rate is commonly known as the discount rate. Both leasing and buying involve cash outflow over an extended period. Since the lease payment is fixed and other costs associated with the lease (salvage value, operating expenses, and interest rates) are highly uncertain, it is important to evaluate the implicit interest rate for a lease-versus-buy decision.

Equipment Leasing

The lessor (owner) receives a series of monthly, semiannual, or annual payments from a lessee who promises to pay for the use of a specific piece of capital equipment. When the lease period ends, the leased equipment goes back to the lessor. However, the lease agreement does in most cases give the lessee (equipment user) the option to purchase the equipment for or initiate a new lease. *Operating leases* are short-term leases that can be cancelled during the contract period. Operating leases make it possible for a company to use assets such as computers, company vehicles, and furniture. The lease term is usually shorter than the life of the asset.

On the other hand, **capital leases** cannot be cancelled during the lease period without a significant penalty. *Financial leases* represent a source of financing for companies that require positive cash flows during the lease period. It is like borrowing money from the bank. The lessee is legally bound to making the payments specified in the lease agreement. Thus, the decision is whether to lease, borrow, or buy the equipment in question.

Capital leases A type of lease that cannot be cancelled during the lease period without a significant penalty.

Lease Versus Borrow and Purchase

The lease-versus-buy decision can be made quickly for some companies. There is a tax advantage if the leasing company has a high tax liability; thus, buying equipment and leasing it to contractors is a profitable business. Since the equipment still must be used on construction projects, the company leases the equipment it owns to contractors. A detailed step-by-step tutorial on the lease-versus-purchase decision is presented later in the chapter.

Implementation

The implementation stage is the process in which companies encumber funds for accepted projects. The approval process usually ends with the board of trustees. This stage in the process is basically a rubber stamp.

Expenditure Control

The time between approval of the capital and completion of the acquisition is the critical scheduling stage. At this stage, the project should stay within budget, and corrective action should be taken if the budget is violated.

Auditing

The capital acquisition process is complex and leads to many assumptions and estimates. The entire project should be audited to analyze the differences. The audit stage also will

identify mismanagement and flaws in the process. If the process has been unsatisfactory, it should be revised or replaced.

DISPOSAL OF CAPITAL EQUIPMENT

LO 16.2 Name some strategies currently used to dispose of capital equipment.

The disposal of capital equipment is becoming more complicated. The Environmental Protection Agency has developed specific guidelines for disposing of specific types of obsolete equipment. The purchasing function is usually charged with the task of scrapping or selling retired equipment. In some cases, the business is able to trade in the obsolete equipment for new purchases. This clearly transfers the burden to the vendor. If the equipment is usable, there may be an active dealer that may purchase the used equipment. In general, most firms have not yet designed a clean process for the disposal of used equipment.

PURCHASING NEW VERSUS USED CAPITAL EQUIPMENT

LO 16.3 Discuss the advantages and disadvantages of purchasing new versus used equipment.

Despite today's competitive markets, it may not be cost-effective to procure new equipment. Depending on the purpose and expected use of the purchased equipment, it may be more cost-effective to buy used equipment. In this section, the guidelines for purchasing new versus used equipment are established.

New Equipment Purchases

When a company buys new equipment, there is no uncertainty regarding the conformance to stated specifications. The buying firm must first determine the number of hours per year the equipment will be employed. The buyer must be careful to pay close attention to the theoretical usage levels of certain equipment. As an example, the life expectancy of construction equipment is easy to predict given the normal operating conditions. Most construction equipment is usually purchased new. In cases where significant demand or uses already exist for a particular piece of equipment, the purchase of new equipment is appropriate. The technological advantages of new equipment also may increase productivity in these situations. In the case of computers, copiers, and other high-tech products, it may be more cost-effective to purchase new equipment. However, if an older model is adequate for the expected use, significant savings could occur.

Remember, new equipment requires less maintenance than used equipment. This is perhaps the strongest argument for considering only new equipment. As an example, after a backhoe is used for more than 10,000 hours, a new $10,000 bucket is usually required. The maintenance record must be considered when deciding to buy used equipment.

Specifications must be carefully considered when purchasing major equipment. It is an easy task to compare new equipment. It is next to impossible to compare different models of used equipment. Sometimes low equipment prices may lead to purchasing equipment that is ready to be scrapped. However, if the used equipment dealer is willing to give you a reasonable warranty and other guarantees, purchasing a specified piece of equipment may be justified.

Used Equipment Purchases

Low cost is usually the only reason to buy used equipment. The determination of the true value of used equipment is extremely difficult. A review of the historical maintenance record should be the first step in the acquisition of used equipment. In some cases, used equipment may provide a good short-term solution to a company's production problems. The buying company also must consider the trade-off between long-term financing costs and short-term maintenance costs. In this case, financial efficiency is more important than maintenance costs. Thorough inspection *must* be performed when buying used equipment. As we all know, used car dealers are experts when it comes to cleaning and painting severely damaged vehicles. Some used equipment dealers will do whatever it takes to mislead an unsuspecting buyer. The selling terms are usually "as is" and net cash with no warranty.

Refurbishing Used Medical Equipment

The market for refurbished medical digital imaging equipment is at a high growth stage. With growth rates in the 7% to 8% ranges, the four main OEMs (Philips, Siemens, GE, and Toshiba) as well as third-party brokers have developed their refurbishing capabilities. After-sales service contracts for refurbished equipment are important to attract customers. OEMs, which each provide the service contracts, therefore have a competitive edge over the third-party brokers. Examples of digital imaging equipment that is refurbished include X-ray equipment and computed tomography (CT), positron emission tomography (PET), magnetic resonance imaging (MRI), and ultrasound scanners. Private-sector and small-sized hospitals are typically the major buyers of refurbished equipment. Some of the drivers of the increased demand for refurbished equipment include the increased number of procedures prescribed by hospital physicians, an increase in the number of private health care organizations, and the financial recession and the associated increased pressure to reduce cost. According to the OEMs we interviewed during the field study, on average the selling price of OEM-refurbished equipment is about 20% less than the price of comparable new equipment. Refurbishing can be categorized in two groups: (1) complete electromechanical refurbishing and (2) cosmetic refurbishing. Third-party brokers typically do not perform electromechanical refurbishing. During interviews with representatives from the four OEMs of digital imaging equipment (Philips, Siemens, GE, and Toshiba), cosmetic refurbishing was several times popularly referred to as "spray and pray." Each of the OEMs interviewed during the field study indicated that their firm performs the complete electromechanical refurbishing, coupled with the offering of service contracts.

LEASE VERSUS BORROW-AND-PURCHASE EXAMPLE

LO 16.4 Demonstrate how to analyze a lease-versus-purchase decision.

When does it make more sense to buy equipment? When does it make more sense to lease? As an example, in the construction industry, the lease-or-own decision is routine when acquiring new and used equipment.

The lease-versus-buy decision can be made quickly for some companies. There is a tax advantage if the leasing company has a high tax liability; thus, buying equipment and leasing it to contractors is a profitable business. Since the equipment still must be used in the construction industry, the company leases the equipment it owns to contractors.

On the other hand, many contractors have higher after-tax costs for buying capital equipment than those faced by the leasing company, allowing the leasing company to pass some of its savings on to contractors and still make a profit. The contractor must then decide whether the savings from leasing are economically attractive. The following lease-versus-buy method can be used to compare (1) the purchase price and lease payments, (2) income tax effects, and (3) present values.

The following example shows how to use these steps. A trucking contractor has two choices: (1) buy a new tri-axle dump truck or (2) lease it for 3 years. The dump truck has a useful life of 5 years and costs $100,000. The Helpful Bank is willing to loan the contractor $88,000 at 6% interest and requires a down payment of $12,000 and annual payments of $20,891, which are due at the end of each of the next 5 years. Since the contractor does not have the proper facilities, the bank will require the contractor to sign a maintenance contract with ACME Mack Trucks. The contract, good for 5 years of maintenance, requires annual payments of $5,000. ACME made the contractor a proposal that competes with the bank's offer. ACME is willing to lease the contractor the same dump truck for 3 years. Since the contractor's cash situation is very tight, ACME structured the lease with the $30,917 payment due at the end of each year. In addition, ACME agreed to

- Perform all of the maintenance during the lease period.
- Give the contractor the right to purchase the dump truck at the end of 3 years for the prevailing market price (estimated to be $35,000).
- Allow the contractor to buy a maintenance contract for 2 years on the dump truck for $6,000 annually, paid at the end of Years 4 and 5.

Step 1: Comparing Purchase Price and Lease Payments

The first step in a lease-versus-buy analysis is listing the purchase price and lease payments.

	Buy	Lease
Today	$12,000	
1 year from today	$20,891	$30,917
2 years from today	$20,891	$30,917
3 years from today	$20,891	$30,917
4 years from today	$20,891	—
5 years from today	$20,891	—

The Today row in the example shows that purchased equipment must be paid for on delivery. This payment may be from cash reserves or from money borrowed from a lending agency, but it must be paid to the bank upfront. The first lease payment, at least in this example, also is shown as one year from today. The purchase option must include interest payments, depreciation, and maintenance expense that also must be paid by the contractor. ACME assumes these costs for the first 3 years of the lease option. At the end of Year 3, a final payment of $35,000 is made to ACME.

Step 2: Comparing Income Tax Effect

One of the most important economic differences between leasing and buying equipment is the way each is treated for income tax purposes. Since the value of these tax benefits varies greatly among individuals and corporations, it is important to calculate potential tax benefits individually.

How much will a tax deduction reduce taxes owed? That depends on the marginal tax rate. The marginal tax rate is how much of each additional dollar earned must be paid as income taxes. Individuals or corporations with high incomes may have marginal tax rates of 35% or more, while those losing money will have tax rates of 0%.

The higher the marginal tax rate, the more a tax deduction is worth. The value of a tax deduction is determined by multiplying it by the tax rate. Using this rule, a $10,000 tax deduction is worth nothing if the tax rate is 0%, $1,500 at 15%, and $2,800 at 28%.

The situation is relatively simple with leases. Each lease payment is a tax deduction for the company leasing the equipment. Its value can be determined by multiplying the marginal tax rate by the lease payment.

If the buy option is chosen, **depreciation** on a tractor must be taken over a 5-year period. Both straight-line and accelerated methods are possible, and either can have its advantages depending on the contractor's tax situation. In this example, straight-line depreciation of $20,000 for each of 5 years is used. The example contractor has a 40% tax rate, so the tax savings will be

Depreciation: The reduction of the value of an asset with the passage of time.

$$\text{Tax savings} = 40\% \times (\text{Interest payment} + \text{Depreciation} + \text{Maintenance})$$

If the lease option is chosen, the tax savings would be calculated as follows:

$$\text{Tax savings (Years 1–3)} = 40\% \times \text{Lease payment}$$

$$\text{Tax savings (Years 4 and 5)} = 40\% \times (\text{Lease payment} + \text{Depreciation, Maintenance})$$

The table from Step 1 can now be rewritten to include taxes, as shown here.

	Tax Deduction Expense	
	Buying Option	**Leasing Option**
Today		
1 year from today	$30,280	$30,917
2 years from today	$29,343	$30,917
3 years from today	$28,350	$30,917
4 years from today	$27,298	$23,500
5 years from today	$26,183	$23,500

Step 3: Comparing Present Values

The after-tax values of the leasing and buying costs have been considered, but the time at which these costs are incurred has not been taken into account. Ignoring their timing can lead to an incorrect decision because money has a time value. Time value is evident every time money is invested for a period of time to earn interest or borrowed for a period of time in exchange for interest payments.

Present value factor: A formula used to estimate the current worth of a sum of money that is to be received at some future date.

The time value of money affects leasing or buying because the further into the future a cost comes due, the less of today's dollars it will take to repay it. How many of today's dollars it will take to pay a cost due in the future depends on the level of interest rates. Interest rates are used to choose **present value factors**, which are, in turn, used to convert future costs into today's dollars. A future cost, expressed in terms of today's dollars, is called a present value. The interest rate chosen is either that at which money can be borrowed or that at which money can be invested.

In the case of the contractor, a 6% rate is used. The present value factor table is used to find the *present value* factors for today through 5 years from today. The contractor must now multiply the present value factors ($PV = 1/(1 + k)^t$) by the net cash outflows.

Net Cash Outflows for Buying Option

			Factor*	Present Value
			$(PV = 1/(1 + k)^t)$	
Today	$12,000	x	1.0	$12,000
1 year from today	$13,779	x	0.94	$12,952
2 years from today	$14,154	x	0.89	$12,597
3 years from today	$14,551	x	0.84	$12,223
4 years from today	$14,972	x	0.79	$11,828
5 years from today	$15,418	x	0.74	$11,409
Total present value cost				**$73,009**

*The discount factors for a 6% interest rate per year are given in Appendix B.

The contractor then uses the same discount factors to find the present value of the after-tax costs of leasing.

Net Cash Flows for Leasing Option

			Factor	Present Value
Today	0	x	1.0	$0
1 year from today	$18,550	x	0.94	17,437
2 years from today	$18,550	x	0.89	$16,510
3 years from today	$18,550	x	0.84	$15,582
3 years from today	$35,000	x	0.84	$29,400
4 years from today	$3,400	x	0.79	($2,686)
5 years from today	$3,400	x	0.74	($2,516)
Total present value cost				**$73,727**

The completed analysis is given in Figure 16.3.

FIGURE 16.3

Solution for Lease Versus Borrow-and-Purchase Example

Tax Rate (TR) = 0.4
Discount Rate = 0.06
Interest Rate = 0.06
Lease Rate = 0.06

Borrow and Purchase

Year	Payment (1)	Interest (2)	Reduction (3)	Principal (4)	Depreciation (5)	Maintenance (6)	Tax-Deductible Expense (7) = 2 + 5 + 6	Savings (8) = 7 * TR	Net Cash Outflow (9) = 1 + 6 - 8	Present Value Factor (10)	Present Value of Purchase (11) = 9 * 10
				$100,000							
Today	$12,000		$12,000	$88,000					$12,000	1	$12,000
1	$20,891	$5,280	$15,611	$72,389	$20,000	$5,000	$30,280	$12,112	$13,779	0.94	$12,952
2	$20,891	$4,343	$16,548	$55,841	$20,000	$5,000	$29,343	$11,737	$14,154	0.89	$12,597
3	$20,891	$3,350	$17,541	$38,301	$20,000	$5,000	$28,350	$11,340	$14,551	0.84	$12,223
4	$20,891	$2,298	$18,593	$19,708	$20,000	$5,000	$27,298	$10,919	$14,972	0.79	$11,828
5	$20,891	$1,182	$19,709	-$1	$20,000	$5,000	$26,182	$10,473	$15,418	0.74	$11,409
Totals	**$116,455**	**$16,454**	**$100,000**		**$100,000**	**$25,000**	**$141,454**				**$73,009**

Lease

Year	Payment (1)	Interest (2)	Reduction (3)	Principal (4)	Depreciation (5)	Maintenance (6)	Tax-Deductible Expense (7) = 2 + 5 + 6	Savings (8) = 7 * TR	Net Cash flow (9) = 1 + 6 - 8	Present Value Factor (10)	Present Value of Purchase (11) = 9 * 10
1	$30,917						$30,917	$12,367	$18,550	0.94	$17,437
2	$30,917						$30,917	$12,367	$18,550	0.89	$16,510
3	$30,917						$30,917	$12,367	$18,550	0.84	$15,582
End of 3	$35,000								$35,000	0.84	$29,400
4	$0				$17,500	$6,000	$23,500	$9,400	-$3,400	0.79	-$2,686
5	$0				$17,500	$6,000	$23,500	$9,400	-$3,400	0.74	-$2,516
Totals	**$127,751**				**$35,000**	**$12,000**	**$139,751**				**$73,727**

Conclusion

The borrow purchase option is slightly better ($718 = $73,727-$73,009) than the lease option. However, it is easy to see that both options are not significantly different. The three-step method remains valid, but legal and accounting advice must be added to any economic analysis before making a decision on leasing or buying capital equipment.

SUMMARY

LO 16.1 Explain the process involved in purchasing capital equipment including cash analysis and methods of economic evaluation.

Long-term investment decisions are usually driven by the tax effect of acquiring equipment now rather than later. There are numerous steps in the acquisition process. Each cross-functional step is a subsystem of the entire process, which is closely related to a variety of other subsystems. If a capital equipment request survives the new project ideas step, cash-flow estimates must be considered for each capital investment idea. Three criteria should apply to the cash-flow analysis: the net cash investment, the net cash flow, and the economic life of the project. The five most commonly used methods for an economic evaluation of individual projects are payback, average rate of return, net present value, internal rate of return, and profitability index.

LO 16.2 Name some strategies currently used to dispose of capital equipment.

The disposal of capital equipment is becoming more complicated. The Environmental Protection Agency has developed specific guidelines for disposing of specific types of obsolete equipment. The purchasing function is usually charged with the task of scrapping or selling retired equipment. In some cases, the business is able to trade in the obsolete equipment for new purchases.

LO 16.3 Discuss the advantages and disadvantages of purchasing new versus used equipment.

Depending on the purpose and expected use of the purchased equipment, it may be more cost-effective to buy used equipment. When a company buys new equipment, there is no uncertainty regarding the conformance to stated specifications. The buying firm must first determine the number of hours per year the equipment will be employed. The buyer must be careful to pay close attention to the theoretical usage levels of certain equipment.

LO 16.4 Demonstrate how to analyze a lease-versus-purchase decision.

There is a tax advantage if the leasing company has a high tax liability; thus, buying equipment and leasing it to contractors is a profitable business. On the other hand, many contractors have higher after-tax costs for buying capital equipment than those faced by the leasing company, allowing the leasing company to pass some of its savings on to contractors and still make a profit. The lease-versus-buy method can be used to compare (1) the purchase price and lease payments, (2) income tax effects, and (3) present values.

KEY TERMS

Capital leases 387
Depreciation 391
Hurdle rate 385
Present value factor 392

DISCUSSION QUESTIONS

1. What role does purchasing play in capital equipment purchasing?
2. Discuss the various steps in the capital equipment acquisition process.
3. Explain the concepts underlying (a) payback analysis, (b) average rate of return, (c) NET present value, (d) internal rate of return, and (e) profitability indexes.

4. Discuss the reasons why a company may want to invest in new equipment instead of used equipment.
5. What are the advantages and disadvantages of leasing as a financing option?
6. What are the evaluation criteria for the lease-versus-buy decision?

SUGGESTED CASES

Case 17: McGruder Pavers, Inc.

Case 22: Natural Construction, Inc.

Case 26: Sage Imaging Center, Inc.

EXERCISES

1. The SBX Construction Company is considering an investment of $50,000 for a horizontal boring machine. There is no increase in working capital requirements and no tax credits. Depreciation is straight line and the salvage value is zero. The tax rate is 40% and the required IRR is 15%. Cash operating costs are $10,000 a year. Cash operating revenues are $30,000 per year. The estimated life of the boring machine is 5 years.
   a. Determine the EATCF stream.
   b. Determine NPV at 10% for the equipment investment.
   c. Determine the IRR for the investment.
   d. Is the boring machine a desirable investment? Explain your answer in a memo to the project manager.

2. Calculate the payback period for the following projects. If the cut-off period is 3 years, which projects do you accept?

Project	Cash Flow Year 1	Cash Flow Year 2	Cash Flow Year 3	Cash Flow Year 4
A	$-10,000	$4,000	$3,000	$5,000
B	$-45,000	$10,000	$15,000	$20,000
C	$-25,000	$2,000	$8,000	$14,000
D	$100,000	$50,000	$55,000	$20,000

3. What is the payback period on each of the following projects?
   a. Given that you wish to use the payback rule with a cutoff period of 2 years, which projects would you accept?
   b. If the opportunity cost of capital is 10%, which projects have positive NPVs?

Cash Flows ($)					
Project	**C0**	**C1**	**C2**	**C3**	**C4**
A	–36,000	+10,000	+10,000	+30,000	0
B	–10,000	0	+10,000	+20,000	+30,000
C	–40,000	+10,000	+10,000	+30,000	+50,000

4. Calculate the net present value of the following project for discount rates of 0%, 50%, and 100%.

   What is the IRR for the project?

Cash Flow ($)		
Year 1	**Year 2**	**Year 3**
–10,645	3,670	16,302

5. The Morningside Hospital has the following investment opportunities, but only $100,000 available for investment. Which projects should it take?

Project	NPV	Investment
1	10,000	20,000
2	15,000	15,000
3	20,000	100,000
4	25,000	70,000
5	25,000	85,000
6	13,000	25,000

6. The Tremont Company has received a proposal for a 4-year financial lease. The cash flows are given in the table below:

Year	0	1	2	3
Lease cash flow	+82,000	−36,800	−28,200	−7,600

These flows reflect the cost of the machine, depreciation tax shield, and the after-tax lease payments. Ignore salvage value. Assume the firm could borrow at 10% and faces a 35% marginal tax rate.

   a. What is the value of the equivalent loan?
   b. What is the value of the lease?
   c. Suppose the machine's NPV under normal financing is $5,000. Should Tremont invest? Should Tremont sign the lease?

7. Net present value. Campbell Industries has a project with the following projected cash flows:

   Initial Cost, Year 0: $468,000

   Cash Flow Year 1: $135,000

   Cash Flow Year 2: $240,000

   Cash Flow Year 3: $185,000

   Cash Flow Year 4: $135,000

   a. Using an 8% discount rate for this project and the NPV model, should this project be accepted or rejected?
   b. Using a 14% discount rate?
   c. Using a 20% discount rate?

8. Profitability index. Given the discount rates and the future cash flows of each project, which projects should they accept using profitability index?

Cash Flows	Project A	Project B	Project C	Project D
Year 0	−$2,000,000	−$2,500,000	−$2,400,000	−$1,750,000
Year 1	$500,000	$600,000	$1,000,000	$300,000
Year 2	$500,000	$600,000	$800,000	$500,000
Year 3	$500,000	$600,000	$600,000	$700,000
Year 4	$500,000	$600,000	$400,000	$900,000
Discount rate	6%	9%	15%	10%

APPENDIX A: FEDERAL ACQUISITION REGULATION; ELECTRONIC AND INFORMATION TECHNOLOGY[1]

DEPARTMENT OF DEFENSE
GENERAL SERVICES ADMINISTRATION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION 48 CFR Parts 2, 7, 10, 11, 12, and 39 [FAC 97-27; FAR Case 1999-607]
RIN 9000-AI69

Federal Acquisition Regulation; Electronic and Information Technology Accessibility

AGENCIES: Department of Defense (DOD), General Services Administration (GSA), and National Aeronautics and Space Administration (NASA).

ACTION: Final rule.

[1] As published in *Federal Register* 66, no. 80 (April 25, 2020), pp. 20894–20896.

Summary

The Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) have agreed on a final rule amending the Federal Acquisition Regulation (FAR) to implement Section 508 of the Rehabilitation Act of 1973. Subsection 508(a)(3) requires the FAR to be revised to incorporate standards developed by the Architectural and Transportation Barriers Compliance Board (also referred to as the "Access Board").

DATES: *Effective Date:* June 25, 2020.

Applicability Date: For other than indefinite-quantity contracts, this amendment applies to contracts awarded on or after the effective date. For indefinite-quantity contracts, it is applicable to delivery orders or task orders issued on or after the effective date.

FOR FURTHER INFORMATION CONTACT: The FAR Secretariat, Room 4035, GS Building, Washington, DC 20405, (202) 501-4755, for information pertaining to status or publication schedules. For clarification of content, contact Ms. Linda Nelson, Procurement Analyst, at (202) 501-1900. Please cite FAC 97-27, FAR case 1999-607.

Supplementary Information

A. Background

The Workforce Investment Act of 1998, Public Law 105-220, was enacted on August 7, 1998. Title IV of the Act is the Rehabilitation Act Amendments of 1998. Subsection 408(b) amended section 508 of the Rehabilitation Act of 1973 (29 U.S.C. 794d). Subsection 508(a)(1) requires that when Federal departments or agencies develop, procure, maintain, or use Electronic and Information Technology (EIT), they must ensure that the EIT allows Federal employees with disabilities to have access to and use of information and data that is comparable to the access to and use of information and data by other Federal employees. Section 508 also requires that individuals with disabilities, who are members of the public seeking information or services from a Federal department or agency, have access to and use of information and data that is comparable to that provided to the public without disabilities. Comparable access is not required if it would impose an undue burden.

Subsection 508(a)(2)(A) required the Access Board to publish standards setting forth a definition of BIT and the technical and functional performance criteria necessary for accessibility for such technology by February 7, 2000. Subsection 508(a)(3) required the Federal Acquisition Regulatory Council to revise the FAR to incorporate the Access Board's standards not later than 6 months after the Access Board regulations were published. The Access Board published the final standards in the *Federal Register* at 65 FR 80500, December 21, 2000.

A proposed rule to amend the FAR was published in the *Federal Register* at 66 FR 7166, January 22, 2001. The 60-day comment period ended March 23, 2020.

This final rule implements the Access Board's regulations by—

- Including the definition of the term "electronic and information technology," a term created by the statute;
- Incorporating the EIT Standards in acquisition planning, market research, and when describing agency needs; and
- Adding a new Subpart 39.2.

Applicability

The proposed rule did not address the issue of whether the new rule would apply to contracts already in existence. A number of public commenters asked for clarification about the applicability of the rule.

For other than indefinite-quantity contracts, this amendment applies to contracts awarded on or after the effective date. For indefinite-quantity contracts, it is applicable to delivery orders or task orders issued on or after the effective date. Indefinite quantity contracts may include Federal Supply Schedule contracts, government wide acquisition contracts (GWACs), multi-agency contracts (MACs), and other interagency acquisitions. Exception determinations are not required for award of the underlying

indefinite-quantity contracts, except for requirements that are to be satisfied by initial award. Indefinite-quantity contracts may include noncompliant items, provided that any task or delivery order issued for noncompliant EIT meets an applicable exception. Accordingly, requiring activities must ensure compliance with the EIT accessibility standards at 36 CFR part 1194 (or that an exception applies) at time of issuance of task or delivery orders.

Contracting offices that award indefinite-quantity contracts must indicate to ordering offices which supplies and services the contractor indicates as compliant, and show where full details of compliance can be found (e.g., vendor's or other exact web page location).

The Access Board's EIT standards at 36 CFR part 1194 do not apply to—

- Taking delivery for items ordered prior to the effective date of this rule;
- Within-scope modifications of contracts awarded before the effective date of this rule;
- Exercising unilateral options for contracts awarded before the effective date of this rule; or
- Multiyear contracts awarded before the effective date of this rule.

Exceptions

Unless an exception at FAR 39.204 applies, acquisitions of EIT supplies and services must meet the applicable accessibility standards at 36 CFR part 1194. The exceptions in 39.204 include—

- Micro-purchases, prior to January 1, 2003. However, for micro-purchases, contracting officers and other individuals designated in accordance with 1.603-3 are strongly encouraged to comply with the applicable accessibility standards to the maximum extent practicable;
- EIT for a national security system;
- EIT acquired by a contractor incidental to a contract;
- EIT located in spaces frequented only by service personnel for maintenance, repair or occasional monitoring of equipment; and
- EIT that would impose an undue burden on the agency.

Micro-Purchases

The exception for micro-purchases was in the proposed rule. It was made in recognition of the fact that almost all micro-purchases are made using the government-wide commercial purchase card. Government personnel, who are not warranted contracting officers, use the purchase card to purchase commercial-off-the-shelf items. Use of the purchase card makes it generally impractical to comply with the EIT accessibility standards unless commercial-off-the-shelf products are labeled for standards compliance. Manufacturers are continuing to develop products that comply with the EIT accessibility standards. It is expected that almost all products will comply with the standards within the next two years, and be labeled by the manufacturer accordingly. Therefore, we have established a sunset date of January 1, 2003, for the micro-purchase exemption. Prior to that date, the Government will revisit the state of technology and the pace at which manufacturers have conformed to the required standards.

The micro-purchase exception does not exempt all products that cost under $2,500. Some commenters were confused about this. The exception is for a one-time purchase that totals $2,500 or less, made on the open market rather than under an existing contract. A software package that costs $1,800 is not a micro-purchase if it is part of a $3,000 purchase, or part of a $3,000,000 purchase. Regardless of purchase price, there still is an agency requirement to give reasonable accommodation for the disabled under section 504 of the Rehabilitation Act of 1973. The current micro-purchase limit is $2,500, set by statute. If the threshold is increased by a statutory change, the FAR Council will consider keeping the FAR Subpart 39.2 limit at $2,500.

In addition, GSA will recommend that agencies modify cardholder training to remind purchase cardholders of EIT accessibility requirements.

Undue Burden

Another set of comments wanted the FAR to elaborate on undue burden. The Access Board discussed undue burden in its final rule preamble (at 65 FR 80506 of the *Federal Register*). Substantial case law exists on this term, which comes from disability law. The Access Board chose not to disturb the existing understanding of the term by trying to define it. The FAR Council agrees with this

approach. Agencies are required by statute to document the basis for an undue burden. Requiring officials should be aware that when there is an undue burden, the statute requires an alternative means of access to be provided to individuals with disabilities.

Clauses

Some commenters asked for a clause, pointing out that unless the FAR prescribes a clause, agencies may produce different clauses, resulting in inconsistent coverage across the Government. Some procurement offices want a clause to help address their lack of experience with the Access Board standards. No clauses were in the January proposed rule. The FAR Council is carefully considering whether clauses are needed and welcomes comments on this issue that would inform a potential rulemaking.

Other Issues

A topic of concern to commenters was the play between the definition of EIT and a contractor's incidental use of EIT. The rule was not intended to automatically apply to a contractor's internal workplaces. For example, EIT neither used nor accessed by Federal employees or members of the public is not subject to the Access Board's standards (contractor employees in their professional capacity are not members of the public for purposes of section 508).

Commenters asked for further information on section 508 product compliance. There is a website at http://www.section508.gov, providing information from manufacturers and vendors on how they meet Access Board standards. The website reference has been added to the FAR language at Subpart 39.2.

Commenters asked whether the Committee for Purchase from People Who Are Blind or Severely Disabled, and Federal Prison Industries (UNICOR) were covered. These are required SOURCES for certain items. Agencies must consider non-compliant EIT items from these sources the same way that they would consider items from commercial sources, i.e., whether purchasing the item would come under an exception. As a matter of policy, purchases from the Committee for Purchase from People Who Are Blind or Severely Disabled, and Federal Prison Industries are to be treated as procurements.

The current status of compliance testing also was discussed in comments. Currently there is no uniform testing. However, there is an industry-led, Government-sponsored, program in the works, Accessibility for People with Disabilities through Standards Interoperability and Testing (ADIT). See the Section 508 website for information.

Questions arose on draft rule section 39.X03, Applicability, on the interpretation of standards available in the marketplace. The rule intended to recognize that initially there will be many products that do not meet all the Access Board's technical standards. Agencies may need to acquire these products. When acquiring commercial items, an agency must comply with those accessibility standards that can be met with supplies and services available in the commercial marketplace in time to meet the agency's delivery requirements. Individual standards that cannot be met would be documented by the requiring official, with a copy to the contract file. If products are available that meet some, but not all applicable standards, agencies cannot claim a product as a whole is not available just because it does not meet all of the standards.

Requirements Development, Market Research, and Solicitations

The requiring official must identify which standards apply to the procurement, using the Access Board's EIT Accessibility Standards at 36 CFR part 1194. Then the requiring official must perform market research to determine the availability of compliant products and services; vendor websites and the section 508 website would be helpful here. The requiring official must then identify which standards, if any, would not apply in this procurement because of, for example, not availability (FAR 39.203) or undue burden (FAR 39.204(e)). Technical specifications and minimum requirements would be developed based on the market research results and agency needs. This information would be submitted with the purchase request. The solicitation would then be drafted, or a task order or delivery order would be placed. Proposal evaluation may yield additional information that could require reconsideration of the need for an exception.

B. Executive Order 12866

The Access Board determined that their December 21, 2000, final rule was an economically significant regulatory action under E.O. 12866, and was a major rule under 5 U.S.C. 804. An economic assessment was accomplished and was placed on the Access Board's website at

http://www.access-board.gov/sec508/assessment. A copy can be obtained from the Access Board. The FAR Council has determined that the assessment conducted by the Access Board provides an adequate economic assessment of both the Access Board rule and this change to the FAR. Accordingly, the Access Board's regulatory assessment meets the requirement of performing a regulatory assessment for this change to the FAR and no further assessment is necessary.

This is an economically significant regulatory action and was subject to review under section 6(b) of Executive Order 12866, Regulatory Planning and Review, dated September 30, 1993. This rule is a major rule under 5 U.S.C. 804.

C. Regulatory Flexibility Act

This rule has a significant economic impact on a substantial number of small entities within the meaning of the Regulatory Flexibility Act, 5 U.S.C. 601, *et seq.*, because small businesses that choose to market their products to the Federal Government must ensure that their electronic and information technology supplies or services meet the substantive requirements of the Access Board's standards. Since this may result in increased costs of producing and selling their products, a Final Regulatory Flexibility Analysis (FRFA) has been performed and the analysis is summarized as follows:

The objective of this rule is to revise the FAR to improve the accessibility of electronic and information technology used by the Federal Government. The standards developed by the Access Board affect Federal employees with disabilities as well as members of the public with disabilities who seek to use Federal electronic and information technologies to access information. This increased access reduces barriers to employment in the Federal Government for individuals with disabilities and reduces the probability that Federal employees with disabilities will be underemployed. The EIT standards developed for the Federal Government may result in benefiting people outside the Federal workforce, both with and without disabilities. The accessible technology from the Federal Government may spill over to the rest of society. Section 508 uses the Federal procurement process to ensure that technology acquired by the Federal Government is accessible. Failure of an agency to purchase electronic and information technology that complies with the standards promulgated at 36 CFR part 1194, may result in an individual with a disability filing a complaint alleging that a Federal agency has not complied with the standards. Individuals may also file a civil action against an agency. The enforcement provision of section 508 takes effect June 21, 2001.

This rule establishes that contractors must manufacture, sell, or lease electronic and information technology supplies or services that comply with standards promulgated at 36 CFR part 1194. For many contractors, this may simply involve a review of the supply or service with the standards to confirm compliance. For other contractors, these standards could require redesign of a supply or service before it can be sold to the Federal Government. According to the Federal Procurement Data System in fiscal year 2000, we estimate that there are approximately 17,550 contractors to which the rule will apply. Approximately, 58 percent, or 10,150, of these contractors are small businesses.

Small businesses will have to analyze whether the electronic and information technology they or their customers plan to sell to the Federal Government complies with the standards. Manufacturers may want to redesign to make their supplies and services compliant to have a better chance for their items to be purchased by the Government. Retailers will need to coordinate with the manufacturers. The statute will decrease demand for some supplies and services that are not compliant, leading to decreased sales for small entities manufacturing or selling those items. Conversely, the statute will increase demand for some supplies and services that are compliant, leading to increased sales for small entities manufacturing or selling those items.

Since the statute imposes private enforcement, where individuals with disabilities can file civil rights lawsuits, the Government has little flexibility for alternatives in writing this regulation. To meet the requirements of the law, we cannot exempt small businesses from any part of the rule.

The FAR Secretariat has submitted a copy of the FRFA to the Chief Counsel for Advocacy of the Small Business Administration. A copy of the FRFA may be obtained from the FAR Secretariat. The Councils will consider comments from small entities concerning the affected FAR parts in accordance with 5 U.S.C. 610. Comments must be submitted separately and should cite 5 U.S.C. 601, *et seq.* (FAR case 1999-607), in correspondence.

APPENDIX B: DISCOUNT RATES

Present Value Table

Discount factors: Present value of $1 to be received after t years = 1/(1 + r)1.

Number of Years	Interest Rate per Year														
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909	.901	.893	.885	.877	.870
2	.980	.961	.943	.925	.907	.890	.873	.857	.842	.826	.812	.797	.783	.769	.756
3	.971	.942	.915	.889	.864	.840	.816	.794	.772	.751	.731	.712	.693	.675	.658
4	.961	.924	.888	.855	.823	.792	.763	.735	.708	.683	.659	.636	.613	.592	.572
5	.951	.906	.863	.822	.784	.747	.713	.681	.650	.621	.593	.567	.543	.519	.497
6	.942	.888	.837	.790	.746	.705	.666	.630	.596	.564	.535	.507	.480	.456	.432
7	.933	.871	.813	.760	.711	.665	.623	.583	.547	.513	.482	.452	.425	.400	.376
8	.923	.853	.789	.731	.677	.627	.582	.540	.502	.467	.434	.404	.376	.351	.327
9	.914	.837	.766	.703	.645	.592	.544	.500	.460	.424	.391	.361	.333	.308	.284
10	.905	.820	.744	.676	.614	.558	.508	.463	.422	.386	.352	.322	.295	.270	.247
11	.896	.804	.722	.650	.585	.527	.475	.429	.388	.350	.317	.287	.261	.237	.215
12	.887	.788	.701	.625	.557	.497	.444	.397	.356	.319	.286	.257	.231	.208	.187
13	.879	.773	.681	.601	.530	.469	.415	.368	.326	.290	.258	.229	.204	.182	.163
14	.870	.758	.661	.577	.505	.442	.388	.340	.299	.263	.232	.205	.181	.160	.141
15	.861	.743	.642	.555	.481	.417	.362	.315	.275	.239	.209	.183	.160	.140	.123
16	.853	.728	.623	.534	.458	.394	.339	.292	.252	.218	.188	.163	.141	.123	.107
17	.844	.714	.605	.513	.436	.371	.317	.270	.231	.198	.170	.146	.125	.108	.093
18	.836	.700	.587	.494	.416	.350	.296	.250	.212	.180	.153	.130	.111	.095	.081
19	.828	.686	.570	.475	.396	.331	.277	.232	.194	.164	.138	.116	.098	.083	.070
20	.820	.673	.554	.456	.377	.312	.258	.215	.178	.149	.124	.104	.087	.073	.061

Number of Years	Interest Rate per Year														
	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	.862	.855	.847	.840	.833	.826	.820	.813	.806	.800	.794	.787	.781	.775	.769
2	.743	.731	.718	.706	.694	.683	.672	.661	.650	.640	.630	.620	.610	.601	.592
3	.641	.624	.609	.593	.579	.564	.551	.537	.524	.512	.500	.488	.477	.466	.455
4	.552	.534	.516	.499	482	.467	.451	.437	.423	.410	.397	.384	.373	.361	.350
5	.476	.456	.437	.419	.402	.386	.370	.355	.341	.328	.315	.303	.291	.280	.269
6	.410	.390	.370	.352	.335	.319	.303	.289	.275	.262	.250	.238	.227	.217	.207
7	.354	.333	.314	.296	.279	.263	249	.235	.222	.210	.198	.188	.178	.168	.159
8	.305	.285	.266	.249	.233	.218	.204	.191	.179	.168	.157	.148	.139	.130	.123
9	.263	.243	.225	.209	.194	.180	.167	.155	.144	.134	.125	.116	.108	.101	.094
10	.227	.208	.191	.176	.162	.149	.137	.126	.116	.107	.099	.092	.085	.078	.073
11	.195	.178	.162	.148	.135	.123	.112	.103	.094	.086	.079	.072	.066	.061	.056
12	.168	152	.137	.124	.112	.102	.092	.083	.076	.069	.062	.057	.052	.047	.043
13	.145	.130	.116	.104	.093	.084	.075	.068	.061	.055	.050	.045	.040	.037	.033
14	.125	.111	.099	.088	.078	.069	.062	.055	.049	.044	.039	.035	.032	.028	.025
15	.108	.095	.084	.074	.065	.057	.051	.045	.040	.035	.031	.028	.025	.022	.020
16	.093	.081	.071	.062	.054	.047	.042	.036	.032	.028	.025	.022	.019	.017	.015
17	.080	.069	.060	.052	.045	.039	.034	.030	.026	.023	.020	.017	.015	.013	.012
18	.069	.059	.051	.044	.038	.032	.028	.024	.021	.018	.016	.014	.012	.010	009
19	.060	.051	.043	.037	.031	.027	.023	.020	.017	.014	.012	.011	.009	.008	.007
20	.051	.043	.037	.031	.026	.022	.019	.016	.014	.012	.010	.008	.007	.006	.005

Note: For example, If the interest rate is 10 percent per year, the present value of S1 received at year 5 is $.621.

DOD INDUSTRIAL PLANT EQUIPMENT REQUISITION

REQUISITION NUMBER

Form Approved
OMB No. 0704-0246
Expires Feb 28, 2006

PLEASE DO NOT RETURN YOUR FORM TO THIS ADDRESS. RETURN COMPLETED FORM TO DEFENSE SUPPLY CENTER RICHMOND, ATTN: JH, 8000 JEFFERSON DAVIS HIGHWAY, RICHMOND, VA 28297-5100

SECTION I - ITEM DESCRIPTION

1. COMMODITY CODE	2. MANUFACTURER			3. MODEL NUMBER
4. STOCK NUMBER	5. POWER CODE	6. ESTIMATED COST	7. PHYSICAL INSPECTION REQUIRED *(X one)* ☐ YES ☐ NO	8. PROCUREMENT SPECIFICATION ATTACHED *(X one)* ☐ YES ☐ NO

9. DESCRIPTION

CONTINUED UNDER REMARKS SECTION ☐ YES ☐ NO

SECTION II - ROUTING AGENCY/FACILITY/CONTRACTOR

10. NAME AND ADDRESS *(Include ZIP Code)*	11. CONTRACT NUMBER	12. DATE *(YYYYMMDD)*	13. COMMAND CODE
	14. PROGRAM *(X one)* ☐ MILITARY ☐ CONTRACTOR		

15. INTENDED USE	16. DATE ITEM REQUIRED AT DESTINATION *(YYYYMMDD)*	17. DATE CERT. N/A REQUIRED *(YYYYMMDD)*	18. PRIORITY
19. BASIS FOR AUTHORIZATION *(X one)* ☐ PRODUCTION ☐ MOBILIZATION ☐ REPLACEMENT	20. PROCUREMENT PLANNED *(X one)* ☐ YES ☐ NO *(If "YES," cite Appropriation)*		21. REBUILD/OVERHAUL CANDIDATE ☐ YES
22. TYPED NAME AND TITLE OF REQUESTING OFFICIAL	23. SIGNATURE OF REQUESTING OFFICIAL		24. DATE *(YYYYMMDD)*

25. CERTIFICATION OF NEED BY ADMINISTERING ACTIVITY		a. ADMINISTERING OFFICE CODE
b. NAME AND ADDRESS *(Include ZIP Code)*	c. TYPED NAME AND SIGNATURE OF PRODUCTION REPRESENTATIVE	d. DATE *(YYYYMMDD)*
	e. SIGNATURE OF ADMIN. CONTRACTING OFFICER	f. DATE *(YYYYMMDD)*

SECTION III - APPROVAL AUTHORITY

26. NAME AND ADDRESS *(Include ZIP Code)*	27. TITLE, SYMBOL AND TELEPHONE NO. OF APPROVING OFFICIAL	
	28. TYPED NAME & SIGNATURE OF APPROVING OFFICIAL	29. DATE *(YYYYMMDD)*

SECTION IV - ALLOCATION AND AUTHORITY TO INSPECT *(To be completed by DSCR)*

30. COMMODITY CODE	31. I.D./GOVERNMENT TAG NUMBER	32. DESCRIPTION *(See attached copy of DD Form 1342, dated)*
33. PRESENT LOCATION *(Name, address and ZIP Code)*		34. SHIPPED TO *(Name, address and ZIP Code)*

35. ESTIMATED TIME REQUIRED FOR SHIPMENT FROM DATE OF ACCEPTANCE *(Enter number of days)*

a. AS IS CONDITION	b. TEST REQUIRED	c. REPAIR REQUIRED	d. REPAIR/OVERHAUL REQUIRED	e. STANDARD ATTACHMENTS REQUIRED

36. TYPED NAME AND SIGNATURE OF ALLOCATING OFFICIAL	37. DATE *(YYYYMMDD)*	38. DATE OFFER EXPIRES *(YYYYMMDD)*

SECTION V - NON-AVAILABILITY CERTIFICATE *(To be completed by DSCR)*

39. The item described in Section I of this form has been screened by DSCR against the idle inventory of the Department of Defense and it is hereby certified as not available or cannot be delivered on or before the date specified in Section II *(Item 16)*. Procurement action resulting from this Certification of Non-Availability must be initiated within 45 calendar days of the date included in this Section *(Item 42)* or complete rescreening is required. Equipment offered by DSCR in Section IV must be considered if the supplier cannot deliver new equipment before expiration of the period specified in Section IV *(Item 35)*.

40. TYPED NAME AND SIGNATURE OF CERTIFYING OFFICIAL	41. DATE CERTIFICATE ISSUED *(YYYYMMDD)*	42. DATE CERTIFICATE EXPIRES *(YYYYMMDD)*	43. CERTIFICATE NUMBER

SECTION VI - CERTIFICATE OF ACCEPTANCE

44. THE ITEM ALLOCATED IN SECTION IV OF THIS FORM *(X as applicable)*

	a. HAS BEEN PHYSICALLY INSPECTED AND IS ACCEPTABLE				b. IS ACCEPTABLE WITHOUT PHYSICAL INSPECTION		
	c. IS ACCEPTED UNDER ONE OF THESE CONDITIONS:						
	(1) AS IS CONDITION		(2) REPAIR REQUIRED		(3) TEST REQUIRED		(4) REBUILD/OVERHAUL REQUIRED
	(5) OTHER						
	d. IS NOT ACCEPTABLE *(A complete description of conditions making item unacceptable must be stated under REMARKS below)*						

45. TYPED NAME AND TITLE OF CERTIFYING OFFICIAL	46. SIGNATURE OF CERTIFYING OFFICIAL	47. DATE *(YYYYMMDD)*

SECTION VII - SPECIAL SHIPPING INSTRUCTIONS

48. SHIP TO *(Include ZIP Code)*	49. FOR TRANSSHIPMENT TO *(Include ZIP Code)*

50. MARK FOR

51. APPROPRIATION CHARGEABLE FOR		d. PAYING OFFICE/ACTIVITY NAME AND ADDRESS *(Include ZIP Code)*
a. PACKING/CRATING/HANDLING		
b. TRANSPORTATION		
c. OTHER		

52. SPECIAL DISTRIBUTION OF SHIPPING DOCUMENTS AND OTHER INSTRUCTIONS

SECTION VIII - REMARKS

53. REMARKS

Source: DD FORM 1419 (BACK), JUN 2003

17 Health Care Purchasing and Supply Management

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

17.1 Identify the complexities a manager may encounter when purchasing in the health care industry.

17.2 Compare the health care supply chain with the traditional industrial supply chain.

17.3 Identify the various supply management methods in the health care field.

17.4 Explain how inventory control is accomplished in the health care field.

17.5 Identify the current trends in health care purchasing.

17.6 Illustrate the capital equipment acquisition process.

17.7 Show how various health care plans are evaluated.

Daniel Moore is currently the director of purchasing at Honda of America. Dan graduated from Penn State with a degree in purchasing and supply chain management 10 years ago. At 9:30 am yesterday morning Dan received a call from a headhunter. The search firm requested an interview with Dan regarding a position as VP of purchasing and supply chain management for Mercy Hospital in Austin, Texas. Mercy is the largest health care provider in the Austin area. It has over 1,400 beds and numerous outpatient clinics throughout the city.

Health care spending in the United States is nearly 18% of gross domestic product (GDP), and more than 40% of this spending is accounted for by supply chain expenses. Power has been studied in various supply chain management environments. However, the health care supply chain is a unique environment, with uncommon dependency relationships and third-party group purchasing organizations (GPOs) bridging the gap between hospitals and their suppliers.

While in a traditional industrial supply chain, firms typically develop relationships directly with their suppliers, in the health care supply chain, health care organizations (HCOs) engage GPOs as an outsourcing strategy to secure their materials.

How would you advise Dan regarding this new opportunity?

.....

INTRODUCTION

The health care industry is expected to grow and consume an even greater share of GNP in the next few years. At the same time, many health care organizations will be driven from the market because of uncontrollable nonsalary costs and declining profits. This radical shift is the result of increased price competition and the regulatory environment. This is good news for health care providers who have planned for the forthcoming changes.

The focus of this chapter is on purchasing day-to-day supplies and capital equipment acquisition. In the next section, we show how supplies are bought and controlled. The third section considers the acquisition of specialized capital equipment.

Hospitals are complex organizations providing a multitude of services to patients, physicians, and staff. These services include dietary, housekeeping, physical plant engineering, pharmacy, laboratory, inpatient treatment (nursing units), surgery, radiology, administration, and others (see Li & Benton, 2003, 2006; Siferd & Benton, 1992). Each area has specific and often unique materials and supply needs, creating a requirement in these facilities for a supply management system that can provide the necessary supplies when needed. In the current climate of increasing health care costs, systems inventory must be optimized without sacrificing the level of service provided. The functions of inventory in the hospital setting, methods of inventory management used, factors unique to the health care setting, and current trends in hospital inventory management are examined.

PURCHASING, SUPPLIES, AND SERVICES

LO 17.1 Identify the complexities a manager may encounter when purchasing in the health care industry.

As in any business concern, the functions of all departments must be consistent with the overall mission and purpose of the business. In hospitals, the primary objective is to provide patient care; the supply management function is in place to support this objective. Inventory control is an important component of supply management; many other functions are also critical to a successful supply management system, and some of these functions are addressed indirectly in this discussion.

There are two primary functions of inventory in the hospital setting: to maximize supply service consistent with maximum efficiency and optimum inventory investment and to provide a cushion between the forecasted and actual demand. The service levels required by the departments will vary depending on the degree of the cost of a stock-out. An illustration of the difference is the cost of a stock-out of laser printer toner for the administrative

offices as opposed to a stock-out of an item such as a diagnostic coronary catheter, which may be critical in an emergency situation. The items in this example may cost the same to purchase and hold in inventory, but the allowable risks of stocking out are very different. This phenomenon also affects the optimal level of "inventory cushion" from a service perspective. The criticality of an item may depend on the restocking lead time, the shelf life, or the special conditions under which the item must be held as well as the effect on hospital operations of a shortage of the item.

Independent-demand purchased items Demand for an item that is unrelated to demand for other items.

Many of the items necessary in the operation of hospitals are **independent-demand purchased items**. However, there are items produced in the hospital setting for which the supplies follow a dependent-demand pattern and the inventories supporting these functions are essentially raw materials used in production. Departments that produce supplies include the print shop (e.g., forms), dietary production (food items), and the pharmacy (unit dosage packaging, IV mixtures). Make-or-buy decisions here are key, and the corresponding inventory issues must be addressed. In addition, the demand for certain items may be derived in advance from the surgical schedule. For example, a certain number of units of blood plasma of specific types may need to be held at the ready on certain days when heart or other complex surgeries are being performed.

Even with only these few examples, it is clear that the supply management functions and inventory control issues in a hospital are complex. Functions of a management system include purchasing, storage space use, inventory management, supply distribution, supply chain management, linen service, printing, and often mail, patient transportation, and courier/messenger services. Effective management of materials requires tremendous time and energy in the constant monitoring of changes in usage, ordering practices within the facility, and pricing. The control and management systems used depend on the size of the institution, degree of automation, and the competitive environment. The hospital administrator's measurement criterion is the highest level of customer satisfaction at the lowest cost, but this satisfaction must be achieved under severe cost constraints.

Operating cost in hospitals has become extremely important as the reimbursement system is no longer based solely on cost. In the mid-1980s, a system of reimbursement based on specific diagnosis-related groups (DRG) was instituted. Under the DRG system, the hospital is reimbursed a flat rate based on a patient's diagnosis regardless of the associated costs. Before the DRG system was instituted, there was little incentive to operate hospitals efficiently or cost-effectively. Today, cost containment is critical to an institution's financial health. Better supply management practices must be implemented to ensure appropriate service levels in the new cost containment environment.

HEALTH CARE SUPPLY CHAIN MANAGEMENT

LO 17.2 Compare the health care supply chain with the traditional industrial supply chain.

There are critical differences between the health care supply chain and industrial supply chains such as the automotive supply chain. One difference is the manner in which revenue is generated. In traditional industrial supply chains, hospitals have been compensated through cost-based reimbursement systems, leading to little incentive to focus on cost or efficiency.

The prolonged cost-based reimbursement systems have had lasting effects on internal operations at hospitals, compared to operations at traditional cost-conscientious industrial firms. A second key difference between the health care supply chain and traditional industrial supply chains is the number of suppliers relative to the number of buyers. Industrial buyers have access to a multitude of suppliers, and these suppliers depend on the volumes requested by the buying organization. Hospitals, on the other hand, have access to only a limited number of suppliers, in the case of most product groups, and these suppliers are much less dependent on the volume requested by an individual hospital. Simply put, while most well-defined traditional industries oftentimes have few buyers and more possible suppliers, the health care industry is one of the unique industries with many buyers and few suppliers. The number of suppliers in an industry represents the number of alternative sources for buyers, which in turn affects a buyer's switching cost and dependence on a supplier.

A third key difference between traditional industrial supply chains and the health care supply chain is in the performance criteria. Members of the health care supply chain should put forth a coordinated effort to deliver the greatest patient value at the lowest cost. Therefore, the hospital purchasing system must contribute to value for patients and payers.

A fourth important difference between traditional industrial supply chains and the health care supply chain concerns the fact that many hospital supply chain managers have relationships with a variety of organizations that bridge the gap between suppliers and the hospital buying organizations, including distributors/wholesalers and the group purchasing organization (GPO). In a GAO report (GAO-323R, 2010), it was revealed that participation in GPOs may lead to increases in product prices for hospitals buying products on nationwide contracts and through the establishment of price ceilings in their agreements with GPOs.

Another key difference between the health care supply chain and traditional industrial supply chains considers the nature of the relationships between the different members of the supply chains. In a traditional industrial supply chain, firms typically develop close relationships with their suppliers (i.e., strategic suppliers and some of their preferred suppliers) based on the value they provide to the organization. More traditional relationships are maintained with transactional suppliers (see Chapter 7). The presence of purchasing partners, or middlemen, such as GPOs in the health care supply chain is a distinctive characteristic. While over 600 GPOs are active in the United States, a relatively small number of GPOs dominate the market. Six GPOs accounted for nearly 90% of the GPO market (GAO-12-399R, 2012). Since Premier Inc., Novation LLC, and Med Assets, the three largest GPOs, account for approximately 75% of the purchasing volume, the health care supply chain is an oligopolistic environment. GPOs develop long-term purchasing contracts with suppliers such as original equipment manufacturers (OEMs) that its members, the hospitals, can access. These exclusive contracts may last as long as 3 to 5 years, and GPOs typically limit the supplier competition by narrowing the number of suppliers to two or three per product or product category (Burns & Lee, 2008). GPOs attempt to increase their hospital members' adherence to these negotiated agreements by having the members agree to use a specific contracted supplier for a contracted product, services, and equipment. The primary source of GPO revenues is the contract administration fee (CAF), paid by the product supplier, which is typically 2% to 3% of the contracted purchase price. GPOs may then distribute a portion of these fees to their customers, the health care

organizations (HCOs) (GAO-10-738, 2010). As hospitals outsource part of their procurement process on a large scale to GPOs, they will save money by not having to employ the necessary support staff to test, research, negotiate, and purchase items on their own (Schneller & Smeltzer, 2006). However, a smaller purchasing staff and consequently less purchasing expertise increase the hospitals' dependence on a GPO. The pool of possible suppliers narrows from the total number of available suppliers to those that are under contract with the GPO for a given product. Consequently, hospitals' use of GPO services directly increases its dependence on the GPO for purchasing support and expertise. It also increases indirectly the dependence on the supplier since purchasing through the GPO reduces the number of available suppliers for the hospital. This double dependence of an HCO may have significant effects on the relationships between a hospital and a supplier and between the hospital and the GPO, through the phenomenon of interfirm power. The role of power has received significant research attention in the marketing channel literature (also see De Jong & Benton, 2018; Benton).

Opportunities in Health Care Supply Management

Purchasing and supply management in the health care supply chain has received wide attention because of its significance in determining hospital financial performance. The cost of supply management can exceed 40% of a hospital's operating budget, with nearly 25% to 30% percent attributable to materials cost directly. The health care supply chain is different from and more complex than supply chains in other more stable traditional industrial environments. In contrast to the health care supply chain, supply chains in many industries have gone through significant transitions over the last few decades.

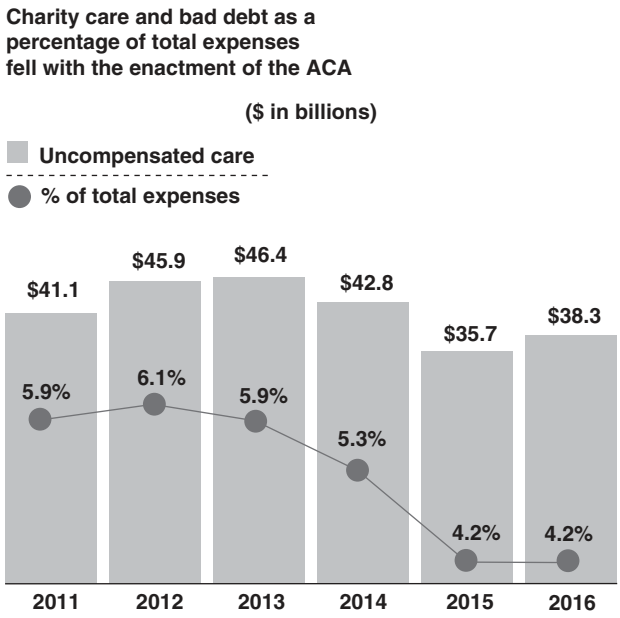
Historically, the health care supply chain has consistently lagged behind traditional industrial supply chain efficiencies. This has changed in recent years. In 2019, IT budgets as a percentage of revenue in the health care sector surpassed the cross-industry average, and most CIOs reported year-over-year budget increases. Clinical process improvement has also been aggressively pursued in many hospitals and medical centers. The basic process has included flowcharting the current systems, eliminating waste, and redesigning the health care supply chain.

U.S. hospital profits increased to more than $76.1 billion in 2018. During the same period, Deloitte reported that 20% to 30% of the 4,800 hospitals generated negative operating margins. This clearly reflects the level of performance between successful and unsuccessful hospitals. As can be seen in Figure 17.1, uncompensated care hit a peak of $46.4 billion in 2018.

Hospitals need to refocus some of their attention to the low-hanging fruit related to supply management. Successful hospitals must consider the following areas for increasing profitability and improving operations:

- Supply chain planning
- Product management
- Sourcing and contracting
- Distribution and inventory management
- Technology enablement

FIGURE 17.1
Uncompensated Care



Source: American Hospital Association

Although the supply chain accounts for the second largest spending area in a hospital, executive leadership typically does not emphasize supply chain management or materials management operations as an area of opportunity. Supply management must be elevated to an integral component of the hospital executive management team. Supply chain leadership influence disparity is needed. Specifically, producing a supply chain strategy showing how the organization plans to source, distribute, and replenish supplies will enable hospital personnel to properly manage human and capital resources. These are costly investments, and hospitals must prioritize between clinical and supply management investments.

Examples of Health Care Savings Opportunities

1. Crozer-Chester Health System had operating and storage facilities at four hospitals and four nursing homes. The health care system consolidated the four facilities into a centralized off-site distribution center and saved approximately $1.5 million annually. At the same time, inventory was reduced by more than $300,000. Contract consolidation also generated $400,000 in savings while item standardization accounted for another $500,000 in savings (Hospitalconnect.com, 2002).
2. Connecting PeopleSoft's Purchasing Module to inventory applications enabled Dartmouth-Hitchcock Medical Center (DHMC) to replenish inventory as supplies were depleting. The inventory cost decreased by almost 50%. As can be seen, the implementation of technology helped DHMC integrate its business processes to obtain reduced costs and better visibility into supplies and replenishment (Danish, 2003).

3. A hospital health care system located in the Southeast identified approximately $3 million in savings in the clinical and support services areas. Supply management had identified the need to standardize clinical and nonclinical items. Clinical focus areas included high-dollar physician preference items, such as orthopedic implants, where a savings of over $300,000 was achieved by reducing the number of suppliers and pursuing demand matching. Similarly, another $200,000 could be realized through reducing the number of suppliers and more aggressively negotiating with the reduced supplier base.

METHODS OF SUPPLY MANAGEMENT

LO 17.3 Identify the various supply management methods in the health care field.

Traditional inventory control methods used in manufacturing are not common in the hospital setting. Modifications are necessary to fit the health care industry, but the same fundamental theories are used. Three of these approaches are discussed individually in this section.

Fixed Order Quantity System

This system is referred to as a fixed order quantity (FOQ) system in which inventory is checked (theoretically) on a perpetual basis after each inventory transaction. (For a detailed discussion on inventory management, see Chapter 5.) When the inventory is withdrawn to a point at which there is just sufficient material to cover the demand during the replenishment lead time, an order is initiated for a fixed quantity. It is also sometimes called an order point system. Determination of the optimum order quantity is influenced by at least two factors: inventory carrying costs and ordering costs. The trade-offs in this instance are obvious. If we order frequently, thus incurring high order costs, we do not have to carry so much in inventory. If we order less frequently, the carrying costs will be higher. Often, the cost to backorder an item and the cost of stocking out are considered as well. Although these costs may be harder to determine, they may be critical, as a patient may not survive if some items are stocked out.

Economic order quantity (EOQ) calculations may be used in the determination of the optimum order size. However, the EOQ is usually based on inappropriate assumptions for the situation and can lead to erroneous decisions. For instance, the assumptions of constant uniform demand and the instantaneous replenishment of stock at the zero level may not reflect clearly the inventory situation faced by most hospitals. Modifications to the basic formula are necessary. An example is shown in Example 17.1. Quantity discounts are not considered in the basic EOQ. Some of these assumptions may be relaxed, although standard EOQ decisions are fairly robust. The order quantity decision is easily implemented, involving a series of calculations that arrive at an order quantity that is most advantageous in a given situation. Reorder points, safety stock (as a function of service level), and total cost of the plan must then be determined. Simple-to-program spreadsheets may be used to determine close-to-optimal order quantities and reorder points.

Fixed Order Interval

In the fixed order interval (FOI) method, users or buyers review quantities periodically at fixed intervals of time, and an order is placed for a quantity sufficient to replenish the stock to a predetermined maximum level. This level also is calculated to minimize the

Example 17.1

ECONOMIC ORDER QUANTITY

River View Hospital buys plasma for use in surgical procedures. The demand for plasma is 3,460 units per year. There is a $50 cost to place an order, and the cost per unit of plasma to hold it in inventory for the year is $85. What is the economic order quantity?

Solution:

$$EOQ = \sqrt{(2 * A * Cp)/Ch}$$

$$EOQ = \sqrt{(2 * 3{,}460 * \$50)/\$85}$$

$$= 63.80$$

where

A = annual demand

Cp = order cost

Ch = inventory holding cost

The best order quantity is approximately 64 units of plasma each time an order is placed. Based on the perishability and refrigeration storage capacity the order quantity may need adjustment.

combined costs of holding and managing inventories. The FOI method was developed primarily for use in mass production schedules in industry and has not been widely used in health care. However, there are several instances in which hospitals may be interested in this method: (1) when there is frequent ordering, calling for stringent control; (2) when it is convenient to order many items from one supplier; (3) when serving the needs of discrete or irregular usage; (4) when there are large-volume orders that represent a large portion of the supplier's capacity; and (5) when storeroom balances are calculated only periodically. This will be a particularly important method for hospitals that move increasingly into assembly and "production" of their supplies. Purchasing agents often encourage the use of FOI methods, since the review period often can be coordinated with a supplier representative's visit to the hospital.

Stockless Inventory Systems

Just-in-time (JIT) inventory control is a common name for this concept, which has been used in industry since the 1950s when it was developed by Toyota. Increasingly, hospitals are finding uses and methods for this concept in their own materials management systems. The stockless inventory system is the process wherein a hospital's prime suppliers manage product purchasing, storage, delivery, and inventory control of medical/surgical supplies used in the hospital. Stockless inventory systems have the potential to reduce redundant activities in the system, the investment by the hospital in inventory, the storage space required, and the handling functions. To ensure successful implementation, several criteria must be met, including the existence of a prime supplier contract and excellent communication and cooperation within the hospital departments, as well as between the hospital and its supplier. Specialized departments such as the laboratory and radiology are particularly suited to a stockless inventory system, but implementation in the entire hospital is an idea gaining popularity.

When a supplier can manage stockless inventory systems for several hospitals, both the buyer and supplier can take advantage of the economies of scale in warehousing and in transportation inherent in such a situation. The supplier may act as the buyer's central warehouse,

and less inventory will be needed to meet the same needs for several locations. The reason for this phenomenon is that variances are pooled, with a lower variance in total than the sum of the variances over all locations.

In addition, transportation may be routed quite efficiently because the supplier will be making many small deliveries weekly or even multiple times a day to a number of hospitals. The central supplier is also able to take advantage of quantity discounts in purchasing materials and in having full truckloads delivered from large hospital supply houses and from pharmaceutical companies.

The Best Method

It is true that no one system is best overall. Certainly the size, purchasing power, and level of control that the supply management department has within the hospital are all factors that must be evaluated. The degree to which the hospital is automated and to which computer systems are integrated is also a factor in the decision in terms of the complexity of the systems models and in the level of calculations required. Clearly, cost/benefit analyses must be performed and systems developed that perform and provide the desired service level. There is little doubt that the system that would be most useful may not be one of the pure systems discussed but a combination of all of them. This is particularly true because of the complex and various needs of the different departments of the hospital.

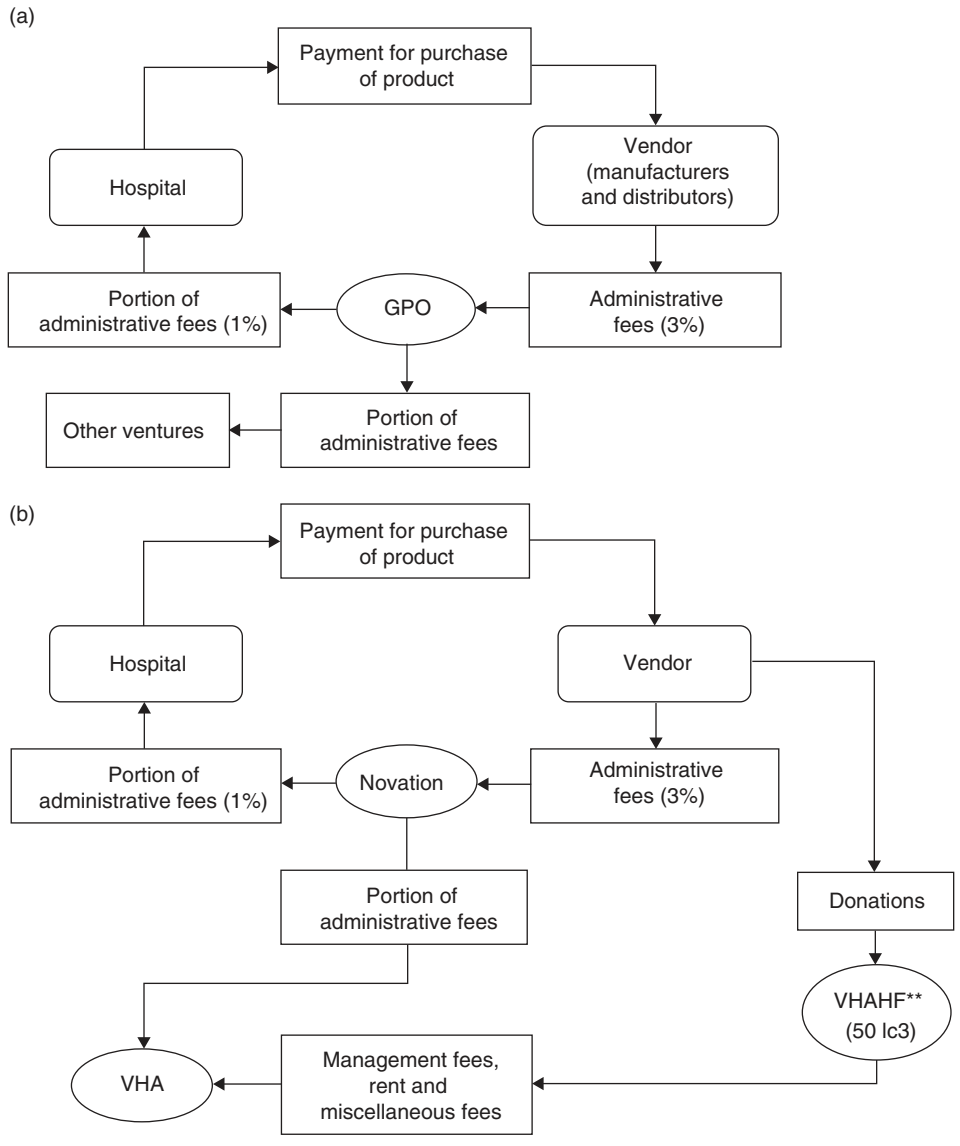
Group Purchasing Organizations

Group purchasing organizations (GPOs) are intermediaries that help health care providers such as hospitals, nursing homes, and home health agencies realize savings and efficiencies by aggregating purchasing volume and using that leverage to negotiate discounts with manufacturers, distributors, and other vendors. Nearly every hospital in the United States (approximately 96% to 98%) chooses to use GPO contracts for their purchasing functions. Additionally, estimates are that hospitals across the United States use, on average, at least two and as many as four GPOs per facility. In 2013, the average U.S. hospital spent $3.8 million on supplies (including medical supplies, pharmaceuticals, physician preference items, and other supplies and items) (Abdulsalam & Schneller, 2017). Approximately 70% of this was allocated through a GPO. GPOs save hospitals and freestanding nursing homes from 10% to 15% off their purchasing costs. Some of the typical characteristics of GPOs are listed here:

- GPOs negotiate contracts with vendors (e.g., manufacturers) on behalf of members (e.g., hospitals).
- Vendors pay GPOs administrative fees based on sales.
- Fees finance operations.
- Surplus fees are distributed to owners or used to finance new ventures.
- GPOs vary by size, scope of service, and ownership type.
    - GPOs do not maintain inventories or engage in other aspects of supply chain management.
    - Annual spend through the Healthcare Supply Chain Association (HSCA)'s 14 member GPOs was more than $200 billion in 2017.

The money flows related to hospital purchases using a GPO are shown in Figure 17.2. In recent years some spend has shifted from national GPO alliances to regional and local GPO alliances. The breakdown of hospital spending (based on a survey by Burns & Briggs, 2018) is shown in Table 17.1, along with the reported primary GPOs used by responding hospitals.

FIGURE 17.2
(a) Money Flows Related to Hospital Purchases Using a GPO
(b) Money Flows Related to Novation VHA and VHAHF



Source: GAO, 2012.

TABLE 17.1
Survey of Vice Presidents of Materials Management in Hospitals That Are GPO Members, 2014

Supply Spending via	Percentage
National GPO alliance	55%
Regional GPO alliance	10%
Local GPO alliance	5%
Self-negotiated contracts	20%
Off-contract purchases	10%
Total	100%
Primary National Alliance	**Percentage**
Amerinet	5%
HealthTrust	12%
MedAssets	13%
Novation	34%
Premier	32%
Other	3%
Total	99%

Anti-Kickback Issues

The Safe Harbor law, a 1987 amendment to the Social Security Act, permits GPOs to charge these contract administration fees (CAFs) to all suppliers with whom they contract. The CAFs are essentially commissions paid by suppliers to GPOs on sales to the HCOs.

The safe harbor exemption allowed these fees, otherwise considered "kickbacks" or illegal payments, to be paid to GPOs. To each participating member, a GPO must disclose the following

- That fees are to be 3% or less of the purchase price, or the amount or maximum amount that each vendor will pay
- At least annually, the amount received from each vendor with respect to purchases made by or on behalf of the member

COMPLICATING FACTORS UNIQUE TO HEALTH CARE FOR INVENTORY CONTROL

LO 17.4 Explain how inventory control is accomplished in the health care field.

Two factors used in the application of all methods of inventory management are problematic for the health care system: inaccurate demand estimations or forecasts and safety stock.

Demand Problems

With the availability of computers in all areas of health care today, forecasting demand using past data and statistical techniques is a far more realistic possibility than it was in the past. Forecasts are never perfect, but they can assist the supply manager to better control inventory to the best economic advantage of the hospital.

Demand, however, is impacted by several unique factors in health care. For instance, the length of stay and patient mix (types of patients and diagnoses) patterns are fundamental to the assessment of the types of supplies required in any given time frame. This is particularly influential to inventory use in a hospital of 400 beds or fewer. Changes in medical staff and the possible related changes in treatment as a result will have a direct impact on the kind of supplies needed. Overall changes in treatment practices also will have an effect. If short-term forecasts for materials could be tied to the demand forecasts of certain types of DRG for patients admitted, then better material forecasts might be possible. Similarly, some hospitals now have critical path plans (CPPs) for patients, where a plan is made for each new admission to a unit. These plans are outcome-driven, where certain outcomes are expected at certain points of time during the patient's stay. If these CPPs could be linked by computer programs to supply management, forecasting for material needs would be more accurate.

Communication between the practitioners (medical staff) and the supply management function is vital, and this is inevitably the area in which the system breaks down. Several situations exist in the hospital that make communication a difficult task. First, practitioners historically give little thought to the evaluation of supply usage or to the prediction of future needs. The COVID-19 pandemic proved this true with the shortage of personal protective equipment (PPE) throughout the United States.

The assumption in the past has been that what is needed will be made available, regardless of the cost or inconvenience of obtaining it. Further, hospitals have traditionally functioned as a set of "little fiefdoms," which fosters competition and difficult communication. This is changing by necessity, as the once unlimited resources are now increasingly limited, and everyone in the hospital must concern himself or herself with the efficient and cost-effective use of those resources. Attention to the issue of supply use and communication between practitioners and supply management is crucial. Incorporating responsibility for supplies in the formal budgeting process of individual departments has been suggested as a way to encourage practitioners to take a serious look at supply needs and use.

Product-line organizational structures incorporating the supplies issue into the profitability of the product line is another approach to encourage middle- and first-line supervisors to increase their concern for supply management. By holding a product-line manager accountable for profit, attention to the efficient and cost-effective use of resources and supplies will result. The product-line manager approach has the potential to work quite well with the critical path plan for patient care because one individual, usually a registered nurse, is in charge of the team of individuals administering a patient's CPP. In addition, patients with similar CPPs are likely to have similar diagnoses. These patients are likely to be in the same DRG and therefore in the same nursing units during the course of their hospital stay. Thus, the nursing unit managers would be a natural choice for product-line managers of selected DRG- or CPP-related products. Careful planning and communication are paramount to the success of such a plan. Extensive audits and interviews using feedback and constant monitoring are the fundamental elements if supply master planning should be implemented. Again,

communication is the key. By whatever innovative method, cooperation and communication must be improved so that higher throughput and lower cost will result.

In the case of dependent demand in which the hospital is producing an item, an explosion-type approach can be taken. This approach resembles a classic material requirements plan, based on a master production schedule. These concepts can be applied to the production of supplies in the hospital setting, and the resulting materials and inventory demands can be derived. The master production schedule is a counterpart to the master surgery schedule and short-term (3- to 6-week) forecast for other expected patient care. Material requirements can be derived from the surgery schedule and forecast, and "exploded" backward to determine when to begin the production of certain supplies assembled or within the hospital. Similarly, continued backward explosion to the lowest levels of raw materials will indicate when and how much raw material to purchase.

Safety Stock

Unique to health care is a classification of the stock-out tolerances of a hospital, categorized by Reisman as urgency requirements (Holmgren & Wentz, 1982). They are as follows:

1. *Use-location urgency.* No stock-out is allowed at a use location. These are the most urgent items and must be available to the materials users at all times.
2. *Facility-location urgency.* No stock-out is allowed at a facility. Interdepartmental transfers can be used to satisfy these local stock-outs. However, the item must be available in the facility as a whole.
3. *Regional-location urgency.* No stock-out is allowed for the region. Interdepartmental and interfaculty transfer can be used to satisfy the stockouts, but the item must be available in the region as a whole.
4. *No urgency.* Items for which stock-outs are allowed at all levels.

Service levels and the corresponding safety stock levels can be derived for many items using this categorization. As discussed earlier, if demand from several locations can be pooled, the overall variance of demand is reduced so that safety stock required to provide the same level of customer service is lowered. Thus, in each situation of lowered urgency, fewer total units of inventory are needed.

Costs of stock-outs are influenced by many factors in the health care arena. These factors include the costs of extra materials, personnel inconvenience, personnel and transportation costs, costs of expedited or emergency orders, lost sales, and a myriad of intangibles ranging from mild dissatisfaction of the practitioner staff to the serious impact that a shortage might have on the treatment and health of a patient and the safety of health care providers. It is difficult to quantify the results. Further, there is little correlation between the cost of the item and the costs associated with its stock-out. Careful evaluation is required; the urgency component must be incorporated into all models and plans. ABC analyses are frequently used to identify the items of supply that are most costly to manage (also including the urgency requirements) and therefore require the most attention.

Stock-outs can be prevented on a temporary basis with substitutable products. The substitutability issue is one of great concern to the supply manager and often a difficult one to reconcile with practitioners. A current listing of one- and two-way substitutability of products must be maintained and updated.

CURRENT TRENDS

LO 17.5 Identify the current trends in health care purchasing.

The health care industry is increasingly looking to proven business techniques to improve performance in many functional areas. This desire to adapt more businesslike approaches is a direct result of the DRG system of reimbursement and increased competition. As indicated throughout this discussion, the most significant trend in the area of supply management in hospital settings is simply the magnitude of the importance and resulting attention to efficiency and cost-effectiveness. Two trends are emerging: inventory management and control by a primary source or supplier and use of automation technology.

Primary Supplier

Primary sources assume most of the functions of the supply management department, much the same as the stockless inventory method described earlier. There are many advantages to this arrangement in that manpower costs for the hospital are reduced and redundancy of activities as well as stock is reduced. Perhaps the critical element of the success of such an arrangement is the level of communication and coordination between hospital departments and the supplier. An outside entity may facilitate and optimize these behavioral issues by being objective as well as being interested in the provision of a high level of service.

Automation Technology

There is no doubt that high technology is a main component of health care today. However, the advanced technology associated with hospitals is in the areas of diagnosis and treatment of illness. Using automation technology and sophisticated information systems in the operation of a hospital is becoming more common but is significantly behind the advances in the manufacturing sector. Its time has come, as evidenced in several studies of the implementation of bar coding in pharmacy inventory management (Chester & Zilz, 1989). Results of this application have been reported to be increased efficiency, decreased total inventory costs, improved storage space use, and reductions in inventory values. Automated technology has been implemented for all aspects of hospital supply management.

Impact of COVID-19 Pandemic on the Health Care Supply Chain

COVID-19 created a major disruption of the global health care supply chain. Hospitals are complex organizations providing a multitude of services to patients, physicians, nurses, and staff. These services include dietary, housekeeping, physical plant engineering, pharmacy, laboratory, inpatient treatment (nursing units), surgery, radiology, administration, and others. Each area has specific and often unique materials and supply needs, creating a requirement in these facilities for a supply management system that can provide the necessary supplies (e.g., ventilators, gowns, gloves, masks, face shields, syringes, plasma) when needed. In the current climate of increasing health care costs, perhaps the global health care supply chain has become too lean. The health care supply chain operates at a reasonable level of effectiveness without sacrificing clinical care or loss of life. The functions of the supply chain in the hospital setting are unique to health care, and current trends in the hospital supply chain must be restructured.

ACQUISITION OF CAPITAL EQUIPMENT PROCESS OVERVIEW

LO 17.6 Illustrate the capital equipment acquisition process.

Capital equipment acquisitions require health facilities to go through an internally defined process. Differing corporate policies and preferred methods of financing will impact this process. As an example, the dollar value for an item to be classified as a capital item is $1,000 for a small hospital in Columbus, Ohio, area hospital and $5,000 for a larger hospital in the same market area. Commonalities exist in the capital budgeting/acquisition process among health facilities. A sample of the common appropriations process used at Grant Hospital in Columbus, Ohio, is shown in Figure 17.3.

A capital item request initiates the process. The requesting departments are required to provide information on utilization statistics. It is important that this information be as accurate and precise as possible. An example of an item request form is shown in Figure 17.4. The requests are then reviewed by one or more of the following: a capital item committee, the supply management department, facilities management/plant operations, and the finance department. The approved request is then compared to the overall expected budget. The most appropriate requests are then recommended for funding. It should be noted that even if an item does not "make the cut," contingency funds are established in most hospitals for the emergency replacement of items. This contingency will generally be 10% to 25% of the total budget. (Also see Chapter 16.)

Overview of the Process

Capital item requisition (CIR)
A form used by a hospital department or unit to request capital equipment for patient use.

This **capital item requisition (CIR)** form is divided into two primary sections. The first section is to be completed by the department requesting the item. This section calls for details concerning the type of request, a summary of the requested item's capabilities, how the item contributes to the hospital's goals (specifically those relating to patient care), and the anticipated changes in operating costs.

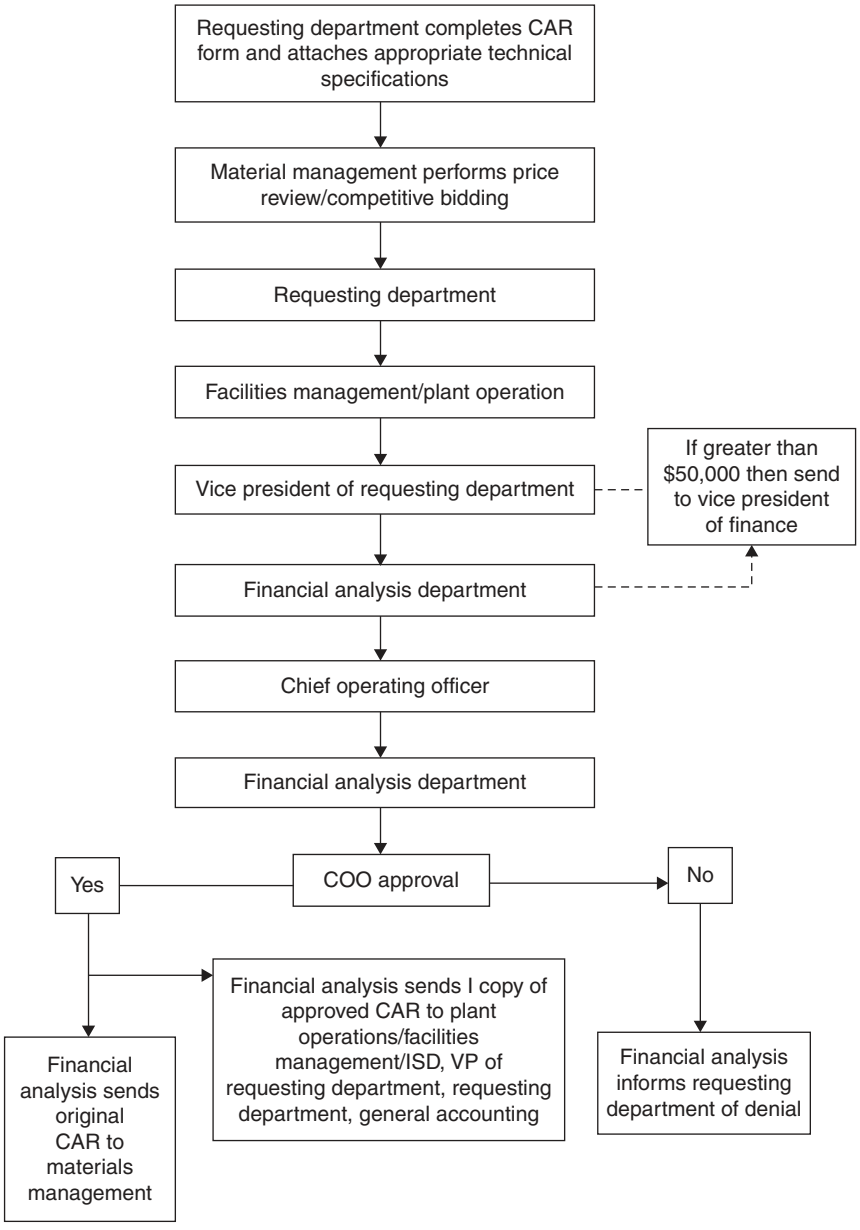
The second section is for the actual financial review of the requested item. This section will be completed by the purchasing department.

Appropriate signatures are required for both sections. It is important not only that the appropriate signatures be obtained but also that the form be completed in its entirety. It is in everyone's best interest that the form is complete and concise since the request must be prioritized. Upon completion of both sections, the CIR should be forwarded to the director of materials management. The approved proposals are then submitted to the appropriate governing board committee (e.g., Finance Committee, Planning Committee). The final step is the approval process.

Factors and Decision Rules

The financial merits of the various proposals are then considered. That is, if two projects are judged to be of equal financial worth, the preference for expenditure would be for the project serving the largest number of people, the one that prevents disease rather than simply preventing fatality, or the one serving children versus the aged. Several qualitative factors are also of utmost importance in identifying capital expenditure projects in health care, namely,

FIGURE 17.3
Capital Appropriation Request (CAR) Process



community need, marketability of the project, urgency for the capital item, competition, and technological need.

1. *Community need* must be given the utmost consideration for capital expenditure project selection. The hospital must be dedicated to serving the needs of the community, and its purchasing practices should reflect this practice.

FIGURE 17.4

Item Request Form Example (to be completed by requesting department)

Facility: DN DW Other Department:_____ Cost Center:_____

Priority:_____

Location of proposed project:_____

Type of Request (As a manner of verifying the request, please include documentation of the regulation requiring the requested item, maintenance records of current unit, or utilization data, whichever is appropriate.) Required by Regulation of Accreditation_____

Replacement of Current Unit _____ Expansion of Existing Service_____

Addition of a New Service _____ Other (Please Explain) _____

Date Needed:_____

Summary description of the requested item, including quantity, components, options, etc.

_____

_____

_____

_____

Will additional space be required for the item? Yes_____ No_____

Will physical plant changes (e.g., plumbing, electrical, heating, ventilation, remodeling, safety codes, etc.) be required?

If yes, provide a brief description of the required physical plant changes and estimated cost for the modifications:

_____

_____

_____

_____

Brief description of the use and capabilities of the requested item:

_____

_____

_____

_____

Please describe how the new item will contribute to hospital goals, specifically those relating to the quality and cost of patient care:

_____

_____

_____

_____

Additional comments (Please describe the present system used to accomplish the same or similar function and why this system is inadequate; what will be done with the existing equipment and other areas that will be affected or will be needed to support the new item):

_____

_____

_____

_____

2. *Marketability* is a concept affecting both the internal and external audience of the facility. In conjunction with the community needs assessment, a hospital should consider how marketable a new piece of equipment will be to the community. Internally, the hospital must "sell" the new item and its virtues to the medical staff. If the administration seeks to purchase a machine that is a "money maker" for the facility or that is to be used to attract new physicians to the facility, the item must be marketable to the current staff. They must see its worth. This will lead to their usage of the machine when appropriate.
3. *Hospital business objectives* relate to whether or not the capital item is for the replacement of current equipment, expansion of current technology, or expansion into a new technological field. From a business perspective, new technology usually is less urgent and more difficult to justify than updating or replacing current technology.
4. *New technology* coupled with external marketability suggests another factor to be considered: *competition*. Hospitals are businesses and must compete. The hospital management, again, should not be telling the community what it needs but must be aware of what is needed and seek to provide for that need on a competitive basis.

The more difficult factor for a hospital to consider when ranking requests is to assess the technology involved. In an often "politically sensitive" arena, the most pressing capital needs must be determined and satisfied by individuals who lack technological as well as medical expertise. Technological assessment can help alleviate this problem.

Technological assessment can be defined as a method of evaluating current and requested capital equipment by considering the results of published clinical investigations and of physical assessment of the equipment in the decision-making process. Three key areas are addressed in technological assessment, namely, the needs of the department, the abilities of the current equipment, and the abilities of new/replacement equipment. The technological assessment is then integrated into the capital item request process.

Technological assessment
A method of evaluating current and requested capital equipment by considering the results of published clinical investigations and of physical assessment of the equipment in the decision-making process.

For technological assessment to occur correctly, priorities must be set beforehand. That is, not all requests will need to undergo as thorough an assessment as will most of the costlier items. Subcommittees are then formed that should include medical personnel who use the equipment as well as physicians. The committee must tour the facility and become familiar with the equipment on hand. Interviews of the personnel who use the equipment should be undertaken. The information gained should be entered into a database. Examples of what the

database should contain are as follows: type of equipment, year purchased, condition, useful life, and whether it will need replacing in the near future (i.e., within 5 years).

When comparing the findings to the predetermined criteria, the committee should be able to rank the needs within and among the departments. The committee members may be aware of ways to upgrade current equipment that would suffice until another capital budgeting year or until a more advanced piece of equipment is released to the market. The suggestions should be brought forth. The committee must consider the strategic goals of the hospital and what equipment (as well as acquisition timing) will be needed to fulfill these goals. This leads to the development of a more comprehensive, multiyear plan. This entire technological process is to promote the efficient allocation of the hospital's resources. Its main points are a comprehensive database, physician involvement, and interdepartmental planning.

Certificate of need (CON) A proposal written by the hospital unit justifying a specific capital equipment item.

A final factor to be considered with capital expenditures is the need in some states for governmental permission to purchase. If the **certificate of need (CON)** is not granted by the state, all the above key factors are meaningless. The goals of a CON law are to protect the consumers, generate benefits for them, and prevent the acquisition of unneeded equipment (i.e., ensure access to quality service at a reasonable cost). Those state officials reviewing CON applications try to determine the need for such a project by looking at the current use of like services and their specific locations. CONs are required in about half of the states, each with varying stipulations for dollar limits and types of purchases. For example, in Ohio a CON is needed for purchases over $1 million for medical equipment, for expenditures over $2 million for capital improvements, or for a project that will entail greater than $450,000 worth of operating cost per year.

Selecting the Right Supplier

Following appropriate justification and formal approval for the acquisition of a new piece of capital equipment, the actual purchasing process begins. The objective of this process and subsequent supplier evaluation is to fulfill a hospital's need with the best equipment for its intended function at the lowest possible total cost. Inherent in the process is the requirement that all segments of the management team be involved in the decision-making process. It must be emphasized that buying the best equipment for a function requires planning several months in advance to enable access to a wide range of vendors and ensure that no opportunities for functional enhancement or cost savings have been overlooked.

Functional Specifications

Before developing an initial base of qualified suppliers, the purchasing and requesting user departments must develop a list of functional specifications that are as detailed as possible. Each specification is to be categorized as a necessary feature, a desirable feature, or a characteristic that is irrelevant or even undesirable. This list of generic specifications will be presented to all prospective bidders and provide a foundation for price competition. It is important that each item specified can be provided by more than one supplier and reflect criteria that can be applied to each seller fairly.

Preference Point System

The preference point system is one useful method of specification. It is not the only one, nor should it be used for all capital equipment purchases. It has proven to be valuable in the purchases of radiology and nuclear medicine equipment and computer systems, but it is certainly not limited to these areas. The system assumes that no two suppliers can offer

identical equipment, the requesting department has identified minimal requirements and preferred characteristics, and it is unlikely that in any fair competitive quotation process a supplier would be able to meet all of the preferences.

Once the functional specifications are detailed as either absolute requirements or preferences, a framework for financial comparisons is provided for the buyer. Degrees of preference are allocated to each characteristic, and usually a point scale of 1–10 is sufficient to identify to vendors the magnitude of a given preference. For example, an option that has 10 points means the buyer is willing to pay 10 times as much for it as for a 1-point option. The hospital will establish a specified dollar amount for each point; however, suppliers will not be informed of this amount. They will only be aware of the relative value placed on each preference.

The assignment of dollar-per-point can pose a problem. In an ideal situation, this would be decided based on the *return on investment* that each specification would contribute, but this is usually almost impossible to determine. The most feasible approach is to survey the market for the expense of an option by analyzing suppliers informally to determine the expected cost. Whatever method is used, dollar amounts should be determined and agreed on internally before the detailed specifications are put out as requests for bids.

Establishing a Bid List

The initial base of suppliers from which to solicit bids will be a subjective list of those already known to the user department. Purchasing can then supplement the list with its own recommendations. Instructions for bidding vary depending on project size and complexity needed for quick delivery, installation, type of institution, and other factors.

Past suppliers' performance can aid in refining a bid list. For instance, suppliers who have failed to provide adequate service or have defaulted on a bid bond may immediately be eliminated. Submitting a preliminary evaluation form to prospective vendors also can help shrink the list by identifying differences among suppliers that may need clarification.

Once a final list is established, a pre-bid conference should be arranged. This meeting involves representatives from all potential vendors and all relevant hospital departments to discuss general perceived requirements of the equipment. It also provides an opportunity to solicit advice and exchange new ideas. Most importantly, the conference ensures that all vendors have heard the same information from the institution.

Bids Evaluation Example	System A	System B
Total bid price	$145,000	$160,000
Preference point	14	76
Dollar value per point	x 250	x 250
Enhancement value	$3,500	$19,000
	145,000	160,000
Adjustment	3,500	–19,000
Comparison	$141,500	$141,000
Decision: Buy System B		

Evaluation of Bids

After bids have been returned, the first step is to review their compliance with the stated specification requirements. In some situations, even though some have been characterized as absolute requirements, deviations will be accepted. This initial appraisal decides immediately if a proposal will be further considered.

When the number of bids has been narrowed down, preference points are then totaled among the different alternatives. The dollar amount of this total is discounted from the total quoted price. This process will sometimes yield a situation in which the highest quoted price turns out to be lower than others when weighted for the enhancements. The following example compares two price quotes that are weighted for enhancements. The main objective is to award the contract based on the highest overall value rather than comparing initial bottom lines.

Final Step

The final step in choosing the right supplier is to derive the total cost of the equipment over its expected life by weighting for service and installation. Installation fees should be known for each vendor, but maintenance and service expenses may not be known. If this is the case, an average weight may be assigned. When all calculations have been completed, the institution should have a price comparison basis that enables it to choose the best equipment for its dollars.

GROUP HEALTH INSURANCE

LO 17.7 Show how various health care plans are evaluated.

Businesses spend hundreds of millions of dollars on group health plans every year, and premiums keep increasing. In 2019, health care costs accounted for approximately 18% of GDP. According to the Kaiser Family Foundation 2018 Employer Health Benefits Survey, the costs for providing health insurance to employees continues to increase: The average premium for family coverage has increased 4% since 2018. With average annual premiums for employer-sponsored health insurance now reaching $19,616 for family coverage, health care benefit costs are clearly a major component of total overhead costs for many firms. Employers have responded to the increased health care benefit costs by moving away from traditional insurance plans to alternatives including consumer-driven plans known as high deductible health plans (HDHP). For a detailed discussion, see the appendix.

SUMMARY

LO 17.1 Identify the complexities a manager may encounter when purchasing in the health care industry.

Hospitals are complex organizations providing a multitude of services to patients, physicians, and staff. The criticality of an item may depend on the restocking lead time, the shelf life, or the special conditions under which the item must be held as well as the effect on hospital operations of a shortage of the item.

LO 17.2 Compare the health care supply chain with the traditional industrial supply chain.

There are critical differences between the health care supply chain and industrial supply chains such as the automotive supply chain. One difference is the manner in which revenue is generated. In traditional industrial supply chains, hospitals have been compensated through cost-based reimbursement systems, leading to little incentive to focus on cost or efficiency.

LO 17.3 Identify the various supply management methods in the health care field.

Traditional inventory control methods used in manufacturing are not common in the hospital setting. Modifications are necessary to fit the health care industry, but the same fundamental theories are used. It is true that no one system is best overall. Certainly the size, purchasing power, and level of control that the supply management department has within the hospital are all factors that must be evaluated. The degree to which the hospital is automated and to which computer systems are integrated is also a factor in the decision in terms of the complexity of the systems models and in the level of calculations required.

LO 17.4 Explain how inventory control is accomplished in the health care field.

With the availability of computers in all areas of health care today, forecasting demand using past data and statistical techniques is a far more realistic possibility than it was in the past. Forecasts are never perfect, but they can assist the supply manager to better control inventory to the best economic advantage of the hospital.

Demand, however, is impacted by several unique factors in health care. For instance, the length of stay and patient mix (types of patients and diagnoses) patterns are fundamental to the assessment of the types of supplies required in any given time frame. This is particularly influential to inventory use in a hospital of 400 beds or fewer.

LO 17.5 Identify the current trends in health care purchasing.

The health care industry is increasingly looking to proven business techniques to improve performance in many functional areas. This desire to adapt more businesslike approaches is a direct result of the DRG system of reimbursement and increased competition. As indicated throughout this discussion, the most significant trend in the area of supply management in hospital settings is simply the magnitude of the importance and resulting attention to efficiency and cost-effectiveness. Two trends are emerging: inventory management and control by a primary source or supplier and use of automation technology.

LO 17.6 Illustrate the capital equipment acquisition process.

Capital equipment acquisitions require health facilities to go through an internally defined process. Differing corporate policies and preferred methods of financing will impact this process.

An example of an item request form is shown in Figure 17.4. The requests are then reviewed by one or more of the following: a capital item committee, the supply management department, facilities management/plant operations, and the finance department.

LO 17.7 Show how various health care plans are evaluated.

Businesses spend hundreds of millions of dollars on group health plans every year, and premiums keep increasing. In 2019, health care costs accounted for approximately 18% of GDP. According to the Kaiser Family Foundation 2018 Employer Health Benefits Survey, the costs for providing health insurance to employees continues to increase: The average premium for family coverage has increased 4% since 2018. With average annual premiums for employer-sponsored health insurance now reaching $19,616 for family coverage, health care benefit costs are clearly a major component of total overhead costs for many firms.

KEY TERMS

Capital item requisition (CIR) 418
Certificate of need (CON) 422
Independent-demand purchased items 406
Technological assessment 421

DISCUSSION QUESTIONS

1. Discuss the purchasing process for supplies and services in the health care field.
2. Discuss the purchasing process for capital acquisition in the health care field.

3. How does supply management work in the health care industry?
4. Define group purchasing in the health care field.
5. What are the various health care plans available to employers and employees? What is the trend for purchasing health plans? (see appendix).
6. What percentage of the GNP is accounted for by the health care sector?

SUGGESTED CASES

Case 18: Medical Laser Equipment, Inc. (C)

Case 26: Sage Imaging Center, Inc.

Case 27: Simpson Hospital Systems

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APPENDIX: PURCHASING HEALTH CARE PLANS

U.S. businesses spend hundreds of billions of dollars on group health plans every year. Premiums continue to grow. Table 17.2 shows the percentage of covered workers in the United States for each of the main types of group medical insurance. In 2018, health care costs accounted for approximately 18% of GDP. According to the Kaiser Family Foundation 2018 Employer Health Benefits Survey, the costs for providing health insurance increased by 3% for single coverage and by 5% for family coverage, since 2017. The average family premium increased by 55% since 2008, and by 20% since 2013. The average cost of a family PPO plan has surpassed $20,000 a year. Most public and private organizations tend to reevaluate their health care options every year. Health care benefit costs have clearly dominated overhead expenditures. Employers are responding to the increased health care benefit costs by moving away from traditional employer-sponsored insurance plans to lower-cost alternatives.

1. *Traditional plan.* A major advantage of traditional group medical insurance is the flexibility. Under this plan, employees can go to any specialist without a referral, and the insurance company has no say as to whether the visit is necessary. Unfortunately, for people who prefer this flexibility, few employers offer traditional group medical insurance anymore. Traditional plans have become too expensive for most private and public organizations to maintain.
2. *Health maintenance organization (HMOs).* HMOs control costs by creating a network of doctors and hospitals to provide services based on negotiated rates. The employees are restricted to the doctors and hospitals that are participating in the network. Employees must switch doctors to participate.
3. *Preferred provider organizations (PPOs).* A PPO operates similarly to HMOs but with more flexibility. PPOs control costs by creating a network of doctors and hospitals to provide services based on negotiated rates but without the restrictions. PPO insurance will pay if you see a nonnetwork provider, but it may be at a lower rate.
4. *Point of service (POS).* A POS plan is a hybrid between the HMO and PPO plans. As with an HMO, members choose a primary care physician who will provide referrals when needed. Participants are free to visit out-of-network providers if they desire, with or without a referral, and the plan will still cover a portion of the expense (which is usually higher).
5. *High deductible health plan (HDHP).* A HDHP, also known as consumer-driven health care, is an employee health plan with low premiums, high deductibles, and tax-exempt savings accounts. These plans are intended to encourage employees to regularly make cost-conscious health care decisions while still providing coverage for catastrophic illness.

The first step in purchasing health insurance for a private or public organization is to engage an experienced broker. The broker must be licensed by the state to sell and service contracts of multiple health plans or insurers.

TABLE 17.2

Percentage of Covered Workers in the United States for Each of the Main Types of Group Medical Insurance

	Traditional	HMO	PPO	POS	HDHP/SO
1988	73%	16%	11%	N/A	N/A
1993	46%	21%	26%	7%	N/A
1998	14%	27%	35%	24%	N/A
2003	5%	24%	54%	17%	N/A
2008	2%	20%	58%	12%	8%
2013	<1%	14%	57%	9%	20%
2018	<1%	16%	49%	6%	29%

18 Sourcing Professional Services

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to:

18.1 Explain the service sector characteristics and strategies.

18.2 State the trends impacting the outsourcing of services domestically and globally.

18.3 State challenges that may arise in managing outsourced services in terms of complexity, coordination, power, and dependence.

18.4 Identify the activities involved in procuring professional services.

18.5 Discuss what is meant by scope of work.

18.6 Discuss how the critical path method is used to plan, schedule, and control complex projects.

Brian Price is currently financing his master's degree by working as a freelance photographer in Southern California. He is a member of the new gig economy. It has been estimated that 30% to 40% of the U.S. workforce make up the gig economy. Numerous other services are also delivered in the form of transactions on online platforms that connect individuals and companies.

Online outsourcing sits at the intersection of temporary staffing services and traditional outsourcing. The tasks involved are usually relatively small and independent of other activities (e.g., translation services, video editing services) although some platforms specialize in facilitating larger and longer-term relationships. For some of the knowledge workers who freelance on platforms like Upwork, the possibility of working remotely and choosing your own hours is the key selling point. For others, trying to earn a living is an exhausting uphill battle.

Buyers considering using these platforms should always ask "what can go wrong?" Buyers must ensure a fit between the tools

and monitoring provided by the platform and the nature of the services and information to be transferred. For buyers seeking specialized skills to fulfill a temporary need, accessing the global marketplace through the online gig economy is an option worth considering.

INTRODUCTION

Over the past 70 years, the service sector has taken on an increasingly important role in the world economy. In the United States, jobs in the service sector have increased from just less than 50% of the total jobs in the U.S. economy to nearly 80% of the total jobs in the U.S. economy. In the past 30 years, much of this growth has occurred in professional and business services, private education and health care, and leisure and hospitality industries. Many organizations in the service sector, especially those offering transportation, financial, and communication services, have encountered changes in their regulatory environment and technological structure. These changes have opened up new global markets but at the same time forced service industries to determine ways in which to remain competitive, or they would cease to exist.

Expanding competition, emerging technologies, and improved communications have altered most of the customers' tolerance for less than full satisfaction with the products and services they receive. In recent years, many manufacturing and service firms have been challenged to increase their focus on customer satisfaction and quality of service. These organizations also have had to increase productivity and quality and decrease cost of service while dealing with the demands of changing technology. For service sector firms, the responses to these challenges often have resulted in making their operations more "manufacturing-like." For example, service sector firms have adapted bar-coding and RFID procedures from manufacturing, using them not only for scanners at checkout counters but also for such diverse applications as tracking auto rentals and identifying hospital patients. At the same time, manufacturing firms have been increasing the emphasis on the "services" they provide to external and internal customers. Remaining in the service sector are many operations for which direct personal contact between customers and service providers must occur. Direct customer contact is increasing in the manufacturing sector as manufacturing flexibility allows more customized design. The need for employees in all types of organizations to recognize and be able to provide high-quality, efficient service to customers has become essential. The importance of a responsive workforce, able to execute procurement activities in keeping with organizational objectives, cannot be overstated.

One purpose of this chapter is to review characteristics and strategies of service-producing organizations. The characteristics are related to various strategies available to service organizations for achieving productivity; managing capacity, growth, and change; and differentiating services to be competitive. This chapter also addresses the procurement of professional services. Two real-world professional service sourcing examples are given in Appendices B and C.

SERVICE SECTOR CHARACTERISTICS AND STRATEGIES

LO 18.1 Explain the service sector characteristics and strategies.

In the last 45 years, researchers and writers in the field of operations management have noted the differences and similarities between characteristics of operations in the service sector and in manufacturing. Some of the generally agreed-on characteristics are shown in Table 18.1. Table 18.1 gives the extreme characteristics most often associated with "pure services" or "pure manufacturing." These characteristics have been divided into those describing operations, the product or service, employees, response time, and location. Most of the characteristics of manufacturing and service operations fall along a continuum between the two extremes given in the table. In categorizing the operations of any given organization, a complicating factor is that individual operations of different segments of a service or goods-producing organization may fall on entirely different parts of the continuum from other segments in the same organization.

That distinction is important because everyone in every type of business sells some element of service. In pure service businesses any transfer of a physical or concrete product is incidental to the service—for example, the written report of a management consultant. Pure service businesses include architects, universities, banks, airlines, accounting firms, law firms, plumbing repair companies, motion picture theaters, and management consulting

TABLE 18.1
Service Sector Characteristics Versus Manufacturing Characteristics

Focal Point	Service Sector Characteristics	Manufacturing Characteristics
Operations	Humanistic Volatile, uncertain Labor intensive Decentralized System malfunction directly affects the customer Difficult to balance resources available with demand Customer is part of the process	Technocratic Stable, predictable Capital intensive Centralized System malfunction affects the customer only indirectly if at all Easy to balance resources available with demand Customer is isolated from the process
Product or service	Simultaneous production and consumption Performed on an individual basis, customized Intangible, perishable Demand is time dependent; in general, no back orders Cannot be inventoried Cannot be transported Cannot be mass-produced	May be produced ahead of time Mass product, standardized Physical, durable Can have back orders Cannot be inventoried Cannot be transported Cannot be mass-produced
Employees	Loosely supervised Must be able to interact with public High personal judgement required High contact with customers Wages may be based on hours worked	Closely supervised Need technical skills only Low personal judgement required Low or no contact with customers Wages may be based on output
Response time	Short	Long
Location	In local markets Near customer	National or international markets Near supply labor or transportations

Source: Adapted from Siford, S. P., Benton, W. C., & Ritzman, L. (1992).

firms. A one-size strategy does not fit all for service businesses. The service sector strategies depend on the specific characteristics of the service sector business. As an example, the uniqueness of the airline industry and plumbing repair sector is impressive. All service sector businesses must develop effective strategies to protect its competitive position. The pricing strategy for Southwest Airlines is based on demand and seat miles for specific routes. Depending on the type of law practice, the pricing strategy could be hourly or one third of the settlement.

In general product sector businesses, the physical reality of the product provides a powerful base on which to develop well-defined business strategies. The question is significantly more difficult for service sector businesses to answer because services are more abstract than products.

OUTSOURCING AND THE SERVICE SECTOR

LO 18.2 State the trends impacting the outsourcing of services domestically and globally.

The service sector has become the engine of growth for the American economy, fundamental to the health and prosperity of U.S. businesses large, medium, or small. Service companies engaged in every type of commercial activity—manufacturing, transportation, energy and utilities, retail and wholesale trade, finance and government—rely on the edge that service firms offer to be integral to their business success. Just as service firms have found a sustainable niche in the United States, many of these companies have expanded to the global arena. Today, U.S. service companies are disseminating knowledge and technology throughout the world. The U.S. government led the effort to complete the North American Free Trade Agreement (NAFTA) between the United States, Canada, and Mexico, as well as its revision to the USMCA. It addresses issues related to trade in service industries as well as physical goods (see Chapter 15 for NAFTA Statistics). Service providers bring hundreds of billions of dollars and thousands of high-wage jobs to the U.S. economy through global transactions. The two fastest-growing outsourced service industries are information services and professional services.

Increasingly, American firms are outsourcing their information technology and services globally. Information services and information technology products have become fundamental to the overall growth and development of the U.S. economy and others around the world. With the development and growth of the Internet, virtually every sector of the economy employs information technology and services in its operations.

The professional business services sector is also becoming a major outsourced business sector. Through innovation and improvements in information technology, U.S. businesses are outsourcing many of their noncore professional services domestically and globally.

MANAGING OUTSOURCED SERVICES

LO 18.3 State challenges that may arise in managing outsourced services in terms of complexity, coordination, power, and dependence.

As outsourced services are used with more frequency, it is important to understand the challenges that come into play when managing these resources. These challenges can be categorized among four factors: complexity, competition, power, and dependence.

Complexity and Coordination

Service sector businesses attribute two thirds of U.S. gross domestic product and nonfarm private-sector employment. The service sector accounts for about 80% of U.S. economic growth. Notwithstanding the prevalent role that the service sector now plays in nearly every industry, many firms struggle to realize the performance benefits they sought when deciding to outsource. Indeed, numerous industry sources (e.g., Bain & Co., Booz Allen Hamilton, and Dun & Bradstreet) have estimated that 30% to 50% of outsourcing organizations fail to realize their performance expectations. Many buying organizations ignore the significant expense related to managing the relationship. A Deloitte Consulting report found that 62% of outsourcing firms indicated they required more management resources than initially estimated (Landis, Mishra, & Porrello, 2005). These additional expenses are referred to as the "hidden costs" of outsourcing. Given the number of studies identifying these costs, it is not apparent that they are actually hidden. Yet it is clear that firms experience difficulty in accurately estimating the costs of outsourcing beyond simply supplier cost and profit. The provider relationship management costs become even more impressive in the complex globalized context.

In 2006, the Commonwealth of Virginia entered into a 10-year, $2.3 billion information technology service contract with Northrop Grumman Corporation (Towns, 2009). This disappointing relationship sheds light on many of the challenges for the buying organization. In 2009, the Joint Legislative Audit and Review Commission (JLARC) released a scathing assessment of the initiative's progress and impact on the 72 in-scope agencies (JLARC, 2009). The report outlines several performance shortfalls, including severely missed milestones, operational disruptions at multiple agencies, and unsatisfactory network reliability. Among the causes cited for this disappointing performance are inadequately understanding the *complexity* of the engagement, poor communication and coordination between internal and external stakeholders, inadequate contractual provisions, and an ill-defined and incomplete performance measurement system (PMS). This nonanomalous example illustrates two common challenges firms face in managing interorganizational relationships: control and coordination.

Several prior studies have identified control and coordination as two necessities for managing interorganizational relationships effectively (Dibbern, Winkler, & Heinzl, 2008). The successful buying organization must align the service provider's behaviors with the buying firm's interests. Aside from these behavioral concerns, the performance of the service provider relationship also depends on effectively integrating processes, resources, and information across firm boundaries (i.e., coordination). The time, effort, and resources associated with achieving adequate levels of provider control (i.e., *control costs*) and interfirm coordination (i.e., *coordination costs*) are prominently noted "hidden costs" with outsourcing. Given the difficulties firms experience in estimating these extra costs, few buying organizations understand the importance of control and coordination.

Transaction cost theory Asserts that complexity enhances the risk of opportunism and the need for costlier formal control mechanisms.

Information processing theory Contends that greater complexity is associated with the need for more expansive coordination mechanisms.

The Virginia JLARC report identified complexity as a root cause of the control and coordination difficulties experienced in the commonwealth's relationship with Northrop Grumman by asserting that "complexity of the state's IT environment was not understood." This industry observation is consistent with two prominent theoretical perspectives that emphasize the salient role of complexity in causing interfirm control and coordination difficulties. **Transaction cost theory** asserts that complexity enhances the risk of opportunism and the need for costlier formal control mechanisms. Likewise, **information processing theory** contends that greater complexity is associated with the

need for more expansive coordination mechanisms (Tanriverdi, Konana, & Ge, 2007). Thus, these established theoretical perspectives as well as observations from practice suggest that an important point of departure for understanding factors contributing to greater control and coordination costs is the complexity of the outsourcing engagement. Complexity is a multifaceted construct examined in an array of fields. The two broad categories of factors that contribute to the overall complexity of the outsourcing engagement are task-specific complexity factors (i.e., scale, breadth, and customization) and location-specific complexity factors (i.e., geographic dispersion, geographic distance, and cultural distance). The decision to focus on task- and location-specific complexity and no other complexity dimensions was motivated by three considerations. The extant literature recognizes task- and location-specific factors as important outsourcing considerations that contribute to complexity and the often underestimated control and coordination costs in interorganizational relationships. Accordingly, buying organizations must address the following question when assessing the merits of service providers' performance: How does the task- and location-specific complexity of the outsourcing service influence the extent to which our (the customer) organization incurs control and coordination costs?

The primary managerial concern is the examination of how salient decisions are made regarding the scope and location of the outsourced work. Task- and location-related decisions may have an influence on the extent to which control and coordination costs are incurred. This deficiency is especially true with respect to coordination costs as there is scant empirical research linking *either* task- or location-specific complexity factors to interfirm coordination costs. Buying organizations must deploy effective control mechanisms to manage control and coordination tasks.

Control and coordination complexity make it more difficult to develop and maintain a completely specified contract. They also make it more difficult to deploy monitoring mechanisms to reduce information asymmetry. The combined effect translates into a greater concern for provider opportunism and the need for more elaborate (and costly) formal controls. The scale of the service, and to a lesser degree the breadth of activities, is also associated with uncertainty. This elevated uncertainty corresponds to greater information processing and coordination requirements.

Larger and more broadly defined outsourcing operations require more extensive interorganizational management resources. These additional expenses may include (but are not limited to) a larger retained management team, developing and maintaining a more complex formal contract, establishing a more elaborate performance monitoring and evaluation program, and more extensive information systems integration, among others. Many outsourcing organizations acknowledge the need for more managerial resources than originally planned (Handley & Benton, 2011). In some cases, it may be that the resources needed to control and coordinate effectively with the provider will largely nullify the benefits of lower labor rates, provider economies of scale, and so forth. Hence, outsourcing organizations must be especially cautious about establishing large, task-diverse arrangements. Outsourcing firms should consider establishing more narrowly scoped relationships. From a managerial perspective, exhaustively evaluating outsourcing opportunities from a strategic perspective allows firms to enter the arrangement with more realistic financial expectations and allows them to focus on critical management factors to mitigate potential strategic risks.

Service customization may be associated with specialized provider investments that in turn increase the commitment for the service provider, not the buyer. This diminishes the service

provider's proclivity to act opportunistically (Handley & Benton, 2013). This reasoning is consistent with evidence that greater provider relationship-specific investments are associated with a lower risk of opportunism. Customized services require greater information exchange and open lines of communication early in the outsourcing process. This may enhance the relationship quality from the outset, which mitigates the need for costly formal controls.

As the relationship involves more countries, it becomes characterized by greater diversity in the legal and regulatory regimes, as well as more dispersed operational responsibility. These factors serve as obstacles to managing fully specified contracts and monitoring provider behavior and outcomes. Uncertainty also increases with the number of geographic locations. This enhanced uncertainty may contribute to greater information processing and coordination requirements. Greater geographic separation complicates monitoring of the service provider's activities and exacerbates information asymmetry. This will lead to a more amplified risk of opportunism and the need for more elaborate and costly formal control mechanisms. Geographic proximity is also noted to facilitate communication and knowledge transfer, which are central to effective coordination. Thus, all else equal, as the geographic distance between customer and provider locations increases, the costs associated with achieving adequate interfirm coordination also increase.

In some cases, geographic coverage may be a service requirement that the customer has stipulated. In such situations, the outsourcing firm needs to be prepared to have the proper resources in place and their cost accounted for. This may include the expenses associated with developing a more complex contract, ensuring that the various legal and regulatory frameworks are being followed, deploying more elaborate monitoring mechanisms, investing in integrated information systems, accounting for the need for more extensive travel to the provider's operations, and retaining a larger management team. Depending on the competitiveness of the supply market, the customer may be able to ask the service provider to bear some of these expenses. In other cases, the outsourcing customer may bear the entire cost. Either way, these insights should assist outsourcing organizations in developing a more realistic business case. In other cases, these geographic and cultural characteristics may simply be a result of the chosen service provider's existing global footprint and not a customer requirement. If this is the case, buying organizations should factor in the impact on control and coordination costs when comparing the relative attractiveness of potential service providers.

Dependence and Power

Dependence power of A over B is equal to and based on the dependence of B on A. Thus, in an interorganizational exchange, the expectations of each party for the other's use of power will be a function of their perception of which firm has a dependence advantage.

The prior section highlighted issues particularly relevant in global outsourcing agreements. This section highlights issues particularly relevant in services that are difficult to measure. Consider the example of construction services. The different kinds of work are highly interdependent (e.g., architecture, construction), making it extremely difficult to assign responsibility for shortfalls. At the same time, the different parties often have different understandings of how difficult and expensive it is to perform various services, and different abilities to assess the quality of the outcome. This makes it possible for a professional service provider and its customers to have mismatched perceptions of which party is dependent on

the other and simultaneously creates opportunities for opportunistic behavior such as shirking, cheating, and overcharging.

Research by Handley, de Jong, and Benton (2019) (see Appendix A) shows that when a professional service provider perceives that its customer has a strong position (a dependence advantage) and is engaging in aggressive business tactics (such as offering rewards and punishments or threatening to sue), the service provider tends to respond negatively by increasing its opportunistic behavior. As one of the managers interviewed explained, "Bullying the supplier does not pay off over the long run." This does not imply that the buyer should not try to influence the supplier's behavior. To the contrary, when the professional service provider perceives that its customer has a dependence advantage and the customer uses expert power (i.e., holds valuable information or expertise) and referent power (i.e., other firms want to identify or associate with it) as influence tools instead, it tends to respond with lower levels of opportunism. Finally, students should note that when the service provider is the party with the dependence advantage, aggressive tactics are still a bad idea in this business context. If pursuing a career in purchasing professional services, students should focus on acquiring relevant technical expertise and a good reputation to get the best work from their future suppliers.

PURCHASING PROFESSIONAL SERVICES

LO 18.4 Identify the activities involved in procuring professional services.

The purchasing of professional services is gaining exceptional attention. Thomas discussed growth strategies for service operations and how these strategies were different from those for manufacturing operations (Thomas, 1978; Wessel, 1989). He based his discussion on a classification scheme that separates service into equipment-based and people-based. The spectrum of service businesses is given in Table 18.2. IBM has evolved into a solutions provider. As a solutions provider, IBM delivers its hardware and integrates the hardware with software to produce business solutions. On the other hand, Cisco Systems is a product provider that focuses on product innovation. Perhaps the largest growth has come from the governmental sector. Federal, state, and city governments are hiring fewer people and outsourcing their tasks. As an example, the Federal Highway Administration (FHWA) and state departments of transportation (DOTs) outsource the design, construction, and inspection of new highways and bridges. Unlike manufacturing, it is more difficult to measure the performance of design consultants, contractors, and inspectors.

LO 18.5 Discuss what is meant by scope of work.

Statement of Work or Scope of Work

The **statement of work** or **scope of work (SOW)** is the area in an agreement where the work to be performed is described. The SOW should contain any milestones, reports, deliverables, and end products that are expected to be provided by the performing party. The SOW should also contain a timeline for all deliverables. Sometimes there is a lack of specificity when two parties disagree on what should have been delivered and a review of the SOW does not support one interpretation over the other. This problem is common in loosely specified agreements and is often where disputes arise.

Statement of work/ scope of work (SOW) The area in an agreement where the work to be performed is described.

TABLE 18.2
Types of Service Organizations

Service Basis	Dominant Labor Force	Examples
Equipment	Automation	Vending machine
	Automatic	Car wash
	Relatively unskilled operators	Motion picture theaters
		Dry cleaners
	Skilled operators	Airlines
		Excavation
People	Unskilled labor	Lawn care
	Skilled labor	Appliance repair
		Catering
	Professionals	Lawyers
		Professional engineers
		Accountants
		Business Consultants

The SOW is the most important component of highway and bridge design contracts. The SOW is an agreement between the project owner (the FHWA and a specific state DOT) and the contractor. The first step in the sourcing of a bridge design professional services contract for the governmental owner is a request for a letter of interest from prequalified bidders. The letter of interest includes company financial information, reputation, qualifications of key personnel, history on similar projects, and the proposed project approach. The letter of interest is usually limited to not more than 12 pages. Predetermined criteria are used to determine the successful bidder. Some of the criteria include capacity, reputation, performance on past projects, the project approach, and financial health. The formal negotiations process follows the SOW. To illustrate the level of complexity, the SOW for an actual FHWA project is given in Appendix B.

Project Management

The management of the project is the last line of defense. If the SOW is adequate, the right contractor is selected, and the ultimate price is reasonable, then a good management effort will secure the project. A poor management effort will undo all three pre-execution achievements. On the other hand, if the project is in trouble when the execution starts, a good project management effort can bail it out, and, conversely, a poor effort will put the final nail in the coffin. To be successful, the project must come in meeting the SOW specifications, on time and within budget.

The duties and responsibilities of the project or contract manager are diversified. The precise duties depend on the owner's organization. The skill and experience of the contractor are the ultimate determinants of a successful project.

Two important factors for successful project management are

1. adequacy of site management and
2. relationship between the owner and the contractor.

Costs are often divided into two categories, direct and indirect costs, defined as follows:

1. *Direct costs* include materials, labor, and subcontract expenditures associated with the actual implementation (subdivided into various accounting codes to reflect the actual work, the work breakdown structure [WBS]).
2. *Indirect costs* are all other expenditures, sometimes referred to as hidden costs.

The tasks involved in a typical complex project are given here:

1. Establish a reasonable budget.
2. Know where expenditures are being made.
3. Forecast final expenditures.
4. Identify problem areas by comparing expenditures and budgets.
5. Apprise contractors and managers of the information early so that actions can be taken to achieve enhanced economies.
6. Determine total cost of each labor classification.
7. Labor crew productivity must be maximized.
8. The field manager must properly balance the indirect costs to achieve the maximum level of efficiency.
9. Contractors/managers must be assigned indirect cost center responsibility early.
10. Joint reviews of indirect cost must take place on a scheduled basis.
11. Tracking curves or lists must be used to monitor budgeted versus actual costs.
12. Work hours must be controlled.
13. At least a 20% productivity improvement over previously established norms for the type of work in question must be established.
14. Labor budgets must be available to the owner early in the project.
15. Measures of actual performance against budgeted performance must be collected accurately. The data must be reliable.
16. The data should then be used for decision-making.

17. Labor productivity, or effectiveness, should be tracked for each of the direct labor accounts.

$$\text{Labor Productivity} = \frac{\textit{Actual usage (direct labor hours)}}{\textit{Budgeted usage (direct labor hours)}}$$

Historical plots are useful for tracking labor productivity.

18. Subcontracts should be issued to cover both direct and indirect work activities.
    - Direct activities—well-defined scope of work
    - Indirect activities—work only on necessary activities
19. Changes to the contracts must be strictly controlled and documented. If not documented, what are the possible outcomes? See the change order form shown in Figure 18.1.
20. Schedule control is essential to the success of any complex project.
21. Major projects are a complex effort to mobilize and coordinate large numbers of personnel, materials, and equipment.
22. Good schedule control is to develop a plan, implement the plan, monitor execution of the plan, and make changes to the plan when necessary to meet the target.
23. The master schedule is generally a logical network-type schedule that reflects perfect execution plans, the strategy, equipment delivery estimates, and engineering plans. Project milestones must be reviewed and assessed.
24. Gantt charts or CPM should be used to assess progress.

Project Planning and Scheduling Processes

Planning must be done before performing any function. A schedule is a time-phased plan. The principal use of schedules in the implementation process is discussed next.

Before Starting Project

1. Provides an estimate of the time required for each portion of the project as well as for the total project
2. Establishes the planned rate of progress
3. Forms the basis for management to issue instructions to subordinates
4. Establishes the planned sequence for the use of manpower, materials, machines, and money

During Project

1. Enables the contractor and the administrator to prepare a checklist of key dates, activities, resources, and so on
2. Provides a means for evaluating the effects of changes and delays

FIGURE 18.1
Change Order Example

CONSTRUCTION CONTRACT CHANGE ORDER *for*
• Contractor (no assignment)

Change Order No. _____
RFP/EWA No. _____
Change Order Amount _____
Document No. _____
Encumbrance No. _____

Project Name _____

Contractor_____

Name/Address _____

PSC Project No._____

Project No. _____

Division of Work _____

Contractor Project No. _____

The above referenced contract is hereby amended to provide for the following described change(s) upon the terms set forth below:

Contractor shall provide: (SCOPE)

Original Calendar Days to Complete the Work	_____	**Original Contract Amount**	**$** _____
Increase/(Decrease) in Calendar Days by Previous Change Orders	_____	**Total of Previous Change Order(s)**	**$** _____
Increase/(Decrease) in Calendar Days by this Change Order	_____	**Increase/(Decrease) by this Change Order**	**$** _____
Current Calendar Days to Complete the Work	_____	**Revised Contract Amount**	**$** _____
Revised Substantial Completion Date	__/__/__		

As changed hereinabove, the above referenced contract shall continue in full force and effect.

CLASSIFICATION (for internal use only)										BUDGET/SCOPE (for UI use only)	
Client Request		PSC Error		CM Error		Code/ Stds		Unforeseen Conditions		Does NOT affect project budget and/or scope	
Staff Changes/ Scope		PSC Omission		CM Omission		Delivery/ Schedule		Closeout		Affects project budget and/or scope (see attached documentation)	

Chart *	Fund *	Organization *	Account *	Program *	Activity	Location

THE UNDERSIGNED HEREBY CERTIFY THAT THIS CONTRACT CHANGE ORDER IS GERMANE TO THE ORIGINAL CONTRACT AS SIGNED AND THAT THE CIRCUMSTANCES NECESSITATING THIS CONTRACT CHANGE ORDER WERE NOT REASONABLY FORESEEABLE AT THE TIME THE CONTRACT WAS SIGNED. THIS CONTRACT CHANGE ORDER IS IN THE BEST INTEREST OF ACME SERVICES INC AND IS AUTHORIZED BY LAW.

PSC/CM/Contractor Approvals

_____ Date _____
Contractor

_____ Date _____
Construction Manager (CM) (if applicable)

_____ Date _____
Professional Services Consultant (PSC)

Acme Services Inc Approvals

_____ Date _____
Service Manager

_____ Date _____
UOCP&RES (Change Orders $50,000 or more)

If this change is $250,000 or more, the following additional signatures are required:

_____ Date _____
General

_____ Date _____
Counsel

Document Source: Template No Changes Contract Type: Capital Contract Sub Type: Construction

3. Serves as a basis for evaluating progress
4. Aids in the coordination of resources

After Completion of Project

1. Permits a review and analysis of the project as actually carried out
2. Provides historical data for improving future planning and estimating

Gantt Chart (or Bar Chart) Method

Gantt charts are useful tools for planning and scheduling projects. Gantt charts accomplish the following:

- Allow you to assess how long a project should take
- Lay out the order in which tasks need to be carried out
- Help manage the dependencies between tasks
- Determine the resources needed

Progress Curves

Progress curves are useful tools when a project is under way. Progress curves

- Monitor progress. You can immediately see what should have been achieved at a point in time.
- Allow you to see how remedial action may bring the project back on course.

LO 18.6 Discuss how the critical path method is used to plan, schedule, and control complex projects.

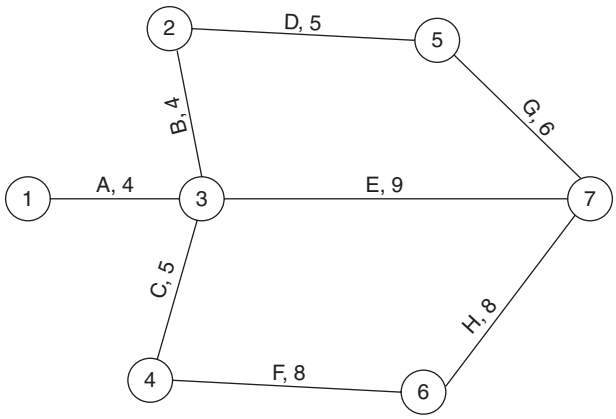
The Critical Path Method

The critical path method (CPM) is a robust logical system for planning and scheduling using bar charts. CPM is a graphical representation of the interrelationships of the various project activities. With CPM, the contract administrator can assess the status of the project at any time, and it enables the contract administrator to monitor and revise scheduling during the project to meet the desired completion date. Specifically, the CPM establishes the following:

- The quantity of work for each activity
- The startup and sequence or order in which the work or activity is to be done
- The rate at which the work will be performed to reach completion

The CPM network consists of arcs and nodes. The arcs represent the actual activities while the nodes (events) represent when the activity starts and finishes. Each node (event) combination between two nodes is unique. The end of one activity is the start

FIGURE 18.2
Simple Network Diagram



of a succeeding activity. The times on the activities (arcs) represent the duration for the specific activity. Each activity is identified by letters on the arcs. In general, the network diagram represents logical relationships between the activities to complete the project. Unlike a tabular list of project activities, the network diagram can be manipulated mathematically.

In Figure 18.2, A is the beginning of the project and must be completed before B, E, and C can start. B, E, and C can then start at the same time. D must be completed before G can begin, and F must be completed before H can start. G, E, and H must be completed before the project can finish.

The critical path is represented by the longest path through the network from Node 1 to Node 7. Thus, the critical path for Figure 18.2 is A–C–F–H, which totals 25 days. There could be more than 100 activities in a typical project. In most large, complex projects, CPM-related computer software is implemented. This discussion of CPM is not meant to be exhaustive; 16-week courses are sometimes dedicated to the topic.

Steps in CPM Project Planning

1. *Specify each individual activity.*

   From the WBS, a listing can be made of all the activities in the project. This listing can be used as the basis for adding sequence and duration information in later steps.

2. *Sequence the activities.*

   Some activities are concurrent with other activities. A listing of the immediate predecessors of each activity is useful for constructing the CPM network diagram.

3. *Draw the network diagram.*

Once the activities and their sequencing have been defined, the CPM diagram can be drawn.

4. *Estimate activity completion time.*

   CPM is usually used for projects with predictable task times. CPM is a deterministic model that does not take into account variation in the completion time, so only one number is used for an activity's time estimate.

5. *Identify the critical path.*

   The critical path is the longest-duration path through the network. Activities located on the critical path cannot be delayed. Because of its impact on the entire project, critical path analysis is an important aspect of project planning.

   The critical path can be identified by determining the following four parameters for each activity:

   - ES—earliest start time: the earliest time at which the activity can start given that its precedent activities must be completed first
   - EF—earliest finish time, equal to the earliest start time for the activity plus the time required to complete the activity
   - LF—latest finish time, equal to the latest start time for the activity plus the time required to complete the activity
   - LS—latest start time, equal to the latest finish time minus the time required to complete the activity

   The *slack time* for an activity is the time between its earliest and latest start time or between its earliest and latest finish time. Slack is the amount of time that an activity can be delayed past its earliest start or earliest finish without delaying the project.

   The critical path is the path through the project network in which none of the activities have slack, that is, the path for which ES = LS and EF = LF for all activities in the path. A delay in the critical path delays the project. Similarly, to accelerate the project it is necessary to reduce the total time required for the activities in the critical path.

6. *Update CPM diagram.*

   As the project rolls through time, the actual task completion times will be known and the network diagram can be updated to include new information. A new or multiple critical paths may emerge, and the project requirements must be updated.

7. *CPM crashing.*

   Speeding up the project is referred to as crashing. As an example, an activity must be located on the critical path. There is a crash cost associated with any feasible activity on the critical path.

SUMMARY

LO 18.1 Explain the service sector characteristics and strategies.

In the last 45 years, researchers and writers in the field of operations management have noted the differences and similarities between characteristics of operations in the service sector and in manufacturing. In pure service businesses any transfer of a physical or concrete product is incidental to the service—for example, the written report of a management consultant. Pure service businesses include architects, universities, banks, airlines, accounting firms, law firms, plumbing repair companies, motion picture theaters, and management consulting firms. A one-size strategy does not fit all for service businesses.

LO 18.2 State the trends impacting the outsourcing of services domestically and globally.

The service sector has become the engine of growth for the American economy, fundamental to the health and prosperity of U.S. businesses large, medium, or small. Service companies engaged in every type of commercial activity—manufacturing, transportation, energy and utilities, retail and wholesale trade, finance and government—rely on the edge that service firms offer to be integral to their business success.

LO 18.3 State challenges that may arise in managing outsourced services in terms of complexity, coordination, power, and dependence.

The service sector accounts for about 80% of U.S. economic growth. Notwithstanding the prevalent role that the service sector now plays in nearly every industry, many firms struggle to realize the performance benefits they sought when deciding to outsource.

LO 18.4 Identify the activities involved in procuring professional services.

The purchasing of professional services is gaining exceptional attention. Thomas discussed growth strategies for service operations and how these strategies were different from those for manufacturing operations. The scope of work (SOW) is the area in an agreement where the work to be performed is described. The SOW should contain any milestones, reports, deliverables, and end products expected to be provided by the performing party. The SOW should also contain a timeline for all deliverables.

The management of the project is the last line of defense. If the SOW is adequate, the right contractor is selected, and the ultimate price is reasonable, then a good management effort will secure the project. A poor management effort will undo all three pre-execution achievements. On the other hand, if the project is in trouble when the execution starts, a good project management effort can bail it out, and, conversely, a poor effort will put the final nail in the coffin.

LO 18.5 Discuss what is meant by scope of work.

The statement of work or scope of work (SOW) is the area in an agreement where the work to be performed is described. The SOW should contain any milestones, reports, deliverables, and end products that are expected to be provided by the performing party. The SOW should also contain a timeline for all deliverables.

LO 18.6 Discuss how the critical path method is used to plan, schedule, and control complex projects.

The critical path method (CPM) is a robust logical system for planning and scheduling using bar charts. CPM is a graphical representation of the interrelationships of the various project activities. With CPM, the contract administrator can assess the status of the project at any time, and it enables the contract administrator to monitor and revise scheduling during the project to meet the desired completion date. The CPM network consists of arcs and nodes. The arcs represent the actual activities while the nodes (events) represent when the activity starts and finishes. Each node (event) combination between two nodes is unique. The end of one activity is the start of a succeeding activity.

KEY TERMS

Information processing theory 432

Statement of work/scope of work (SOW) 435

Transaction cost theory 432

DISCUSSION QUESTIONS

1. Why are organizations buying more professional services?
2. What are some of the key differences between buying services and buying OEM goods?
3. How are governmental megaprojects procured?
4. How are megaprojects managed? What is meant by contract administration?
5. What are global trends in professional services sourcing? Give at least three real-world examples from the Internet.
6. Discuss some of the complexities of global outsourcing? Give specific examples.
7. As a buying organization, what questions do you suggest asking each of the following potential service providers? You must be specific.
   - Construction management
   - Underground construction
   - Aboveground construction
   - Engineering design
   - Health and safety
   - Environment
   - Printing and promotions
   - Legal services
   - Facilities maintenance
   - Information technology

SUGGESTED CASES

Case 4: Boston Gaming Systems, Inc.

Case 12: Great Lakes University

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APPENDIX A: PRELIMINARY EXPLORATORY INTERVIEWS

Prior to conducting our main data collection, we interviewed four industry experts with extensive experience (i.e., more than 15 years each) with outsourced technical professional services (e.g., engineering, architectural, general contracting). Each interview was approximately 1 hour in duration. Collectively, the interviews provided the research team with both buyer and provider perspectives of the management of outsourced technical professional services. These exploratory interviews were conducted for three primary purposes: (1) to ensure that our study was appropriately grounded in practice and was managerially relevant, (2) to receive feedback on our online questionnaire, and (3) to identify the most appropriate professionals to target with our data collection. The following table provides a brief background on the interviewees.

	Role(s)	Context
Interview 1	Owner, business development, lead civil engineer	Provider of civil engineering and contract management services to municipal, state, and federal DOT
Interview 2	Facilities manager (manages outsourced construction, engineering services, etc.)	Multinational industrial company specializing in elevator systems
Interview 3	Director of procurement for indirect services (engineering, plant construction, etc.)	Experience in consumer packaged goods and energy sectors
Interview 4	Engineering and construction professional with experience on both buyer and provider side of outsourced technical services	Experience with food and beverage processing facilities, health care facilities, educational facilities, etc.

Source: Handley, S. M., Jurrian DeJong and W. C. Benton. "How Service Provider Dependence Perceptions Moderate the Power–Opportunism Relationship with Professional Services" Production and Operations Management, July, 2019, Pages 1692–1715

APPENDIX B: FHWA PROJECT EXAMPLE

USDOT and NENA (National Emergency Number Association) Wireless Implementation Plan

Parties interested in assisting in this first-ever Wireless Implementation Plan (WIP) program are encouraged to send their letter of interest to NENA Wireless Implementation Director James Burgin at Burgin@nena.org.

Background and Introduction

As part of its efforts to improve the safety and efficiency of surface transportation, the USDOT supports the implementation of National Wireless E9-1-1 capabilities. This contract is intended to facilitate the deployment of enhanced wireless E9-1-1 services by supporting the efforts of state and local public safety answering points (PSAPs) in coordinating and implementing the upgrades that will be necessary.

There are approximately 100 million wireless subscribers in the United States. These wireless subscribers call 9-1-1 an estimated 70,000 times per day, or 25–30 million calls per year. Wireless calls represent almost 40 percent of the 100 million calls to 9-1-1 each year. Many of the calls to 9-1-1 from wireless devices are calls from travelers on the nation's highways. Wireless calls currently present an immediate and growing challenge to the essential health of the nation's 9-1-1 infrastructure. Without location, these calls will continue to consume excessive amounts of call capacity and personnel resources in the 9-1-1 systems. Additionally, there is a related consumption of resources for police, fire, and EMS as the responders resort to heroic and costly efforts to locate callers. For these reasons, the implementation of wireless E9-1-1 location technology is a matter of growing importance and national interest, and may have the unintended consequence of creating a challenge to the effectiveness of 9-1-1 as perceived by the public.

The challenge of implementing caller location technology for wireless E9-1-1 is compounded by the fact that many stakeholders must collaborate for the process to move forward. The slow progress to date is due in part to these stakeholders—that is, wireless carriers, public safety answering points (PSAPs), incumbent 9-1-1 service telephone companies, third-party database vendors, and location technology firms—having little or no history of collaboration. A lack of regulatory clarity of responsibilities, a lack of central leadership within the stakeholder groups, a greater-than-expected growth in the wireless industry, and new and emerging location technologies all have contributed to a de facto delay in the implementation of wireless E9-1-1.

Currently, there is a movement throughout the country to implement the first phase (Phase I) of wireless service. The above challenges, coupled with budgetary, technical, and skills/training issues, serve to slow the progress, however. Consequently, there remain a large number of PSAPs and wireless carriers that are far from beginning their Phase I implementation.

No current activity of any single stakeholder can reach the desired outcome of full wireless implementation (including Phase II) on its own. In order to make significant progress in this area, a comprehensive and coordinated approach to implementation will be required.

This contract is intended to produce and carry out a comprehensive plan to help address coordination and implementation issues with the wireless carrier community, the major telephone companies that provide 9-1-1 service (and the host of small Telcos that provide 9-1-1 services), the public safety community, and telephone handset, hardware, and switch manufacturers that must develop technology to meet the new demand for wireless location technology.

Contract Objectives

The objectives of this contract are to develop the necessary tools, technical guidance, and training and outreach materials to facilitate implementation of the wireless E9-1-1 services throughout the 50 states. A related objective is to foster coordination among the many players in this field to ensure efficient approaches to the implementation process.

Scope of Work

As a high-level summary, the activities of the contractor (NENA) shall include performing program management; developing a work plan; providing technical and operational assistance to public safety answering points (PSAPs); creating, and publishing on electronic and print format, a National Contract Clearinghouse including a database of forms and form clauses that have been agreed to by parties across the nation; developing and maintaining a tracking system that accurately depicts the current status of wireless E9-1-1 implementation across the 50 states; developing the wireless deployment profile; conducting the necessary analyses and evaluations

of wireless location technologies to provide technical assistance and to gather the necessary operational and technical information and insights; developing a test program for wireless implementation; serving as a technical resource for PSAPs in planning for and implementing wireless E9-1-1 services; providing consultation to the government regarding wireless E9-1-1; developing training and outreach materials; and producing and distributing three targeted instructional videos.

Delineation of Contractor (Nena) Tasks

Task 1: Program Management, Administration, and Reporting

Develop and submit to FHWA a draft work plan for this project, identifying major activities, organizational and staffing responsibilities for various tasks, as well as overall plans and schedules for accomplishing individual tasks. FHWA will review the draft work plan and provide comments within 30 days of receipt of the draft plan. Based on the input of FHWA, develop and maintain a final work plan to guide the remainder of the contract. Conduct meetings with APCO and NASNA and other stakeholders to facilitate program planning and travel planning as well as coordination and consensus-building activities. The contractor (NENA) shall also fulfill the reporting and administration requirements contained in this contract.

As to each deliverable item producible in paper form (such as plans, reports, and white papers), the contractor (NENA) shall deliver to the COTR: (a) five ordinary photocopies; (b) one camera-ready, reproducible copy; and (c) one electronic copy.

Task 2: Provide Operational and Technical Assistance

A. Develop/maintain a knowledge base in order to provide technical and operational assistance to PSAPs regarding the implementation of wireless E9-1-1 services. The contractor (NENA) shall maintain an understanding of the contracting processes necessary for the PSAPs to enter into service agreements with the wireless companies in their jurisdictions and establish a database of the various contract types and procedures that are being used to establish wireless location capabilities at PSAPs. Provide technical assistance, as necessary and appropriate, to help facilitate contract negotiation.

To achieve this aspect of the project, the contractor (NENA) shall create a national clearinghouse of legal contracts, forms, and trends that are occurring in the nation that would accelerate the implementation process in the scenario where a PSAP and wireless company are actively negotiating for the service.

The contractor (NENA) shall create, and publish in electronic and print format, a National Contract Clearinghouse comprising a databank of forms, and form clauses, that have been agreed to by parties across the nation. This databank will be a passive reference tool for both wireless company attorneys and local prosecutors and so on to review and get an industry practice orientation for their particular implementation.

The contractor (NENA) shall execute and create a second element to facilitate a contractor (NENA) supported format for contract essential terms, and even highlighting certain clauses that are too onerous or perhaps rendered meaningless by rule clarification or S800, or other local law development.

The contractor (NENA) shall confer with legal experts in all states to develop, gather, and distill common practices and methods of contract formation and project management. Key trends in Project Locate also will be incorporated in this work to the extent data are available through that effort.

The Contract Clearinghouse shall be initiated and available for use by April 15, 2002. The clearinghouse would be maintained dynamically thereafter during the contract period.

It is anticipated that a task force and electronic interface will be created for this aspect of the project immediately. It is anticipated that an electronic interface, which complements the National Deployment Profile, will be available for utilization by April 1, 2002. Once established, the Clearinghouse will be updated dynamically as component documents are modified.

Model contracts for each state and service area will be established. The national inventory of contracts will flow

to the implementation step of the process in an orderly fashion, and will permit the parties to do effective project management for their respective roles in the wireless implementation process.

B. Develop and maintain a tracking system that accurately depicts the current status of wireless E9-1-1 implementation across the 50 states. The contractor (NENA) shall develop approaches for collecting implementation status on a national basis and for presenting/displaying this information in a graphical and interactive manner. NENA will provide access to this information through an Internet-based, point-and-click map of the nation, with state and county boundaries. Utilize this dynamic inventory to draw attention to key practical roadblocks in the implementation process.

To achieve this work, the contractor (NENA) shall develop the Wireless Deployment Profile that will enable all those responsible for or interested in wireless deployment to find out the status of wireless implementation throughout the United States. The profile will be maintained at the state and county level, accessible using a point-and-click map of the United States with state and county boundaries.

The contractor (NENA) shall develop, and will post the Web site described herein, and will keep its information current through a host of data collection efforts, including but not limited to

- Direct surveys
- Direct telephone calls
- E-mail surveys
- Web-based surveys
- Collaboration with secondary and industry resources for updates
- Collaboration with associations and statewide offices containing wireless implementation data

This deployment profile will be maintained and managed by the contractor (NENA), with the participation of other parties. The results of the inventory will be posted on the Internet for the benefit of all parties related to the wireless implementation project.

The following information elements will be included in the profile:

Wireless Phase II status. Over the next several years, each county or PSAP system will be in various stages of Phase II implementation. The profile will track that status on a quarterly basis and indicate in tabular form progress toward implementation.

Readiness level. A number of implementation steps are required for Phase II, as indicated on the NENA wireless checklist.

Information related to PSAP readiness includes but is not limited to

- PSAP capability to display X, Y coordinates
- Wireless carriers serving the area
- 9-1-1 service provider(s), including the incumbent or host company
- Third-party vendors
- Choice of location determination technology (LDT) by carriers serving the area
- The impact of wire line 9-1-1 on wireless deployment
- Type of wireless solution

The Wireless Deployment Profile will be updated on a recurring basis. PSAP system is obtained either through personal contact or by survey. The states and 9-1-1 systems that take the lead on Phase II will be the first entries into the profile.

The contractor (NENA) shall work closely with state 9-1-1 coordinators, NENA chapter presidents, county 9-1-1 coordinators, service providers, and wireless carriers to obtain current status.

This inventory will be created and posted in a skeletal format by April 1, 2002, and a comprehensive version of this inventory will be available and posted on the Web site on June 1, 2002. Once completed, this tool will be made available for each interested party to view their county/jurisdiction, and to point and click on a graphical interface that connects the viewer to a tabular database summary of the progress for that jurisdiction.

C. Conduct the necessary coordination with stakeholder organizations and other entities involved in the implementation of wireless E9-1-1 services. The contractor (NENA) shall establish mechanisms to facilitate coordination among various groups involved in the implementation of wireless caller location technologies. Wireless legislation in each state commonly includes the establishment of a state funding board charged with the responsibility of determining how wireless funds are collected and distributed in that state. The contractor (NENA) shall facilitate communication with (and between) the individual state funding boards to permit the exchange of useful information regarding what processes have been used by states to provide funding to the PSAPs for the implementation of wireless E9-1-1 services. This may include the conduct of a workshop meeting for state funding board representatives, with necessary follow-up communications to ensure the full exchange of information.

To complete this aspect of the project, the contractor (NENA) shall hold workshop meetings for state funding board representatives, with follow-up and ongoing communications via conference calling and Web conferencing. Summary information and feedback from the boards will help shape and resolve funding issues that emerge during wireless Phase II.

D. The contractor (NENA) shall develop, in cooperation with other public safety resource providers, a technical assistance component that can directly assist stake-holders in moving forward with wireless implementation. The component will be designed to rapidly and effectively deploy assistance as appropriate and necessary.

The contractor (NENA) shall ensure that technical assistance and outreach activities performed under this project are coordinated with the broader government activities envisioned within the DOT E9-1-1 initiative, such as the planned development of "expert assistance teams."

The contractor (NENA) shall make its technical staff available for direct consultation, and will facilitate technical forums on key issues facing the technical implementation of wireless 9-1-1 services. The contractor (NENA) shall lend technical support and advice through its staff and by collaboration of key members, and will utilize electronic meetings and white papers to frame the issues impacting the implementation process.

Task 3: Perform Technical Analyses and Evaluation of Wireless E9-1-1 Implementation Approaches and Performance Issues

A. Conduct the necessary analyses and evaluations of wireless location technologies, including handset, tower-based, and hybrid solutions, to be able to provide technical assistance (see Task 2 of this Statement of Work) to the PSAP community, to the government, and to other stakeholder organizations. This task is also structured to gather the necessary operational and technical information and insights needed for the contractor (NENA) to fulfill the activities identified in Task 4 ("Develop and Conduct Educational and Outreach Programs") of this Statement of Work.

To accomplish this portion of the contract, the contractor (NENA) shall develop a testing program for wireless implementation. Test parameters will be developed by the contractor (NENA) with input from DOT and appropriate public safety and industry contacts. The tests will be designed to answer questions identified by the contractor (NENA) review team.

These tests and technology parameters shall be conducted in the first and second quarters of the contract period. The contractor (NENA) shall develop and submit to FHWA a Technical Analyses and Evaluation Report of Wireless Location Technologies. FHWA will review the draft report and provide comments within 30 days of receipt of the draft report. The contractor (NENA) shall prepare a final Technical Analyses and Evaluation Report of Wireless Location Technologies based on the input of FHWA.

B. The contractor (NENA) shall maintain a technical awareness of wireless implementation approaches and of performance and operational issues in order to serve as a technical resource for the PSAPs in planning for and implementing wireless E9-1-1 services in their local areas. The contractor (NENA) shall provide consultation to the government regarding wireless E9-1-1 implementation (including

technical, regulatory, and rulemaking) issues, and shall provide recommendations and advice for expediting implementation of national wireless E9-1-1 services.

The contractor (NENA) shall maintain an awareness of telemetric devices and services that potentially will interface with PSAPs, and shall assess the implications of nontraditional access to 9-1-1 on PSAP operations. This shall include the monitoring of efforts aimed at answering any unresolved issues raised by the NMRI process. Include any technical, policy, and public education issues from this subject matter into the education and outreach program discussed in Task 4 of this Statement of Work.

The contractor (NENA) shall design this activity with a view towards answering the unresolved issues raised by the NMRl process. It is anticipated that the technical, policy, and public education issues will be addressed in concert with the wireless E9-1-1 program.

The contractor (NENA) shall write white papers, conduct surveys, and lead an issue resolution program regarding the integration of telemetric and intelligent transportation data transfer to public safety centers. In completing this objective of this contract, the contractor (NENA) shall distill results of other DOT initiatives such as the field operational tests and other outreach efforts and trials of "nontraditional" communications to the 9-1-1 system. Each white paper should be submitted to FHWA in draft form for review and comment. Each white paper will then be revised based on the input of FHWA.

For this portion of the program, a series of white papers shall be produced on a quarterly basis during the contract period.

As to each deliverable item producible in paper form (such as plans, reports, and white papers), the contractor (NENA) shall deliver to the COTR (a) five ordinary photocopies; (b) one camera-ready, reproducible copy; and (c) one electronic copy.

Task 4: Develop and Conduct Educational and Outreach Programs

A. The contractor (NENA) shall develop training and outreach materials that support the government efforts to facilitate implementation of wireless E9-1-1. These materials shall be in the form of instructional videos for PSAP personnel and other stakeholders, white papers, and presentation materials to be used at educational forums. The contractor (NENA) shall distribute appropriate training videos to the PSAP community and shall provide follow-up services to this community to resolve residual questions and issues that may arise. This activity is designed to ensure maximum exposure of educational materials to users who have time and travel (cost) limitations for attending national- or regional-level conferences and forums.

The contractor (NENA) shall submit white paper topics and content descriptions to the COTR for approval prior to the development of the white paper. COTR approvals also will be obtained regarding the topics and contents (storyboards) of the planned training videos.

To address this objective of the scope of work, the contractor (NENA) shall produce three instructional videos for further training and orientation for key stake-holders in the process. The contractor (NENA) shall submit a draft storyboard and script to the FHWA for review and comment before production of any video. The final storyboard and script shall be approved by the FHWA before production of any video is initiated. The three required videos are further described below. Instructional videos remain an effective technology delivery method for widespread distribution of the knowledge, project planning, and industry insight.

The contractor (NENA) shall produce and distribute three targeted instructional videos for distribution to key parties in the implementation process, as follows:

Video One. For PSAPs: The contractor (NENA) shall produce this instructional video by editing existing raw footage from four wireless critical issues forums (CIFs) previously taped by NENA.

Video Two. For wireless companies: The contractor (NENA) shall produce this video by editing existing wireless CIF footage and adding elements from NENA's Introduction to Technology course to meet the fundamental needs of over 200 wireless companies.

Video Three. For states and the public: The contractor (NENA) shall produce this video in such a way that it focuses on the states and the public sector as an audience.

The contractor (NENA) shall collaborate with key stakeholders in producing each of the three required videos.

It is anticipated that the video production will begin immediately upon contract award (or as soon thereafter as practicable) and that it will be completed by October 15, 2006, for videos one and three. It is anticipated that video two will be completed by January 15, 2020.

Contractor (NENA) shall provide two master copies of each video to the COTR upon completion of that video.

B. The contractor (NENA) shall sponsor educational sessions at stakeholder conferences and hold special forums among the stakeholder communities to ensure wide distribution of educational information and to permit a broad exchange of views among stakeholder organizations. The education forum component of this activity also will serve to bring together companies (e.g., wireless E9-1-1 service providers) who are users of the equipment with manufacturers of switches and handsets to foster discussion relative to (product) demand, technical, and schedule issues.

The contractor (NENA) shall work with all stakeholders to hold forums and develop white paper recommendations.

C. The contractor (NENA) shall work with all stakeholders to develop white paper recommendations. The contractor (NENA) shall create an industry white paper on product development, services, and technical issues associated with Phase II. The paper shall address issues of product choice, demand, and manufacturing cycle times in addition to any performance and implementation issues identified. Recommend other white paper topics considered appropriate to this effort.

The contractor (NENA) shall hold a technology summit in conjunction with the planned Technical Development Conference and address the specific aspects of technical interoperability addressed herein. The education forum component of this activity will bring together companies (e.g., 9-1-1 service providers) having demand requirements with manufacturers of switches and handsets to realistically assess product demand and schedule. This forum will be held during the first quarter of calendar year 2002, and the forum will lead to a white paper process of identifying and capturing the key cycle times of wireless location technology.

Each white paper should be submitted to FHWA in draft form for review and comment. Each white paper will then be revised based on the input of FHWA.

The contractor (NENA) shall develop and submit to FHWA a draft final report. FHWA will review the draft final report and provide comments within 30 days of receipt of the draft report. The contractor (NENA) shall revise the final report based on the input of FHWA and provide a final version to FHWA.

As to each deliverable item producible in paper form (such as plans, reports, and white papers), the contractor (NENA) shall deliver to the COTR (a) five ordinary photocopies; (b) one camera-ready, reproducible copy; and (c) one electronic copy.

As can be seen from the NENA project, it is easy to see the complexity of developing the scope of work, the selection of the contractor, the pricing mechanism, and the management of the project.

APPENDIX C: FORTUNE 500 COMPANY EXAMPLE

Document Destruction Services Example

With growing attention to protecting competitive information and increasing awareness of consumers regarding privacy, the demand for document destruction services has grown substantially over the last 5 years. As the demand has increased, so have the number of

companies offering the service. There are over 600 firms nationally in the business of destroying discarded documents. This expanding market share will attract both new demand and new suppliers. Processes and technology have been improved along with improved logistics strategies. These improvements have led to significant cost reduction.

Industry Specifics and Legislation

Recent legislation has resulted in an increased demand for destruction services. This legislation is largely a reaction to the exponential growth of identity theft and other forms of information-based fraud. Often it turns out that the information used to commit the fraud was obtained from casually discarded documents containing personal data.

The Gramm-Leach-Bliley Act—also known as the Financial Modernization Act of 1999—enacted by the federal government, went into effect in July 2004. This law mandates that all financial institutions must establish procedures for protecting personal information, including the protection of discarded information. The Gramm-Leach-Bliley Act consists of three principal parts: the financial privacy rule, the safeguards rule, and the pretexting provisions.

Financial privacy rule. This rule applies to all financial institutions requiring them to provide customers with a detailed explanation of the management of information sharing and collection practices within the institution. This rule also allows for customers to request the confidentiality of specific information, which limits the amount of financial information that outside companies can access.

Safeguards rule. This rule is enforced by the Federal Trade Commission to require financial institutions to implement a method for maintaining and safeguarding customers' private financial records. This rule would include a need for document destruction after a required holding period.

Pretexting provision. This provision prohibits the act of obtaining or requesting an individual's financial information under false pretenses—this includes the act of impersonation or the use of fraudulent statements.

There has been a substantial growth in the numbers of firms requesting document destruction services because of the abundance of laws that have been passed along with the Health Information Portability and Accountability Act, or HIPAA, requirements. As a result of HIPAA, institutions were required to have a program in place to protect patient information at every point by April 2003.

The third act of legislation that plays a role in document destruction is the passing of the Sarbanes-Oxley Act of 2002. This act requires all public corporations to follow specific guidelines regarding the correct auditing and accounting practices. With this act comes the need for confidential accounting and auditing practices. Certain information that should not be released or reach the wrong audiences also will need to be destroyed in a confidential and reliable manner. Once again, this act of legislation requires further expansion of the document destruction industry.

The Economic Espionage Act is another example of the need for confidential document destruction services. This act states that once property is released for trash pickup, it is no longer private property. This means that anyone who may come across confidential papers in the trash or actually choose to seek them out has legal rights to that information. This act makes it necessary for corporations with confidential information to appropriately dispose of these documents so as not to break laws of confidentiality.

Finally, the Fair and Accurate Credit Transactions Act (FACTA) of 2003 is important legislation for Nationwide to familiarize them with. This act encompasses virtually every business organization. It was passed to combat crimes such as identity theft and other consumer fraud. This act requires the destruction of all private consumer information and holds a company responsible for any known consumer information that gets into the wrong hands. FACTA and all other outlined legislation are reasons why it is very important for a financial institution, such as Nationwide, to be prudent about the abundance of private consumer information maintained by the company.

Because of the increasing legislative requirements, there has been a new attraction for firms to enter the document destruction business. Many of these new entrants are smaller companies. In order to compete on a national basis with the large suppliers, smaller suppliers have established a network of facilities in order to gain more business. The abundance of suppliers has led to a significant decrease in the cost of implementing a document destruction program. Smaller suppliers have been able to compete with larger suppliers using a lean business model (i.e., reduced overhead and technology). For example, larger suppliers have increased their overhead by acquiring small document destruction businesses. On the other hand, smaller document destruction suppliers have syndicated to create a national network of document destruction companies. This allows the smaller suppliers in the industry to effectively compete for national contracts.

Scope of Activity for Document Destruction Sourcing

- Documenting business requirements.
- Identifying savings opportunities.
- Assessing business risks.
- Obtaining supplier information.
- Estimating total costs. The project team conducted diligent research throughout the industry and realized that there was an opportunity for a minimum savings of 30% with local suppliers.
- Specifying service levels.
- Assessing supplier diversity implications.
- Preparing and issuing an RFP.
- Awarding contract; negotiating.
- Developing a scope of work; issuing contract.

Obtaining supplier information involves the prequalification of potential suppliers, narrowing the field from possible suppliers to acceptable suppliers. More importantly, depending on the nature, size, and importance of the purchase, it is during the inquiry phase that decisions are formed concerning future projections on the potential for extended relationships, given the increased importance of relationships in the context of managing an entire supply chain.

With particularly large purchases, the review scope during the inquiry phase can extend to the supplier's supplier. Regardless of the relationship sought, a critical analysis by the Acquisition Project Team is needed to gather more specific information in the following areas: financial stability—analyzing financial statements; service quality and quality philosophy—establishing quality reputation and TQM; major customers and suppliers—obtaining names and contacts; minority business commitment—reviewing track record; technological expertise—meeting both current and future requirements; cost and shortage conditions—handling rush, weekend, and urgent requests. The aim is to identify those suppliers who are capable of providing a continuous source of supply. Three suppliers were selected at the identification stage. The suppliers included Royal Document Destruction (RDD), All Shred, and the current supplier, Iron Mountain.

After identifying the suppliers, a risk assessment was conducted to determine which suppliers would be acceptable. The following provides an overview of risks to be considered when making the document destruction decision:

- *Strategic risk*. The degree to which the proposed investment will align with the company's strategic direction and integrate into the existing business.
- *Financial risk*. The probability that the project will deliver on the proposed financial benefits.
- *Technology risk*. The degree to which the investment must rely on new or untested technologies, including hardware, software, and networks.
- *Organizational impact or operational risk*. The amount of change needed within the business unit to benefit from the new investment, as well as the effort required to continue operations once the investment is implemented.

Results of Sourcing

RDD was awarded the contract. The 3-year contract resulted in a savings of approximately $707,000. The results are given below.

Location	Annual Savings
Home office	$62,088.00
Dublin	15,750.00
Grove City	3,570.00
Service centers	76,500.00
Field offices	77,730.00
3-year total costs	$(671,710)
Annual savings	235,638
3-year savings (estimated)	706,914

Cases

Case 1: AMD Construction Company: Negotiating the Old-Fashioned Way[1]

In June, AMD Construction Company was awarded a $120 million contract for building a section of I-65 near Birmingham, Alabama. The contract called for clearing, tunneling, paving, bridge building, blasting, and landscaping 85 miles of roadway, two lanes in each direction. The contract also required a 10% DBE (disadvantaged business enterprise) goal.

Over a period of 6 months prior to the bid opening, Jane Axle, salesperson for Allen Manufacturing Company, had been calling on AMD to sell it the CAT-1 horizontal boring machine. Ms. Axle joined Allen about 8 months ago. She had been the sales manager at a well-known fashion house in New York for the past 10 years. Although AMD had used the older labor-intensive models of horizontal boring machines, the company had no experience with the newer, fully automated boring machines. In September, Jane convinced Tom Reed, president of AMD, to witness a demonstration of the CAT-1. Because Mr. Reed's time was limited, the demonstration's sole purpose was to acquaint him with the general operating procedures for the boring machine.

Prior to the initial sales interview, Jane had searched the Internet to familiarize herself with the highway market. In her research, she compared Allen's equipment prices with other distributors in the industry. If successful, this would be her first sale in the highway market. In addition, she had familiarized herself thoroughly with the industry jargon.

The following interview occurred the day after the product demonstration. Jane had learned on the same morning that the contract in question had been awarded to AMD.

Jane: Good morning, Mr. Reed.

Tom: Good morning, Jane.

Jane: I understand you have received the I-65 contract.

Tom: That's right. All we have to do now is finish it under budget.

Jane: This appears to be the biggest project since the Coronavirus epidemic.

Tom: Yes. However, we did have a similar project 3 years ago in Montgomery. We had major design problems on that job, and we missed our estimate by $344,000.

Jane: Doesn't the state pay for any errors or mistakes they make in their design work?

Tom: Yes, they pay for their mistakes. However, that mistake was ours, and we didn't get paid for it! You know, Jane, the highway business is unforgiving, and if you make a large enough mistake on one job, you will go belly up.

Jane: That's exactly why I'm here this morning, Mr. Reed, and that is why I gave you the demonstration yesterday. I am here to show you how to make money by saving on construction costs right down the line. We realize that you have been in business many years and have the know-how, or you wouldn't still be operating today. But I have

studied your problems and believe we have a machine that will reduce your tunneling labor costs by 25%.

Tom: Well, at the present, I have two horizontal boring machines and two three-person tunneling crews, and I can't see how your boring machine will benefit me at all. I did like your demonstration yesterday, but, of course, the tunneling operation is only one category of work, and I have the crews and the equipment to get it done.

Jane: That's true, Mr. Reed, but remember the new CAT-1 can easily produce 2 times the rate of your current equipment. What's more, the CAT-1 requires only one two-person crew. Believe me, we can get the dirt flying. Isn't it true that the tunneling operation must stay on schedule to bring the job in under budget?

Tom: Yes.

Jane: Well, the CAT-1 is capable of operating 2,000 hours at 80% capacity without maintenance. Two operators versus six is a significant savings. There is no loading or unloading to consume time that runs up the cost. The loading and unloading operation has been automated. The CAT-1 is ready to go.

Tom: I don't see how your product can live up to all of those specs.

Jane: Let's see. You will get 2 times the production rate and save two thirds of your estimated labor cost. This savings goes straight to the bottom line.

Tom: That does sound interesting, but you have no real data to support your claim. You are aware that all projects are different.

Jane: I have factored all of those concerns into my calculations. The numbers never lie.

Tom: Numbers don't lie, but productivity can't be predicted. If the CAT-1 is so good, why do my competitors not use it?

Jane: In the demonstration yesterday, you were able to see that dirt flying. Dirt flying is productivity.

Tom: How long does it take to train a crew on the CAT-1?

Jane: It takes approximately 2 days to train an experienced operator on the CAT-1.

Tom: I understand that there is a comparable boring machine sold by one of your competitors. I will call them tomorrow for a demonstration. How does your machine compare to the B-34?

Jane: Yes, there are other machines we compare with. However, ours can compete with all of them. It is efficient and productive. Most of the other machines have some of our features but not all of them. Our machine is appropriate for your project.

Tom: Well, Jane, the CAT-1 certainly sounds economical.

Jane: It is economical, Mr. Reed. Two people operate the CAT-1 generally. The machine has digital hydraulic controls and a wide-vision cab that gives the operators clear vision and maximum flexibility at all times. It has a 350-horsepower GMC engine that operates at five different speeds. Perhaps the maintenance efficiency is also an attractive feature. There is a computerized cylinder cooling system that prevents

damage to the cylinder walls. This feature is a significant improvement over your current boring machines. The machine can bore 5 1/2 feet below ground level and can bore up to 30 linear feet at a time. The total height of the machine is 10 feet. What's more, it passes all of ALDOT's [Alabama Department of Transportation] requirements for highway projects.

Tom: Do you have any figures on the actual operating costs of your boring machine?

Jane: We have. We figure average operating cost per year at 1,500 hours for the CAT-1 is approximately $296,000 without operators or $371,000 with two operators.

Tom: What is the cost?

Jane: I have it right here. The cost for the CAT-1 is $895,233.

Tom: Your cost figures seem rather high since our estimate for tunneling is $676,000.

Jane: No, Mr. Reed, experience has shown that it is possible to amortize the cost of our machine over a 2-year period. In addition, when you calculate the productivity and labor savings . . .

Tom: Jane, in this business, you have to plan one year at a time. I am not sure when I will get the next tunneling job. My current problem is my . . .

Jane: Of course there is also a lease option. We currently offer a 3-year open-end lease with the following conditions: no down payment, free maintenance, $25,000 per month, and a salvage value of $100,000 after 3 years.

Tom: I will have to get back with you next week. I need to take a closer look at our alternatives. I am also in the process of determining how our 10% DBE goal will be satisfied. Only then will I be able to move forward.

Jane: Mr. Reed, you are in luck. According to CFR 49 part 26, a portion of your DBE goal can be satisfied with the purchase of the CAT-1. We are partners with a certified DBE firm in another business. We can run the sale through his company.

Tom: If this is acceptable, I will get back with you tomorrow. This purchase could easily kill two birds with one stone.

Jane: Thank you, and I look forward to meeting with you tomorrow.

Tom: Goodbye, Ms. Axle

Case 2: The Art and Science of Bidding Not to Get a Job[1]

Jr. Barnes Construction and Moncrief and Sons Construction are fierce competitors. The president of Jr. Barnes is so excited about the growth that he is considering adding two new crews for the 2020 construction season. In 2019, Jr. Barnes successfully won four out of five jobs for which they competed. Mr. Barnes stated that he has revised the financial targets to account for the unexpected growth they experienced in 2019. During the same period, Moncrief Construction won only one out of seven jobs. In 2019, Jr. Barnes Construction and Moncrief and Sons Construction were successful bidders on the projects given in Table C.1. The overhead for each firm is also given in Tables C.2 and C.3.

TABLE C.1
Successful Project Bids

Number	Bid ($)	Bidder	Cost ($)
101	109,000	Moncrief	83,450
101	167,200	Moncrief	138,023
101	72,600	Jr. Barnes	69,567
101	134,700	Jr. Barnes	130,567
101	108,600	Jr. Barnes	106,356
101	141,700	Jr. Barnes	138,945
101	77,000	Jr. Barnes	75,782
101	193,458	Jr. Barnes	192,890
101	119,900	Jr. Barnes	120,875
101	63,700	Jr. Barnes	75,673
102	91,700	Jr. Barnes	87,456
102	122,000	Jr. Barnes	117,234
102	99,100	Jr. Barnes	95,783
102	88,700	Jr. Barnes	85,982
103	147,100	Moncrief	118,934
103	78,000	Jr. Barnes	74,673
103	97,100	Jr. Barnes	92,783
105	118,900	Jr. Barnes	113,892
105	132,800	Jr. Barnes	128,903
107	87,600	Jr. Barnes	84,675
107	123,700	Jr. Barnes	120,987
109	111,200	Moncrief	93,200
109	76,300	Moncrief	65,090
109	104,700	Moncrief	91,400
109	112,346	Moncrief	99,200
109	137,600	Jr. Barnes	136,784
110	141,000	Jr. Barnes	138,934
110	92,600	Jr. Barnes	91,653
110	108,200	Jr. Barnes	107,634

110	111,700	Jr. Barnes	113,456
112	178,800	Jr. Barnes	170,987
112	133,400	Jr. Barnes	128,764
112	117,100	Moncrief	96,234
118	80,800	Jr.Barnes	82,894

TABLE C.2
Jr. Barnes Construction Company Home Office Overhead Expenses

Overhead	Expense ($)
Management wages	140,000
Estimating (part time)	20,000
Office Mgr./Sec./Acct.	28,000
Payroll taxes (Mgt.), 25%	47,000
Hospitalization (5 families @ $500 per month)	30,000
Office rent	2,400
Telephone	2,400
Postage	1,200
Office supplies	1,800
Legal	1,000
Accounting	7,000
Interest	16,000
Travel (mileage)	6,000
Mobile phone	2,400
Pager—rental	600
Association dues	500
Marketing	2,000
Estimating—Cost of plans	2,400

TABLE C.3
Moncrief and Sons Construction Company Home Office Overhead Expenses

Overhead	Expense ($)
Management wages	140,000
Estimating (Part time)	20,000
Office Mgr./Sec./Acct.	18,000
Payroll taxes (Mgt.), 25%	44,500
Hospitalization (4 families @ $500 per month)	24,000
Office rent	2,400
Telephone	1,200
Postage	350
Office supplies	450
Legal	750
Accounting	4,000
Interest	3,890
Travel (mileage)	2,430
Mobile phone	650
Internet/Technology	1,320
Association dues	500
Marketing	3,500
Estimating—Cost of plans	1,800

Assignment Questions

1. Analyze the performance for each firm. Your analysis should be as *thorough* and convincing as possible given the data and lessons learned from the textbook.
2. What are the strengths and weaknesses of each company?
3. Write a memo outlining your recommendations for each of the businesses.

Case 3: The Auction Case

EDI Associates is a small distributor with two full-time and five part-time consultants. Revenues during the past 3 years were approximately $10 million.[1] EDI Associates packs and exports commodities to the Asian market. EDI has provided logistical services for the KACI Corporation for the past 3 years. Each year EDI negotiates transport and shipping rates with a variety of carriers. Recently, KACI decided to conduct a reverse auction for all packing and shipping services. The current contract with EDI was valued at $1.6 million per year. EDI Associates outsources approximately 80% of the contract to a major shipping company.

The Auction

KACI contracted with Auction.com, a multinational, market-leading e-commerce company specializing in e-procurement and auctions. Auction.com has approximately 1,000 employees worldwide and has conducted auctions for 140 large multinational clients. They have conducted about $21 billion in auctions, resulting in savings of about $6 billion. KACI is a global organization based in the United States undergoing financial strain due to increased worldwide competition. To reduce costs, KACI turned to Auction.com to conduct a reverse auction. The auction event was a global procurement exercise focusing on logistics and transport. The auction event consisted of five stages:

1. Making the market (client)
2. Prequalification (supplier)
3. Pre-auction planning (supplier)
4. Auction strategy (supplier)
5. Postauction analysis (client)

Making the Market

Shortly after the notification from KACI, EDI Associates began to prepare for the upcoming reverse auction. EDI received a CD with the documentation of the reverse auction process. This documentation consisted of over 50 files including tender documents, quote spreadsheets, specifications, and other relevant information. There were at least four updates prior to the final auction. The deluge of information was overwhelming.

Prequalification

The nonperforming suppliers are eliminated from the auction at the prequalification stage. At this stage, Auction.com must ensure there are an adequate number of bidders remaining. EDI Associates had no idea how many other companies had been prequalified. Prequalification also introduces some financial parameters for the event. Auction.com set the switching cost at $1.3 million, that is, the price when KACI would consider awarding the contract away from the EDI supplier. The difference between the switching and existing contract prices was approximately 19%. This figure is important as much of the advertising material by Auction.com quotes savings of 19%. EDI Associates again expended considerable resources at this stage: two site visits, four subcontractor

[3] Adapted from Andrew Stein and Paul Hawking, Southern Cross University, "Reverse Auction e-Procurement."

meetings, 200 phone calls, 45 e-mails out, 15 e-mails in, 30 hours of the managing director's time, and 20 hours of the consultant's time. EDI's setup costs for the reverse auction were increasing.

- EDI Associates' market entry price: $2 million
- Existing contract price: $1.6 million
- Reserve (switching) price: $1.3 million

For EDI Associates, the setup for the new quoting process was impressive.

Auction Strategy

Waiting for the auction was stressful for EDI. What strategy should be adopted? What would happen if the power failed or the ISP went down? What would be the lowest position EDI Associates would take in the auction? Would they be swept up in the auction dynamic? Who would press the buttons? Would they hold their nerve? Auction.com conducted a training session from their Asian headquarters, and EDI Associates soon mastered the auction interface. EDI established three strategies for the auction: entry, middle, and end strategy. The entry strategy was to come in at the high prequalification bid after about 3 minutes and then watch the market develop. The middle strategy was to maintain control on the screen and drive the bids down in a controlled manner. It is important to understand that in the auction event you only see bids and do not know where they come from. The only strategy was to be in the end game, and if EDI Associates did not win, they wanted to be under the switching cost at the end. This would show KACI that EDI Associates was a serious bidder. EDI Associates had seen sample auction events where the end game was frantic.

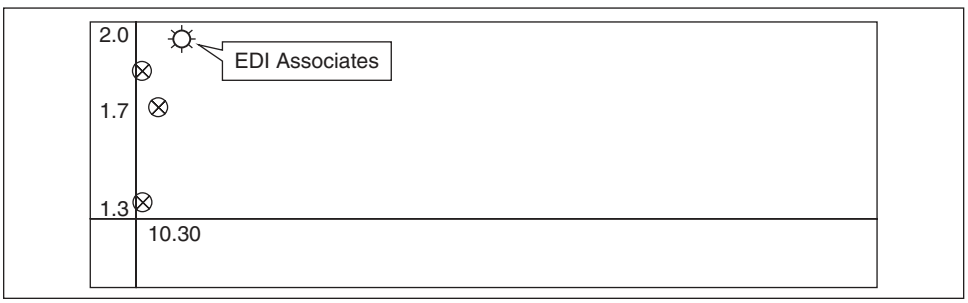
The Auction Event

The auction was delayed a week, and with a late flurry of updates and clarifications, EDI Associates waited until 10:33 to press the bid accept button. In 5 seconds, the early and middle strategies were destroyed. There were three other bidders, and one bidder came in right on the switching price. This was felt to be a ploy to scare off other bidders; it was felt that this was the existing contractor.

Early Action

Where did that bid come from? (See Figure C.1.)

FIGURE C.1
Start of the Auction



Middle Game (A Sinking Feeling)

After about half an hour, another bidder entered and soon started to drive down the bids (see Figure C.2). EDI Associates' strategy was to drive down to the reserve price.

End Game (A Dogfight)

At this stage (see Figure C.3), it is fair to say that the phones were put on hold. As the scheduled auction time elapsed, the bidding intensified. A bid in the last minute extends the auction by 1 minute. There were three bidders left. The original button presser passed to the managing director when the low position previously agreed on was passed. The auction entered the phase that Auction.com calls the auction dynamic, the dynamic that drives the price down. The reserve was driven down $90,000 in 7 minutes. The number of bids in the last 7 minutes tripled all bids in the previous 1.5 hours. The managing director started to lose some semblance of control as he did not want to lose to the other bidders. The agreed-on low margin of 12% was reduced to 5%. *EDI Associates did not win the auction*; they were in the game at the end and drove the market down to inflict some pain on the other bidders.

FIGURE C.2
One Hour Into the Auction

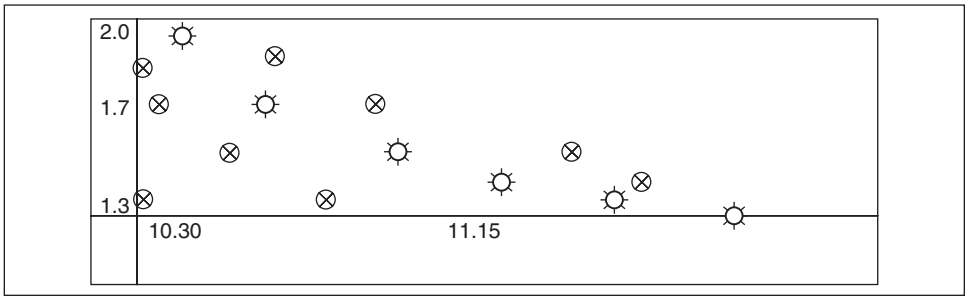
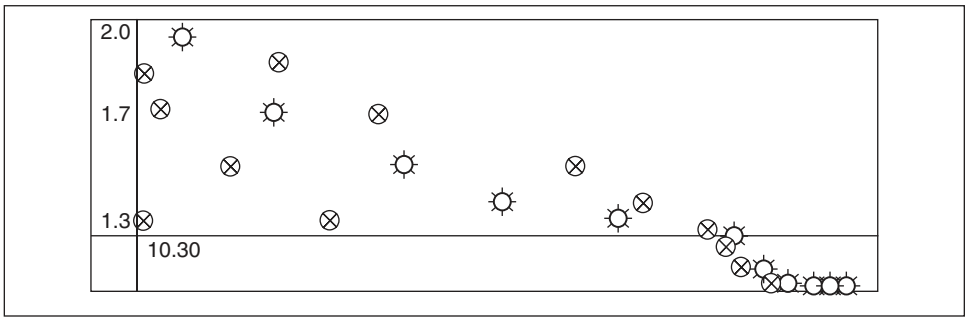


FIGURE C.3
End of Auction



Postauction Analysis

After the auction, EDI Associates was told they would have to wait 5 weeks for the result; it came much earlier. EDI Associates lost the contract they had at the start. The managing director took about 2 weeks to get over losing to the competition.

1. As the purchasing manager for KACI, what arguments would you use to convince EDI to participate in future reverse auctions?
2. As the sales manager for EDI, how would you approach future reverse auctions?

Case 4: Boston Gaming Systems, Inc.[1]

Boston Gaming Systems (BGS) manufactures state-of-the-art gaming computers. Its current product line includes the CS-23 and a number of other well-received personal gaming computers. A gaming PC is a custom personal computer designed for playing competitive video games that require a high amount of computing power. Jamie Day, an MIT engineer and self-described gaming enthusiast, started the company in 2015. Boston Gaming Systems has a strong research and development department that continually searches for ways to improve existing gaming computers as well as develop new machines.

Currently, the research and development department is working on the development of a revolutionary 10th-generation gaming computer that will have a built-in machine learning module. Tentatively named the CS-5300, the computer will initially be sold for around $2,500; therefore, the target market consists of serious, passionate gamers interested in investing their spare time getting quality screen time. At this price, profits will be attractive. Last month BGS rolled out a working prototype and is satisfied that, with cooperation from the production and marketing departments, the product can be ready in time for the Christmas buying season. A target date that is 22 weeks away has been set for the introduction of the 10th-generation CS-5300.

Current Problem

Boston Gaming Systems' marketing vice president, Lindsey Bailey, has recently learned from the company's marketing intelligence consultant that Dell is also in the process of developing a similar 10th-generation gaming computer, which it intends to roll out for the Christmas buying season. In addition, the consultant also indicated that the competitor plans to sell its product, which will be somewhat heavier than the CS-5300, for $2,300 in the hope of appealing to passionate trust fund gamers. Lindsey, with the help of several key people involved in marketing the CS-5300, has decided that to compete, the selling price for the CS-5300 will have to be lowered to within $300 of the competitor's price. At this price level, it will still be profitable, although not nearly as profitable as originally anticipated.

However, Lindsey is wondering whether it would be possible to expedite the usual product introduction process to beat the competition to the market. If possible, she would like to get a 6-week jump on the competition; this would put the product introduction date only 16 weeks away. During this initial period, BGS could sell the CS-5300 for $2,500, reducing the selling price to $2,000 when the competitor's product actually enters the market. Since forecasts based on market research show that sales during the first 7 weeks will be about 2,000 per week, there is an opportunity for considerable extra profit if the early introduction can be accomplished. In addition, there is a certain amount of prestige involved in being first to market. This should help enhance the CS-5300's image during the anticipated battle for market share.

Data Collection

Since BGS has been through the product-introduction process a number of times, the R&D department has developed a list of the tasks that must be accomplished and the order in which they must be completed. Although the times and costs vary depending on the

particular product, the basic process does not. The list of activities involved and their precedence relationships are presented in Table C.1. Time and cost estimates for the introduction of the CS-5300 are presented in Table C.2. Note that some of the activities can be completed on a crash basis, with an associated increase in cost.

TABLE C.1
List of Activities

Activity	Description	Immediate Predecessor
A	Select and order equipment	—
B	Receive equipment from supplier	A
C	Install and set up equipment	A
D	Finalize bill of materials	B
E	Order component parts	C
F	Receive component parts	E
G	First production run	D, F
H	Finalize marketing plan	—
I	Produce magazine ads	H
J	Script for TV ads	H
K	Produce TV ads	J
L	Begin ad campaign	I, K
M	Ship product to consumers	G, L

TABLE C.2
Time and Cost Estimates

Normal Time Minimum Crash Cost				
Activity (Weeks)		Normal Cost Time (Weeks)		($/Week)
A	3	$2,000	2	$4,500
B	8	9,000	6	9,000
C	4	2,000	2	7,000
D	5	1,000	3	4,000
E	2	2,000	1	3,000
F	5	0	5	—
G	6	12,000	3	12,000
H	4	3,500	2	8,000
I	4	5,000	3	10,000
J	3	8,000	2	35,000
K	4	100,000	3	160,000
L	8	10,000	8	—
M	1	5,000	1	—

Case 5: BSD at 777-Holdings[1]

Barbara Mercury, purchasing manager for the Business Systems Division (BSD), was reviewing the purchasing process for electronics components. She believed BSD should be able to do a better job but wondered what action to take. She had discussed her concerns with Tracy Morgan, the buyer involved. Tracy had suggested the possibility of systems contracting. Tracy was introduced to the concept of systems contracting while completing her studies at the Fisher College of Business.

BSD is a division of 777-Holdings, a large multinational company involved in a wide variety of industries and products. BSD specialized in industrial controls that normally involved a large number of custom orders. During the past year, BSD purchased $600,000 worth of electronics components from six local distributors. BSD maintained an excellent working relationship with each distributor and had depended on each at one time or another to provide specialized assistance to some of the BSD managers. Unit values of electronic components ranged from $2 to about $150. According to the BSD accounting department, it cost BSD about $104,000 last year to purchase electronic components since each order was triggered by an individual purchase order. BSD also maintained a stock of electronic components averaging about $202,000 with a 20% obsolescence rate.

BSD's ordering pattern was highly irregular as shop loads were significantly volatile. Engineering specifications had to be 100% correct. Frequently, customers themselves specified the use of certain electronic components. Obsolescence was significantly high because of engineering changes, improved technology, and feedback from the field on the reliability of past designs.

Barbara had called several colleagues in a related division of 777-Holdings and received sympathy but not many concrete suggestions. Apparently, nowhere within 777-Holdings had anyone implemented a systems contract for electronic components. In fact, Barbara was surprised to find that within BSD's production and engineering departments, several individuals expressed strong negatives toward systems contracts. Tracy, however, had become more excited about the concept of systems contracting as she completed her research. Tracy concluded that BSD could work successfully without most of its current inventory. She further concluded that BSD could reduce purchasing costs by at least 40% and obtain lower prices by at least 22% if BSD was willing to set up a systems contract with only one distributor.

Case 6: Carter Systems Canada, Inc.[1]

Mr. Travis received a purchase request from the operations manager for 12,000 GMT-680 housing assemblies. The engineering department had made the necessary design changes submitted by GM. One month ago, a purchase order for a similar design for the same auto platform was $27.88 per unit for 8,000 units.

Background

Mr. Travis, the supply manager at Carter Systems Canada, was responsible for the purchase of the GMT-680 housing assembly. The GMT-680 housing assembly was the major component part for automobile seat warmers for the GM luxury product line. Seat and steering wheel warming technology is complex, and the manufacturing process is wrought with quality problems. It is not unusual to receive a sourcing shipment with a yield of 70% good housing assemblies. The source of the quality variation was traced to the numerous engineering changes submitted by the auto manufacturers. In other words, each new housing assembly purchase represented a new design. Mr. Travis found it useful, therefore, whenever he was required to issue a request for quote (RFQ) for housing assemblies, to make an estimate of the probable cost of the item from historical costs of similar equipment and from his experience with previous cost-adjusted engineering changes. He would estimate the new housings by adjusting the previous housing assembly cost with the new design estimated costs. This analytical approach required Mr. Travis to use his engineering and business school skills. This way he was well prepared to better evaluate the supplier quotes. This approach also could result in more effective negotiation sessions with successful suppliers. Mr. Travis determined the change in materials costs by analyzing the engineering changes (see Table C.1).

TABLE C.1
Engineering Changes

Added Components	Estimated Yielded Materials Cost/Unit
Terminal pin	$ 0.53
Cap cermult 1006-03 15uf xrt	1.08
Diode rectifier	1.28
Cap tantalium 4.7 5.6 ASIC	1.89
Cap electric 22uf	0.9
Unit Cost of Added Materials	$11.28
Removed Components	
Zener diode	$0.89
Mosfet 174a 55v	5.73
Res 50803 40%	1.86
Cap electric 47uf	0.3
Unit Cost of Deleted Materials	$8.78

[1] Names and data have been disguised.

Mr. Travis realized that prospective suppliers for the procurement would include a group different from his usual suppliers and decided for that reason to make an extremely careful estimate of the probable cost.

After analyzing the engineering changes, Mr. Travis used his business skills to prepare the estimate shown in Table C.2. The engineers' estimate generated by Mr. Travis will serve as a baseline for the negotiations process. As shown in Table C.2, the estimated price is $28.26.

Meanwhile, requests for proposals were sent out to 12 suppliers. Mr. Travis received eight responsive quotes, of which three were in the range from $29.78 to $33 per unit, and three ranged from $35.60 to $42.00. The last two bids were $22.14 and $24.68. Mr. Travis evaluated each supplier's cost breakdown with the others and compared each cost with his estimated costs. Mr. Travis was impressed with the quality of the two proposals that came in below his estimate and was surprised that both firms had each supplied similar housings during the past year. Both companies were well-established component engineering companies with good reputations for satisfactory performance on previous contracts. The cost breakdowns for the two low proposals are reproduced in Table C.3.

After investigating the cost breakdown, Mr. Travis wondered why the other five responsive quotes were significantly higher than the Bell and D&G quotes. He decided to call San Onofre Technologies (SOT) to discuss their $29.78 quote. After his conversation he reevaluated the SOT quote. The SOT cost breakdown is given in Table C.4.

TABLE C.2
Estimate

Direct Materials (DM)	Direct Labor (DL)	Manufacturing Overhead Estimated 100% of DL	Tooling	General and Administration Estimated 5%	Profit Margin 10%	Estimated Selling Price
$7.30	$5.09	$10.18	$2.00	$1.23	$2.46	$28.26

TABLE C.3
Cost Breakdowns

	Direct Materials (DM)	Direct Labor (DL)	Manufacturing Overhead Estimated 100% of DL	Tooling	General and Administration Estimated 5%	Profit Margin 10%	Estimated Selling Price
Mr. Travis	$7.30	$5.09	$10.18 (100%)	$2.00	$1.23 (5%)	$2.46 (10%)	$28.26
Bell Systems	**$6.20**	**$4.35**	**$8.48** (75%)	**$3.22**	**$0.88** (4%)	**$1.76** (8%)	**$24.68**
D&G Technologies	**$5.20**	**$4.00**	**$8.40** (110%)	**$2.20**	**$0.62** (3%)	**$1.03** (5%)	**$22.14**

TABLE C.4
Cost Breakdown of SOT Quote

Direct Materials (DM)	Direct Labor (DL)	Manufacturing Overhead Estimated 100% of DL	Tooling	General and Administration Estimated 5%	Profit Margin 10%	Estimated Selling Price
$7.02	$4.50	$7.20	$8.35	$1.35	$1.35	$29.78

Assignment Questions

1. What factors might have caused the variance between D&G Technologies' quotation and Mr. Travis's estimate? Between D&G Technologies' quotation and Bell Systems' quotation? Between SOT and the two lowest quotes?
2. In light of your answer to the above question, what conclusions can you draw concerning (a) the reliability and usefulness of cost estimates made by the buyer and (b) the value to be gained from the comparison of one supplier's quotation with the others?
3. Write a two-page memo justifying your recommendations.

Case 7: Case Construction Company[1]

"For the last 5 months I've heard nothing but flimsy excuses from you people as to why the competition was beating us out of the city's curb and gutter work," remarked John Case, owner of Case Construction. "Excuses, excuses, excuses, that's all I ever hear! Since the administration changed, we have won only two city jobs in the past 2 years. I hire you guys to be estimators! Everyone seems to outbid us. Maybe our bidding process leaves something to be desired. If you guys don't come up with answers, then we'll have two estimating positions to fill by midyear. There is another major bid letting coming up next week, and I want to win at least three jobs."

Background

Case Construction grew from a $250,000 to a $4 million construction company from 2013 to 2018. Case's strength was in its ability to work well with the customer. Its reputation for quality work far exceeded the local competition's reputation.

Most of Case's contracts from 2015 to 2018 were long-term customers who used sole-source procurements and paid the extra price for quality and service. However, when there was a downturn in private funding, Case found that unless it penetrated the competitive bidding market, its business would decline significantly.

In 2018, Case was "forced" to go union in order to bid government work. Unionization reduced Case's profit margin but offered a greater promise for increased business. Case hired two new estimators with competitive bidding experience. The estimators were paid a base salary and a commission on successful bids.

On January 20, 2019, the estimators met to consider a strategy for winning more city and other government projects. They decided to collect data on an upcoming project. Data on the three most likely competitors is given in Table C.1. The three companies were ACE, Reed, and Talcott. The following notes were shared among the two estimators.

1. In 2015, ACE was contract-rich and had a difficult time completing its projects.
2. In 2017, Reed filed for bankruptcy.
3. Talcott entered the government market in 2015.

TABLE C.1
Data

Customer Number	Winning Bid/$$	Successful Bidder	Total Direct Cost
101	79,000	Reed	54,450
101	137,200	ACE	108,023
101	42,600	Reed	39,567
101	104,700	Talcott	100,567
101	78,600	ACE	76,356

[1] Names and data have been disguised

101	111,700	Reed	108,945
101	47,000	Talcott	45,782
101	163,458	Reed	162,890
101	89,900	ACE	90,875
101	33,700	ACE	45,673
102	61,700	Reed	57,456
102	92,000	Talcott	87,234
102	69,100	Reed	65,783
102	58,700	Reed	55,982
103	117,100	ACE	88,934
103	48,000	Reed	44,673
103	67,100	Reed	62,783
105	88,900	Reed	83,892
105	102,800	Reed	98,903
107	57,600	Reed	54,675
107	93,700	Talcott	90,987
109	81,200	ACE	63,200
109	46,300	Talcott	35,090
109	74,700	ACE	61,400
109	82,346	ACE	69,200
109	107,600	Reed	106,784
110	111,000	Reed	108,934
110	62,600	Talcott	61,553
110	78,200	Reed	77,634
110	81,700	Reed	83,456
112	148,800	Talcott	140,987
112	103,400	Talcott	98,764
112	87,100	ACE	66,234
118	50,800	Reed	52,594

Case 8: Central Texas Wine Distributors (CTWD)[1]

Central Texas Wine Distributors (CTWD) is a small wine distributor located in Dallas, Texas.

From January 1, 2019 through December 31, 2019, this market generated $3,220,892.54 in wine sales. The warehouse manager, Gad Turner, is an expert wine buyer. CTWD is a family owned business. The company demographics are given in Table C.1.

It is easy to see that as an independent distributor, CTWD does not have the purchasing power of a large wine distributor. Instead, CTWD takes an approach to operations based on superior customer service. As an example, if a new wine is purchased CTWD will sometimes inform specific retail customers based on knowledge of their preferences. Any competitive advantage is gained through quality, service, and by offering unique products enhanced by unmatched delivery service. Gad is in charge of all wine, beer, and low-alcohol spirits (under 44 proof) purchasing.

According to Gad, wine purchasing is based on unique taste, a high level of customer interaction, and discussions with knowledgeable sales representatives. Major wine deliveries are received on Wednesdays and Fridays, but some additional wine is delivered on Thursdays. Specialty orders are delivered throughout the week. All wine orders are stocked in the warehouse when received.

It is a common practice for all orders to be in by 7:00 am and stocked by 10:00 am. Gad personally places all wine orders. The CTWD sales representatives visit retail stores Monday–Friday with samples. Orders are usually placed by the retail stores during these visits. Retail buyers are also invited to attend Friday wine tasting sessions. The CTWD sales representatives sometimes scan the retailer sales floor inventory and discuss the observed needs with the retailer's wine buyers.

Based on information received from the CTWD sales representatives, Gad decides whether to place certain orders. Purchasing deals are common, and Gad is alerted of these opportunities by the various supplier representatives. The large wine sellers usually initiate the various purchasing deals.

TABLE C.1
Company Demographics

Description	Metrics	Comments
Business duration	28	years
Management team	4	employees
Sales reps	8	employees
Drivers	5	employees
Warehouse	2	employees
Customers	Approximately 300	Dallas, Fort Worth, Austin, San Antonio
Suppliers	Approximately 25	Throughout the world: France, Germany, Spain, Italy, Australia, New Zealand, Norway, United States

[1] Names and data have been disguised Copyright 2020 W. C. Benton Jr.

The Wine Department Operations

The wine department is divided into three sections (Wine, Bottled Wine, and Jug Wine). Table C.2 is an Excel spreadsheet consisting of a list of wine sales for 2019, the description of the products, the quantity sold during the year, the average price, and the cost of goods sold. As can be seen in Table C.2, CTWD carries an extensive number of products. From January 1, 2019, to December 31, 2019, over 1,300 different items were sold under the classification of bottled wine.

The Wine Purchasing Process

The wine purchasing process is driven by wine promotions, discounts, and deals that CTWD receives from wine bottlers. According to Gad, the promotions were accurately correlated with sales and eliminated the need to develop a forecast. Historical sales information for 2019 is shown in Table C.2. To determine order quantities, Gad uses the information in Figure C.1 and input from the sales representatives to roughly estimate purchasing amounts based on previous seasonal sale revenues.

Assignment Questions

How should Gad manage the wine inventory for 2019?

Write a report to Gad with your analysis, recommendations, and implementation plans. Make sure your analysis is thorough and convincing.

TABLE C.2
2019 Wine Sales

Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
camo-rdc14 (Ca'Momi Rosso di Ca'Momi 2014)	15,833.00	6.29	63,558.00
ros-rosa (Rosa di Rosa Dulce)	9,609.00	9.35	61,167.39
fre-nrnv (Frey Natural Red NV)	8,391.00	6.67	35,579.30
kirk-ccr (Kirkland Signature Chianti Classico Riserva)	6,720.00	6.96	33,532.80
fre-pror (Pacific Redwood Organic Red)	5,302.00	6.67	22,474.16
fre-nwnv (Frey Natural White NV)	5,003.00	6.67	21,218.05
mon-bbNV (Francois Montand Blanc de Blancs Brut NV)	3,382.00	9.33	21,977.03
msc-mo13 (Masciarelli Montepulciano d'Abruzzo 2013)	3,921.00	7.63	19,146.97
msc-mo14 (Masciarelli Montepulciano d'Abruzzo 2015)	3,441.00	7.99	18,018.47
evt-emj4paks (Evil Twin – Even More Jesus 6-4paks)	380.33329	67.14	15,596.23
coh-cen14 (Cota de Hayas Centenaria 2014)	2,508.00	9.99	16,256.85
evt-bisc4paks (Evil Twin – Imperial Biscotti Break 6-4paks)	350.16663	67.14	14,356.83
camo-bianco14 (Bianco di Ca'Momi 2014)	3,674.00	6.36	14,740.00

(*Continued*)

(Continued)

Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
anp-cs14 (Ancient Peaks Cabernet Sauvignon 2014)	2,075.00	11.26	17,824.64
sws-pc (Sweet Silhouette Sparkling Moscato Peach)	4,129.00	5.33	15,292.70
liv-rrnv (Live A Little Really Ravishing Red NV)	3,299.00	6.67	13,334.02
evt-fudge22oz (Evil Twin – Liquid Double Fudge 66cl)	3,892.00	5.59	13,299.40
don-ra14 (Bodegas Don Ramon Vino Tinto Barrica 2014)	4,047.00	5.33	14,190.75
camo-ch14 (Ca'Momi Chardonnay 2014)	2,232.00	9.64	15,288.57
cos-cdr15 (St. Cosme Cotes du Rhone 2015)	1,974.00	10.48	14,453.66
evt-ilove4pk (Evil Twin I Love You With My Stout Imperial Stout 4pak)	322.62501	62.26	13,234.47
evt-molotovlite4pak (Evil Twin – Molotov Lite – Double IPA – 4pak 6 to a case)	436.83099	44.97	13,075.83
esp-cs13 (Elizabeth Spencer Cabernet Sauvignon 2013)	632.00	28.66	13,303.50
cgf-bs10 (Chateau Grand Francais Bordeaux Superieur 2010)	1,352.00	13.33	13,211.22
fee-orsm (Fee Brothers Orange Bitters 5 oz)	3,273.00	5.48	11,687.97
cos-cdr14 (St. Cosme Cotes du Rhone 2014)	1,587.00	10.65	11,836.96
ste-cs15 (Stellar NSA Cabernet Sauvignon 2015)	2,271.00	7.33	10,658.01
fre-agred14 (Frey Agriculturalist Red 2014)	2,080.00	7.99	10,751.81
camo-me14 (Ca'Momi Merlot 2014)	1,680.00	9.61	11,285.93
hon-blnv (Honeyrun Blackberry Honeywine)	1,524.00	9.99	9,781.82
goo-pg15 (Good Pinot Grigio 2015)	2,259.00	6.67	9,889.99
fil-real13 (Filon Real 2013)	1,720.00	8.66	10,700.63
4sta-cs14 (Four Star Napa Valley Cabernet Sauvignon 2014)	1,231.00	11.99	10,229.80
evt-dough (Evil Twin Imperial Doughnut Break)	1,151.00	12.79	9,495.75
fee-ofbsm (Fee Brothers Old Fashion Bitters 5 oz)	2,605.00	5.49	9,301.68
luz-cr12 (Luzon Crianza 2012 Seleccion 12)	1,646.00	8.40	9,995.71
msc-moma13 (1.5 L Masciarelli Montepulciano Magnum 2013)	1,003.00	13.33	9,511.05
elc-ro15 (Elicio Rose 2015)	1,818.00	7.16	8,203.50
fre-prcs14 (Pacific Redwood Cabernet Sauvignon 2014)	1,491.00	8.66	8,675.92
per-pg14 (Perlage Pinot Grigio 2014)	1,473.00	8.66	8,622.93
goo-pg14 (Good Pinot Grigio 2014)	1,838.00	6.67	8,058.72
fre-cs14 (Frey Cabernet Sauvignon 2014)	963.00	12.66	7,226.25
camo-rosso14 (Ca'Momi Rosso di Napa 2014)	1,761.00	6.67	7,286.00
fil-ti15 (Filon Garnacha 2015)	1,887.00	5.99	8,244.02
chm-cb14 (Domaine de Chateaumar CDR "Cuvee Bastien" Grenache 2014)	1,150.00	9.81	8,087.16
esp-sb14 (Elizabeth Spencer Sauvignon Blanc 2014)	1,122.00	9.99	8,271.96
evt-mtail4pak (Evil Twin Molotov Cocktail 4 pak 6 to a case)	179.00	62.35	7,340.16
anp-cs13 (Ancient Peaks Cabernet Sauvignon 2013)	1,037.00	10.66	8,727.83
bad-jr15 (Badger Mountain Riesling 2015)	1,378.00	7.99	6,665.16

frs-barb14 (Franco Serra Barbera d'Alba 2014)	1,496.00	7.33	7,038.63
hon-menv (Honeyrun Honeymead NV)	1,278.00	8.49	6,922.48
luz-blk14 (Luzon Black 2014)	1,718.00	6.15	7,188.89
fre-pn15 (Frey Pinot Noir 2015)	923.00	11.33	7,392.00
bar-ro15 (Bargemone Rose 2015)	951.00	10.95	8,048.63
bor-bopg15 (Borgo Boschetto Pinot Grigio 2015)	1,174.00	8.66	5,310.73
sca-mod15 (Scagliola Moscato d'Asti "Primo Bacio" 2015)	1,179.00	8.57	8,499.68
frs-br11 (Franco Serra Barolo 2011)	459.00	21.99	6,670.00
esp-cs12 (Elizabeth Spencer Cabernet Sauvignon 2012)	346.00	28.66	6,938.00
tora-sb14 (Tora Bay Sauvignon Blanc 2014)	1,041.00	9.33	6,855.48
fil-ti14 (Filon Garnacha 2014)	1,601.00	5.99	6,879.60
che-renv (Cheap Red NV)	2,056.00	4.66	5,700.56
tur-ro15 (Turkey Flat Rose 2015)	707.00	13.33	6,886.62
kill-cs13 (Killibinbin Seduction Cabernet Sauvignon Langhorne Creek 2013)	937.00	9.99	6,105.30
bad-boxred15 (Badger Mountain Pure Red 3 Liter Box 2015)	540.00	17.33	6,138.17
anb-amnv (A. Barbadillo Medium Dry Amontillado Sherry)	1,070.00	8.66	5,230.28
per-pg15 (Perlage Pinot Grigio 2015)	1,059.00	8.66	6,186.28
baci-red (Baci Dolci Sweet Sparkling Red NV)	1,363.00	6.67	6,147.00
cru-ti14 (Crucillon Tinto 2015)	1,948.00	4.66	5,854.00
raf-mr12 (Bodegas Raffy Malbec "Reserve" 2012)	626.00	14.36	5,077.36
tur-bb14 (Turkey Flat Butcher's Block Red 2014)	667.00	13.33	6,374.68
bul-ti14 (Bula 2014)	1,023.00	8.66	5,820.29
lat-ro15 (Latue Rosado 2015)	1,339.00	6.61	5,600.00
ofc-apexpredator4 paks 6 case (Off Color Brewing Apex Predator 4pks 6 to a case)	166.16668	52.70	5,736.23
fee-cherry (Fee Brothers Cherry Bitters 5 oz)	1,576.00	5.48	5,610.73
sws-pr (Sweet Silhouette Sparkling Moscato Pear Tart)	1,599.00	5.33	5,978.21
evt-geyser4pk (Evil Twin/Two Roads – Two Evil Geyser Gose 6-4paks per case – Ice. . .	161.83332	52.56	5,404.36
fre-prpn15 (Pacific Redwood Pinot Noir 2015)	977.00	8.66	6,358.00
coh-fa13 (Cota de Hayas Fagus 2013)	632.00	13.33	5,940.64
ste-me15 (Stellar NSA Merlot 2015)	1,122.00	7.33	5,264.52
sws-gra (Sweet Silhouette Sparkling Moscato Grapefruit)	1,531.00	5.33	5,744.91
sti-gosewild66cl (Stillwater – Gose Gone Wild 66cl)	1,135.00	7.10	5,116.50
ste-sb15 (Stellar Sauvignon Blanc 2015)	1,092.00	7.33	5,073.56
mar-cve10 (Marina Cvetic 2010)	399.00	19.99	5,320.27
frs-bars13 (Franco Serra Barbaresco 2013)	476.00	16.65	5,730.00
sti-fleek4pak (Stillwater – On Fleek 6-4pak)	150.00	52.73	4,875.00
luz-altos11 (Altos de Luzon 2011)	730.00	10.66	5,611.41
chr-ka14 (St. Christopher Bernkastler Kurfurstlay Kabinett Riesling 2014)	1,061.00	7.33	5,259.59
liv-ww (Live A Little Wildly Wicked White NV)	1,158.00	6.67	4,682.36

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
evt-yang4pk6toacase (Evil Twin Yang Imperial IPA 6-4paks to a case)	123.83327	62.13	4,712.77
anp-re13 (Ancient Peaks Renegade 2013)	575.00	13.33	5,302.77
sch-kodorn14 (Schloss Koblenz Private Label Dornfelder Sweet Weinhaus 2014)	874.00	8.62	4,664.01
anp-me13 (Ancient Peaks Merlot 2013)	690.00	10.87	5,781.86
frs-neb14 (Franco Serra Nebbiolo 2014)	778.00	9.33	4,927.02
des-picp15 (Domaine Del Sol Picpoul de Pinet 2015)	989.00	7.33	4,955.00
sca-mod14 (Scagliola Moscato d'Asti Primo Bacia 2014)	832.00	8.66	5,139.90
evt-citra4paks (Evil Twin – Citra Sunshine Slacker – Session IPA – 4paks 6 to a c. . .	157.50	45.55	4,649.34
evt-modern12oz (Evil Twin – Modern IPA 12oz Cans 4paks 6 to a case)	187.00	38.33	4,397.44
bat-mare14 (Sierra Batuco Malbec Reserva 2014)	1,113.00	6.43	5,308.08
bad-jr14 (Badger Mountain Riesling 2014)	894.00	7.99	4,320.97
liv-dky24 ((Dinky) Live-A-Little Ravishing Red 250 ml)	2,818.00	2.53	4,270.34
kill-sh13 (Killibinbin Sneaky Shiraz Langhorne Creek 2013)	708.00	9.99	4,654.99
bir-srnv (Birbet Semi-Sweet Sparkling Red NV)	879.00	7.93	4,504.91
fre-prpn14 (Pacific Redwood Pinot Noir 2014)	802.00	8.66	5,214.00
evt-falco16ozcans (Evil Twin – Falco – IPA – 16oz can 4paks 6 to a case)	160.91666	43.12	4,749.50
evt-emJ66CL (Evil Twin Even More Jesus 66cl)	540.00	12.78	4,275.00
cos-jamwh14 (St. Cosme Little James Basket Press White 2014)	1,029.00	6.71	6,669.25
fre-ch14 (Frey Chardonnay 2014)	686.00	9.98	4,459.00
dlm-ch14 (Domaine de La Motte Chardonnay 2014)	1,022.00	6.67	4,632.75
far-mo14 (Farina Moscato 2014)	681.00	9.98	4,785.51
sws-co (Sweet Silhouette Sparkling Moscato Coconut)	1,270.00	5.33	4,767.58
tri-sbca15 (Tricky Rabbit Sauvignon Blanc/Carmenere Reserva 2015)	1,013.00	6.67	4,837.82
chm-ro15 (Domaine de Chateaumar Rose Cotes du Rhone 2015)	719.00	9.32	4,470.83
raf-he12 (Raffy Hedera Malbec 2012)	773.00	8.66	5,078.33
hon-elnv (Honeyrun Elderberry NV)	705.00	9.33	4,409.35
pog-cc13 (Poggio Amorelli Chianti Classico 2013)	655.00	9.99	4,686.26
evt-lilB 4pks 6 to a case (Evil Twin Lil 'B 4pks 6 to a case)	104.74666	62.26	3,981.13
evt-heavy66cl (Evil Twin – Molotov Heavy 66cl)	480.00	13.58	4,200.00
per-can14 (Perlage Canah Brut 2014)	546.00	11.76	4,491.65
anb-finv (A. Barbadillo Pale Dry Fino Sherry NV)	727.00	8.66	3,578.46
bad-ch15 (Badger Mountain Chardonnay 2015)	699.00	8.65	3,379.59
luz-ve15 (Luzon Verde 2015)	996.00	6.05	4,101.80
camo-cs14 (Ca'Momi Cabernet Sauvignon 2014)	390.00	15.33	4,361.50
vno-vi13 (Villano 2013)	690.00	8.66	4,030.41

fre-agwh14 (Frey Agriculturalist White 2014)	736.00	7.99	3,807.80
pen-vp15 (Penya Rouge 2015)	674.00	8.66	3,618.61
evt-nomawe4pak (Evil Twin – Nomader Weisse 4 pak 6 to a case)	110.79167	52.67	3,884.26
frs-br12 (Franco Serra Barolo 2012)	264.00	21.99	3,835.25
omni-sel66cl (Omnipollo – Selassie 66cl)	479.00	11.98	3,792.08
fee-bw (Fee Brothers Black Walnut Bitters 5 oz.)	1,036.00	5.51	3,709.81
evt-biscottihalfbarrel (Evil Twin – Imperial Biscotti Break Half Barrels)	19.00	300.00	3,781.00
ofc-troublesome (Off Color Brewing Troublesome 12 oz 4 paks 6 to a case/Gose)	107.29169	52.37	3,500.36
fre-prch14 (Pacific Redwood Chardonnay 2014)	645.00	8.66	3,603.64
anb-crnv (A. Barbadillo Full Rich Cream Sherry)	628.00	8.66	3,079.85
evt-minigrowler (Evil Twin/Westbrook – Mini Growler Imperial Stout)	420.00	12.78	3,325.00
ste-cs16 (Stellar NSA Cabernet Sauvignon 2016)	731.00	7.33	3,430.73
tur-ro16 (Turkey Flat Rose 2016)	401.00	13.33	3,906.63
bad-boxwh15 (Badger Mountain Pure White 3 Liter Box 2015)	361.00	14.66	3,336.70
evt-emj6barrel (Evil Twin Even More Jesus 6 barrel)	30.00	175.17	3,282.00
sch-kodorn15 (Schloss Koblenz Private Label Dornfelder Sweet Weinhaus 2015)	563.00	9.33	3,005.32
bat-pnre13 (Sierra Batuco Pinot Noir Reserva 2013 Estate)	811.00	6.48	3,864.10
frs-ro15 (Franco Serra Rosato Piemonte 2015)	775.00	6.67	3,516.75
ste-ch14 (Stellar Chardonnay 2014)	693.00	7.33	3,313.47
baci-bl (Baci Dolci Blond NV)	758.00	6.67	3,424.50
ama-cs12 (Amavi Cabernet Sauvignon 2012)	294.00	17.00	4,278.44
anb-donv (A. Barbadillo Oloroso Sherry NV)	576.00	8.66	2,829.20
che-whnv (Cheap White NV)	1,053.00	4.66	2,895.75
evt-xmaseve4pks (Evil Twin Xmas Eve at a NYC hotel Room 4 paks 6 to a case)	72.00	67.15	2,952.00
omni-fatamorgana (Omnipollo Fatamorgana Double IPA 66 cl)	670.00	7.19	3,299.08
vil-an15 (Villa des Anges Cabernet Sauvignon 2015)	654.00	7.33	3,471.51
sor-pg14 (Villa Sorono Pinot Grigio 2014)	910.00	5.26	3,206.00
omni-bianca66cl (Omnipollo – Bianca Mango Lassi Gose 66cl)	659.00	7.16	3,240.09
evt-maple12oz (Evil Twin – Michigan Maple Jesus 12oz)	494.00	9.53	2,470.00
tri-sbca16 (Tricky Rabbit Sauvignon Blanc/Carmenere Reserva 2016)	703.00	6.67	3,341.62
omni-yellowbelly33cl (Omnipollo/Buxton Brewery – Yellow Belly – Imperial Stout 33cl)	494.00	9.45	3,190.41
cov-re09 (Covila Reserva 2009)	349.00	13.33	3,334.50
fre-prme14 (Pacific Redwood Merlot 2014)	533.00	8.66	3,007.49
fre-zi14 (Frey Zinfandel 2014)	462.00	9.99	3,003.00
ste-pi15 (Stellar NSA Pinotage 2015)	626.00	7.33	2,952.32
fre-prme15 (Pacific Redwood Merlot 2015)	527.00	8.66	2,989.22

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
sti-phuket66cl (Stillwater – Gose Gone Wild – World Tour, Phuket 66cl)	634.00	7.16	2,853.00
nor-al15 (Nora Albarino 2015)	425.00	10.66	3,342.61
ilb-sa15 (Il Bastardo Sangiovese 2015)	840.00	5.33	3,020.75
luz-bn14 (Luzon Blanco 2014)	745.00	5.99	2,608.02
kaj-do14 (Karl Josef Dornfelder 2014)	691.00	6.41	2,910.68
sti-as follows 4pks 6 to a cse (Stillwater As Follows 4pk 6 to a case)	102.54166	43.08	2,977.43
hac-cbnv (Hacienda del Carche Brut Cava NV)	732.00	5.99	2,998.65
chm-cb15 (Domaine de Chateaumar CDR "Cuvee Bastien" Grenache 2015)	431.00	9.99	3,061.39
per-sg13 (Perlage Sgajo Prosecco Spumante 2013)	430.00	9.98	2,873.29
nai-nai14 (Naia 2014)	493.00	8.66	3,113.61
evt-wet4paks (Evil Twin – Wet Dream 6-4paks)	88.875	47.79	2,892.50
sti-bunny4paks (Stillwater/AZ Wilderness – Big Bunny 4-6paks)	110.625	38.30	2,602.14
frs-neb13 (Franco Serra Nebbiolo 2013)	453.00	9.33	2,947.75
piq-ro15 (Pique Poul Rose 2015)	449.00	9.33	2,938.00
esp-sb15 (Elizabeth Spencer Sauvignon Blanc 2015)	419.00	9.99	3,105.66
evt-retro12oz (Evil Twin – Retro IPA – 12oz Cans 4 paks 6 to a case)	107.16667	38.32	2,549.26
fre-sb14 (Frey Sauvignon Blanc 2014)	440.00	9.33	2,490.00
sti-nutropic4pak (Stillwater – Nu Tropic 6-4paks)	106.16327	38.38	2,495.95
blo-rg13 (Chateau Blouin Bordeaux Rouge 2013)	602.00	6.67	2,754.00
hon-chnv (Honeyrun Cherry Honeywine)	439.00	9.12	2,670.60
omni-ybsundae33cl (Omnipollo – Yellow Belly Sundae)	360.00	11.11	2,385.00
omni-aniara66cl (Omnipollo – Aniara – Lemon Pale Ale 66 cl)	556.00	7.17	2,733.68
pow-sh12 (Powers Sheridan Reserve Cabernet Sauvignon 2012)	239.00	16.66	2,868.00
evt-nohero4paks (Evil Twin – No Hero 6-4paks)	82.66668	47.90	2,692.78
bad-boxred14 (Badger Mountain Pure Red 3 Liter Box 2015)	228.00	17.33	2,582.10
tri-cssy13 (Tricky Rabbit Cabernet Sauvignon/Syrah Reserva 2013)	591.00	6.67	2,811.99
nic-aa07 (Nicolis Valpolicella Classico "Ambrosan" Amarone 2007)	82.00	47.99	2,962.19
mos-cl13 (Mosen Cleto Crianza 2013)	652.00	5.99	2,610.00
omni-abra66cl (Omnipollo – Abrahadabra 66cl)	540.00	7.19	2,655.00
cos-jamre13 (St. Cosme Little James Basket Basket Press Red 2014)	580.00	6.67	3,595.15
fee-whbarrel (Fee Brothers Barrel Aged Whisky Bitters)	386.00	9.99	2,161.60
pow-csbx14 (Powers Cabernet Sauvignon 3 Liter Box 2014)	263.00	14.66	2,627.78
nai-snaia14 (Naia S-Naia Sauvignon Blanc 2014)	445.00	8.66	2,697.44
evt-simcoe4paks (Evil Twin – Imperial Simcoe Slacker 6-4paks)	80.33333	47.93	2,614.90
evt-auntodo33cl (Evil Twin – Aun Mas Todo Jesus 33cl)	600.00	6.38	2,250.00

omni-rasp66cl (Omnipollo – Raspberry Bianca Gose 66cl)	480.00	7.96	2,600.00
evt-fudge6barrel (Evil Twin – Liquid Double Fudge 6 barrel)	30.00	124.83	2,520.00
fee-azchoc (Fee Brothers Aztec Chocolate Bitters 5 oz)	674.00	5.50	2,408.11
evt-fudgehalfbarrels (Evil Twin – Liquid Double Fudge Half Barrel)	13.00	285.00	2,587.00
nor-al14 (Nora Albarino 2014)	347.00	10.66	2,711.57
dlm-pn14 (Domaine de La Motte Pinot Noir 2014)	503.00	7.33	2,589.91
anp-re14 (Ancient Peaks Renegade 2014)	276.00	13.33	2,562.01
fre-prsy14 (Pacific Redwood Syrah 2014)	418.00	8.66	2,351.23
cos-jamwh15 (St. Cosme Basket Press White 2015)	417.00	8.66	2,482.44
sti-statesaison4pk6toacase (Stillwater Stateside Saison 4pk 6 to a case)	83.66668	43.06	2,264.78
evt-ilove6barrel (Evil Twin I Love You With My Stout Imperial Stout 6 barrel)	26.00	138.46	2,314.00
ste-sh15 (Stellar NSA Shiraz 2015)	491.00	7.33	2,307.47
mcb-jungle4pak (Marz Community Brewing – Jungle Boogie 6/4paks)	50.00	71.88	2,600.00
tur-bb13 (Turkey Flat Butcher's Block Red 2013)	265.00	13.37	2,628.70
sti-super4paks (Stillwater – Super Hop 6-4paks)	73.91666	47.92	2,161.59
man-mano13 (Mano a Mano 2013)	481.00	7.33	2,416.97
tora-sb15 (Tora Bay Sauvignon Blanc 2015)	376.00	9.33	2,499.40
pen-ro15 (Penya Rose 2015)	581.00	6.03	3,051.74
inf-ro15 (In Fine Rose 2015)	407.00	8.59	2,102.83
evt-sdk4pak (Evil Twin – Soft DK 4paks 6 to a case – Imperial Stout w/ Vanilla)	60.37501	57.89	2,521.38
gue-ti750ml (Gueuze Tilquin – Oude Gueuze Tilquin A L'Ancienne 750 ml)	216.00	15.92	2,376.00
evt-mtailhalfbbl (Evil Twin Molotov Cocktail Imperial IPA Half Barrel)	12.00	285.00	2,388.00
evt-dough6barrel (Evil Twin Imperial Doughnut Break 6 barrel)	17.00	200.00	2,193.00
evt-hipcans (Evil Twin Hipster 6-4paks)	88.625	38.32	2,113.91
fre-ps14 (Frey Petite Sirah 2014)	299.00	11.33	1,943.50
mos-cl12 (Mosen Cleto Crianza 2012)	561.00	5.99	2,245.74
mon-bbsplits (Francois Montand Splits Blanc de Blanc Sparkling NV)	840.00	3.99	2,088.06
nic-va14 (Nicolis Valpolicella Classico 2014)	77.99994	9.99	2,329.14
sti-cellardoor6 4pks (Stillwater Cellar Door 6x4 paks to a case)	78.00	42.57	2,123.81
evt-molotovlite6barrel (Evil Twin – Molotov Lite – Double IPA 6 barrel)	31.00	106.61	2,278.50
fee-peach (Fee Brothers Peach Bitters 5 oz)	599.00	5.49	2,134.90
cap-br09 (Capanna Brunello 2009)	78.00	41.99	2,000.50
gue-til375ml (Gueuze Tilquin – Oude Gueuze Tilquin A L'Ancienne 375ml)	342.00	9.56	2,052.00
omni-aurora66cl (Omnipollo – Aurora 66cl)	452.00	7.18	2,222.33
fre-biof14 (Frey Biodynamic Field Blend 2014)	325.00	9.99	2,227.66
fre-me14 (Frey Merlot 2014)	256.00	12.66	1,664.00
per-pro14 (Perlage Riva Moretta Prosecco 2014)	323.00	9.98	2,434.54
coh-fa12 (Cota de Hayas Fagus 2012)	240.00	13.33	2,291.29
ofc-dinostout4paks (Off Color Brewing – Dino'smores 4paks 6 to a case)	29.9999	105.54	2,070.00

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
evt-umami66cl (Evil Twin – Imperial Biscotti Break Raspberry Umami 66cl)	180.00	17.56	2,175.00
sor-pn14 (Villa Sorono Pinot Noir 2014)	589.00	5.33	2,073.75
msc-tr15 (Masciarelli Trebbiano d'Abruzzo 2015)	393.00	7.94	2,082.80
frs-ga15 (Franco Serra Gavi 2015)	424.00	7.33	2,125.00
evt-impbiscotti (Evil Twin Imperial Biscotti)	240.00	12.79	1,900.00
evt-auncafejesus33cl (Evil Twin – Aun Mas Cafe Jesus 33cl)	480.00	6.39	1,800.00
don-im13 (Don Ramon Garnacha Imperial Roble 2013)	512.00	5.99	1,696.86
pow-kv12 (Powers Kiona Vineyard Reserve Cabernet Sauvignon 2012)	153.00	19.99	1,989.00
evt-bikcans (Evil Twin Bikini Beer Cans 4pk 6 to a case)	86.66667	35.10	1,864.69
vov-vv14 (Vinho Verde 2014)	507.00	5.99	2,209.59
dlm-pn15 (Domaine de La Motte Pinot Noir 2015)	414.00	7.33	2,077.50
mon-ronv (Francois Montand Sparkling Rose Brut NV)	302.00	9.99	2,142.05
har-ba12 (Scott Harvey Mtn. Selection Amador Barbera 2012)	251.00	11.99	1,861.24
coh-cen13 (Cota de Hayas Centenaria 2014)	301.00	9.99	1,957.22
evt-msimcoe6b (Evil Twin – Molotov Simcoe 6 barrel)	24.00	125.00	2,016.00
dar-rg14 (Les Darons 2014 Rouge)	299.00	10.03	2,131.49
fre-biof13 (Frey Biodynamic Field Blend 2014)	300.00	9.99	2,050.01
evt-falcohalfbarrel (Evil Twin Falco Half Barrel)	17.00	174.35	2,364.66
frs-bars12 (Franco Serra Barbaresco 2012)	177.00	16.66	2,130.00
jig-pn14 (Jigsaw Pinot Noir 2014)	221.00	13.33	2,136.52
anb-rsnv (A. Barbadillo. Extra Rich Pedro Ximinez Sherry)	288.00	10.08	2,302.39
fre-cs15 (Frey Cabernet Sauvignon 2015)	230.00	12.62	1,725.00
evt-biscotti6barrel (Evil Twin – Imperial Biscotti Break 6 barrel)	20.00	145.00	1,780.00
ste-ch15 (Stellar Chardonnay 2015)	394.00	7.33	1,854.88
ofc-eek750ml (Off Color/Miller – Eeek! 750ml)	181.00	15.94	2,036.25
bbf-classicsaison750ml (Blackberry Farms – Classic Saison 750ml)	241.00	11.94	2,000.61
esp-gren14 (Elizabeth Spencer Grenache 2014)	196.00	14.66	2,161.50
sti-super16oz4pak (Stillwater – Super Hop 16oz cans 6-4paks)	49.83333	57.55	1,894.45
har-thrstag12 (Scott Harvey Three Stags Red 2012)	457.00	6.24	3,214.37
sti-fleekhalfbarrel (Stillwater – On Fleek Half Barrel)	10.00	285.00	2,050.00
cab-sn14 (Cabirau Serge et Nicolas 2014)	194.00	14.66	1,937.13
evt-lowlife16ozcan (Evil Twin – Low Life -Pilsner- 16oz can 4paks 6 to a case)	66.66667	42.63	1,974.67
evt-mission4paks (Evil Twin – Mission Gose 6-4paks)	53.58336	52.67	1,878.32
tri-cfca13 (Tricky Rabbit Cabernet Franc Carmenere Reserva 2013)	422.00	6.67	2,006.87
rhe-ka12 (Weinland Rheingau Hochheimer Daubhaus Riesling Kabinett 2012)	601.00	4.66	1,853.83

nic-seri12 (Nicolis Valpolicella Classico “Seccal” Ripasso 2012)	163.00	17.06	2,017.79
bat-mare13 (Sierra Batuco Malbec 2014 Reserva Estate)	416.00	6.67	2,002.07
nin-ncs10 (Nine Mile Cabernet Sauvignon 2010)	319.00	8.66	1,914.00
evt-mtail6barrel (Evil Twin Molotov Cocktail 6 barrel)	22.00	125.00	1,848.00
luz-ve14 (Luzon Verde 2014)	408.00	6.67	1,700.86
fee-grapefruit (Fee Brothers Grapefruit Bitters 5 oz)	494.00	5.48	1,760.59
ilb-sa14 (Il Bastardo Sangiovese 2014)	508.00	5.33	1,827.49
cru-ti15 (Crucillon Tinto 2016)	580.00	4.66	1,741.22
fre-prcs15 (Pacific Redwood Cabernet Sauvignon 2015)	312.00	8.65	1,820.02
ste-heav (Heaven on Earth Organic Sweet Wine NV 375 ml)	311.00	8.66	1,875.25
sem-pr15 (Semaphore 7 Portuguese Red 2015)	311.00	8.66	1,568.38
bad-nspn14 (Badger Mountain NSA Oregon Pinot Noir 2016)	252.00	10.66	1,888.94
evt-yin4pk6toacase (Evil Twin Yin Imperial Stout 6-4paks to a case)	43.0416	62.25	1,649.83
bat-rbre14 (Sierra Batuco Red Blend Reserva 2014)	413.00	6.48	1,968.86
urb-death500 (Urban Family Brewing – Death To Cereal 500ml)	357.00	7.45	1,885.42
anp-zi12 (Ancient Peaks Zinfandel 2012)	242.00	10.95	2,079.14
bat-ch14 (Sierra Batuco Chardonnay Reserva 2014)	412.00	6.43	1,987.81
bar-ro14 (Bargemone Rose 2014)	233.00	11.33	2,008.52
fee-lemon (Fee Brothers Lemon Bitters 5 oz)	480.00	5.49	1,713.60
ltv-sb15 (Latin Vid Sauvignon Blanc 2015)	439.00	5.99	1,481.74
bad-nsc15 (Badger Mountain NSA Cabernet Sauvignon 2015)	246.00	10.66	1,843.99
esp-pn13 (Elizabeth Spencer Pinot Noir 2013)	112.00	23.33	1,921.00
urb-kriek375ml2015 (Urban Family – Kriek 2015 – 375ml)	296.00	8.79	1,776.00
fre-sb15 (Frey Sauvignon Blanc 2015)	278.00	9.33	1,575.31
chm-cdp13 (Domaine de Chateaumar Chateauneuf-du-Pape 2013)	97.00	26.66	1,852.35
sun-sb14 (Sunday Mountain Marlborough Sauvignon Blanc 2014)	263.00	9.77	1,842.98
sor-pg15 (Villa Sorono Pinot Grigio 2015)	481.00	5.33	1,687.00
ste-me14 (Stellar NSA Merlot 2015)	349.00	7.33	1,636.70
ann-bl15 (Domaine St. Anne Bordeaux Blanc 2015)	254.00	9.99	1,698.55
blo-rg14 (Chateau Blouin Bordeaux Rouge 2014)	380.00	6.67	1,723.50
mar-cve13 (Marina Cvetic Montepulciano d’Abruzzo 2013)	123.00	20.48	1,803.80
nin-shn13 (Nine Mile Shiraz 2013)	287.00	8.66	1,776.00
cic-pm14 (Cicchitti Primmo Malbec Mendoza 2014)	286.00	8.66	1,712.31
ken-cf12 (Kenefick Caitlin’s Select Cabernet Franc 2012)	74.00	33.33	1,887.50
sca-giNV (Scagliola Giocofiore Rosso Dolce 2013)	253.00	9.66	1,731.68
fre-bz14 (Frey Biodynamic Zinfandel 2014)	193.00	12.66	1,737.00
gue-oq375 (Gueuze Tilquin – Oude Questche Tilquin A L’Ancienne 375ml)	192.00	12.72	1,584.00
vil-an14 (Villa des Anges Cabernet Sauvignon 2014)	333.00	7.33	1,756.00
evt-hiphalfbarrel (Evil Twin – Hipster Ale half-barrel)	13.00	187.31	1,677.00
fee-gin (Fee Brothers Gin Barrel-Aged Orange Bitters 5 oz)	358.00	6.75	2,004.80

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
anp-me14 (Ancient Peaks Merlot 2014)	212.00	11.33	1,775.27
evt-emjhalfbarrels (Evil Twin – Even More Jesus Half Barrels)	8.00	300.00	1,592.00
ken-cs12 (Kenefick Ranch Chris's Cuvee Cabernet Sauvignon 2012)	57.00	41.99	1,725.00
chr-pmkab15 (St. Christopher Piesporter Michelsberg Kabinett 2015)	326.00	7.33	1,610.10
ofc-tiger750ml (Off Color Brewing – Space Tiger 750ml)	176.00	13.55	1,686.66
frs-do15 (Franco Serra Dolcetto 2015)	324.00	7.33	1,632.50
evt-ryan4pks (Evil Twin – Ryan and the Beaster Bunny 6-4pks to a case)	55.00	43.14	1,520.37
anb-manv (A. Barbadillo Manzanilla Sherry NV)	273.00	8.66	1,326.47
bat-pnre14 (Sierra Batuco Pinot Noir Reserva 2014)	354.00	6.67	1,698.09
luz-pv13 (Luzon Petit Verdot 2013)	270.00	8.66	1,398.81
fre-bc14 (Frey Biodynamic Chardonnay 2014)	184.00	12.65	1,572.76
lan-ro15 (Chateau de Lancyre Rose 2015)	197.00	11.80	1,587.31
vent-ossa11 (Venta La Ossa 2011)	215.00	10.66	1,688.29
bor-bopg14 (Borgo Boschetto Pinot Grigio 2014)	263.00	8.66	1,205.43
fre-pn14 (Frey Pinot Noir 2014)	201.00	11.33	1,608.00
raf-gr10 (Bodegas Raffy Malbec "Grande Reserve" 2010)	121.00	18.75	2,126.43
hon-crnv (Honeyrun Cranberry Honeywine)	248.00	9.13	1,510.74
ofc-fierce4pak (Off Color Brewing – Fierce – Berliner Weisse – 4pak 6 to a case)	42.91666	52.67	1,394.79
evt-heavy6barrel (Evil Twin Molotov Heavy 6 Barrel)	11.00	205.00	1,529.00
bbf-noble750 (Blackberry Farms – Noble Cuvee (Hoppy Saison) 750ml)	187.00	11.92	1,550.99
sti-super6barrels (Stillwater – Super Hop 6 barrel)	23.00	96.39	1,587.00
sti-haze66cl (Stillwater – Tangerine Haze 66 cl)	308.00	7.19	1,514.33
don-ra12 (Bodegas Aragonesas Don Ramon Vino Tinto Barrica 2012)	413.00	5.33	1,450.78
cos-coro14 (St. Cosme Cote Rotie 2014)	44.00	49.99	1,507.82
esp-halfcs13 (Elizabeth Spencer 375 ml Cabernet Sauvignon 2013)	132.00	16.48	1,584.00
bad-nm14 (Badger Mountain NSA Merlot 2014)	204.00	10.66	1,528.82
fre-ch15 (Frey Chardonnay 2015)	217.00	9.99	1,410.50
omni-nautilus66cl (Omnipollo – Nautilus – Sour Ale w/Blueberries, Lactose, & Vani. . .	300.00	7.19	1,475.00
sti-hopvine66cl (Stillwater/Hudson – Hopvine Bling 66cl)	300.00	7.19	1,475.00
evt-lilB6barrel (Evil Twin Lil B 6 barrel)	17.00	126.76	1,418.00
camo-pn13 (Ca'Momi Pinot Noir 2013)	161.00	13.33	1,471.50
urb-crimson500ml (Urban Family – Crimson Fawn 500ml)	299.00	7.17	1,495.00
sti-cen66cl (Stillwater/Cigar City – 21st Century Means 66cl)	298.00	7.18	1,465.17
nic-am09 (Nicolis Valpolicella Classico Amarone 2009)	57.00	37.33	1,493.30
peg-pl13 (Plan Pegau Lot 11-12-13)	133.00	15.98	1,413.21

ofc-sib4pak (Off Color – Sibling Rivalry 6-4paks)	40.33333	52.68	1,391.50
tri-pnsy13 (Tricky Rabbit Pinot Noir/Syrah Reserva 2013)	317.00	6.67	1,538.93
des-picp14 (Domaine Del Sol Picpoul de Pinet 2014)	288.00	7.33	1,445.00
evt-sourbikini4paks (Evil Twin – Sour Bikini – 6-4paks)	39.95866	52.70	1,398.56
fee-plum (Fee Brothers Plum Bitters 5 oz)	382.00	5.51	1,367.39
fee-rhubarb (Fee Brothers Rhubarb Bitters 5 oz)	383.00	5.49	1,369.20
ofc-scurry (Off Color Brewing Scurry 6-4paks)	39.83333	52.68	1,294.58
bad-ch14 (Badger Mountain Chardonnay 2014)	242.00	8.66	1,169.64
sti-statesidehalfbarrelnew (Stillwater Stateside Saison Half Barrel)	11.00	190.45	1,419.00
ddc-ma12 (Domaine du Crampilh Madiran l'Originel 2012)	174.00	11.99	1,392.00
evt-molotovlitehalfbarrel (Evil Twin – Molotov Lite – Double IPA Half Barrel)	9.00	230.78	1,485.00
pit-cs12 (Pitch Columbia Valley Cabernet Sauvignon 2012)	207.00	10.01	1,778.31
cov-cr13 (Covila Crianza 2013)	221.00	9.33	1,486.77
per-sa14 (Perlage Marche Sangiovese 2014)	310.00	6.64	1,375.64
evt-pach4pak (Evil Twin/Two Roads – Pachamama Porter 6-4pks)	39.00	52.66	1,270.21
nin-cs10 (Nine Mile Cabernet Sauvignon 2010)	198.00	10.27	1,537.04
stem-ch14 (Robert Stemmler Carneros Chardonnay 2014)	144.00	14.05	1,470.00
cos-jamre15 (St. Cosme Basket Press Red 2015)	232.00	8.66	1,365.77
fre-prch15 (Pacific Redwood Chardonnay 2015)	232.00	8.66	1,314.64
ced-cr14 (Domaine des Cedres Cotes du Rhone 2014)	232.00	8.66	1,405.00
evt-auncafekeg30L (Evil Twin – Aun Mas Cafe Jesus 30L Keg)	5.00	400.00	1,375.00
roy-fr10 (Clos du Roy Fronsac 2010)	120.00	16.66	1,350.00
evt-modernhalfbarrels (Evil Twin – Modern IPA – Half Barrel)	10.00	199.60	1,390.00
est-vi/ch15 (Estampa Estate Viognier/Chardonnay 2015)	230.00	8.66	1,230.84
evt-citrahalfbarrel (Evil Twin – Citra Sunshine Slacker – Session IPA – Half Barr. . .	10.00	199.00	1,390.00
ste-sp15 (Stellar Organic Sparkling Extra Dry 2015)	213.00	9.33	1,290.00
sti-g-13bottle (Stillwater – G-13 (Wild Yeast IPA) 66cl)	276.00	7.19	1,357.00
anz-pg14 (Anziano Pinot Grigio 2014)	331.00	5.99	1,336.00
vov-vv15 (Aviva Vinho Verde 2015)	331.00	5.99	1,451.31
jel-ma11 (Jelu Malbec 2011)	212.00	9.33	1,233.44
cos-gig14 (St. Cosme Gigondas 2014)	69.00	28.66	1,320.06
jig-pn13 (Jigsaw Pinot Noir 2013)	147.00	13.45	1,389.70
gue-sr750 (Gueuze Tilquin – Stout Rullquin – Gueuze & Belgian Strong Dark Ale Blend)	88.00	22.31	1,290.65
cov-gr08 (Covila Gran Reserva 2008)	101.00	19.33	1,462.01
pow-me13 (Powers Merlot 2013)	225.00	8.66	1,361.03
est-rcasycs14 (Estampa Reserve Carmenere/Syrah/Cab 2014)	202.00	9.64	1,493.33
gue-oq750 (Gueuze Tilquin – Oude Questche Tilquin A L'Ancienne 750ml)	84.00	23.10	1,288.00
evt-citra6barrel (Evil Twin – Citra Sunshine Slacker – Session IPA 6 barrel)	21.00	92.05	1,347.00

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
nai-lbr15 (Las Brisas 2015)	263.00	7.33	1,365.39
ilb-pg15 (La Bastarda Pinot Grigio 2015)	361.00	5.33	1,304.36
mcb-junglekeg30L (Marz Community Brewing – Jungle Boogie 30Liter Keg)	8.00	240.00	1,352.00
sti-syrligt33cl (Stillwater/Dugges – Syrligt (Sour Ale w/Rhubarb & Lingonberries). . .	480.00	3.99	1,160.00
sti-sunrise33cl (Stillwater/Dugges – Tropic Sunrise 33cl)	480.00	3.99	1,160.00
bat-csre13 (Sierra Batuco Cabernet Sauvignon Reserva 2013 Estate)	287.00	6.67	1,379.84
sti-darkly4paks (Stillwater A Saison Darkly Belgian Dark Saison w/ Rose Hips 4pak. . .	64.625	29.48	1,886.20
chr-ka15 (St. Christopher Bernkastler Kurfurstlay Kabinett Riesling 2015)	259.00	7.33	1,293.27
evt-yang6barrel (Evil Twin Yang Imperial IPA 6 barrel)	17.00	111.47	1,323.00
sti-tropic33cl (Stillwater/Dugges – Tropic Punch (Sour Ale w/Peaches, Mango & Pas. . .	474.00	3.99	1,145.50
chr-pms15 (St. Christopher Piesporter Michelsberg Spatelese 2015)	258.00	7.33	1,378.67
sti-tropickeg30L (Stillwater/Dugges – Tropic Punch 30L)	7.00	269.29	1,330.00
sti-stereo4paks (Stillwater Contemporary – Stereo 4paks 6 to a case – IPA)	38.79167	47.88	1,173.32
frs-ga14 (Franco Serra Gavi 2014)	252.00	7.33	1,275.00
sti-tijuana66cl (Stillwater – Gose Gone Wild – World Tour, Tijuana 66cl)	256.00	7.18	1,152.00
fre-sy14 (Frey Syrah 2014)	183.00	9.99	1,210.70
smma-ch13 (Smith Madrone Chardonnay 2013)	83.00	21.99	1,295.42
est-cabpv13 (Estampa Estate Cabernet Sauvignon/Petite Verdot 2013)	285.00	6.40	1,466.83
loc-ch14 (Lockhart Chardonnay 2014)	226.00	7.99	1,167.24
sws-manv (Sweet Silhouette Roasted Marshmallow NV Moscato)	338.00	5.33	1,276.85
caj-pn14 (Casa Julia Bosler Pinot Noir 2014)	180.00	9.99	1,108.38
dls-mo13 (Della Scala Montepulciano 2013)	533.00	3.34	1,831.62
ama-sy13 (Amavi Syrah 2013)	113.00	15.76	1,633.97
bad-nm15 (Badger Mountain NSA Merlot 2015)	167.00	10.66	1,251.79
alc-des (Alcyone Tannat Dessert Wine 500 ml)	76.00	23.33	1,147.35
luz-bl13con (Luzon Black 2014)	270.00	6.55	741.14
urb-lady500 (Urban Family Brewing – Lady of the Night 500ml)	239.00	7.39	1,247.08
ros-san14 (Rossignole Sancerre 2014)	115.00	15.33	1,371.58
sti-fleek6barrel (Stillwater – On Fleek 6 barrel)	14.00	125.00	1,246.00
esp-grrose15 (Elizabeth Spencer Rose of Grenache 2015)	143.00	12.21	1,148.00
urb-temp500ml (Urban Family – Temporary Permanance 500ml)	199.00	8.78	1,197.00
vir-cr13 (Viridiana Crianza 2013)	201.00	8.66	1,192.47
keg-dep (Keg Deposit)	58.00	30.00	1,740.00

bat-csre14 (Sierra Batuco Cabernet Sauvignon Reserva 2014)	278.00	6.24	1,325.24
chac-cs12 (Chacewater Cabernet Sauvignon 2012)	153.00	11.33	1,298.97
sti-whole66cl (Stillwater – Whole-icious 66cl)	240.00	7.19	1,180.00
urb-apricot500ml (Urban Family – Apricot Love 500ml)	240.00	7.19	1,200.00
omni-mack66cl (Omnipollo – Mackaper 66cl)	240.00	7.19	1,180.00
omni-milkshake11oz (Omnipollo/Tired Hands – Milkshake IPA 33cl)	360.00	4.79	1,050.00
urb-lime500ml (Urban Family – Limesicle 500ml)	239.00	7.18	1,195.00
urb-del500ml (Urban Family – Delicious Ambiguity 500ml)	239.00	7.18	1,195.00
sti-rockstar66cl (Stillwater/Other Half – Rockstar Farmer (Farmhouse Session Ale . . .	239.00	7.18	1,077.75
evt-minigrowlerkeg (Evil Twin/Westbrook – Mini Growler Imperial Stout 6 Barrel)	9.00	190.00	1,065.00
bad-boxwh14 (Badger Mountain Pure White 3 Liter Box 2014)	116.00	14.64	1,100.00
noc-ba12 (Nuova Cappelletta Barbera del Monferrato 2012)	159.00	10.66	1,248.75
omni-noapecan33cl (Omnipollo – Noa Pecan Mudcake (Imperial Stout) 33cl)	192.00	8.77	1,120.00
sti-extra4paks (Stillwater – Extra Dry (Sake Saison) 6-4paks)	38.99998	43.08	1,150.51
kaj-pmkab14 (Karl Joseph Piesporter Michelsberg Riesling Kabinett Mosel 2015)	250.00	6.67	1,134.00
cas-mo15 (Cascina Castle't Moscato d'Asti Bug 2015)	139.00	11.99	1,185.00
gue-mure375 (Gueuze Tilquin – Mure Tilquin A L'Ancienne 375ml)	132.00	12.62	1,089.00
dur-pg14 (Durerweg Pinot Grigio 2014 Alto Adige Sudtirol DOC)	164.00	9.99	1,162.72
fav-in11 (Chateau La Faviere "Integrale" Bordeaux Superieur 2011)	36.00	45.33	1,194.00
bbf-smoke750 (Blackberry Farms/Evil Twin – From Tennessee w/Smoke 750ml)	120.00	13.59	1,140.00
est-malps13 (Estampa Estate Malbec Petite Sirah 2013)	220.00	7.41	1,128.38
sti-bunny6barrel (Stillwater/AZ Wilderness – Big Bunny 6 barrel)	17.00	95.00	1,122.00
jel-ma12 (Jelu Malbec 2012)	162.00	9.97	939.60
ani-ro15 (Annibals VDP Rose 2015)	161.00	9.99	1,221.50
ofc-dinostout6barrel (Off Color Brewing Dinos'mores Stout 6 barrel)	8.00	199.99	1,040.00
evt-freudslip4 paks (Evil Twin Freudian Slip 4 paks 6 to a case)	25.70834	62.18	1,056.70
evt-modern6barrel (Evil Twin – Modern IPA – 6 barrel)	16.00	99.63	1,104.00
ann-rg13 (St. Anne Bordeaux Rouge 2013)	149.00	10.66	1,132.50
pel-rg14 (Chateau Pech-Latt Corbieres Rouge 2014)	169.00	9.33	1,098.50
cdf-cr11 (Castillo de Fuendeyalon Paper Wrapped Crianza 2011)	263.00	5.99	1,051.52
luz-altos10 (Altos de Luzon 2010)	147.00	10.66	1,131.36
bbf-springsaison750ml (Blackberry Farms – Spring Saison 750ml)	118.00	13.26	1,086.25
frs-do13 (Franco Serra Dolcetto d'Alba 2013)	213.00	7.33	1,067.50
sti-gosewild6barrel (Stillwater – Gose Gone Wild 6 barrel)	13.00	120.00	1,027.00
omni-aurora6barrel (Omnipollo – Aurora 6 barrel)	12.00	130.00	1,008.00

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
bea-gre14 (Domaine Beausejour Les Grenettes Touraine Sauvignon Blanc 2014)	166.00	9.33	1,098.50
cha-pn12 (Guy Chaumont Bourgogne Pinot Noir 2013)	176.00	8.77	1,606.50
bat-sb14 (Sierra Batuco Sauvignon Blanc Reserva 2014)	230.00	6.67	1,101.98
evt-startmeup66cl (Evil Twin – Start Me Up 66cl)	213.00	7.14	1,047.25
ger-pf14 (Domaine Gerbeaux Pouilly-Fuisse 2014)	76.00	19.99	1,078.00
ofc-bare4paks (Off Color Brewing – Bare Bear – Sahti – 4paks 6 to a case)	28.91666	52.49	1,013.53
goo-ch14 (Good Chianti 2014)	226.00	6.67	992.60
evt-erase#2HalfBarrel (Evil Twin – Erase & Rewind Batch #2 Half Barrel)	5.00	300.00	1,125.00
evt-eraseHalfbarrel (Evil Twin – Erase & Rewind Half Barrel)	5.00	300.00	1,125.00
stem-pn12 (Robert Stemmler Carneros Pinot Noir 2012)	66.00	22.66	1,141.60
cap-brres10 (Capanna Brunello di Montalcino Reserva 2010)	24.00	61.99	1,120.00
evt-geyserhalfbarrels (Evil Twin/Two Roads – Two Evil Geyser Gose Half Barrel – I. . .	8.00	185.00	1,032.00
ban-ge15 (Banyan Gewurtztraminer 2015)	229.00	6.44	1,168.63
urb-redux500ml (Urban Family – Magnolia Redux (Mosaic & Amarillo Hops) 500ml)	205.00	7.18	1,027.50
vin-onix13 (Vinicola Priorat ONIX Red 2013)	100.00	14.66	1,028.00
ilc-pg13 (Il Cantico Pinot Grigio 2013)	275.00	5.33	901.74
clo-ma14 (Los Clop Malbec 2014)	244.00	5.99	1,037.00
hof-zuurtildonk33cl (Brouwerij Hof ten Dormaal – Zure (Sour Ale) 33cl)	264.00	5.53	1,052.87
ant-fbNV (Antica Fratta Franciacorta Brut NV)	73.00	19.99	1,092.67
anp-re12 (Ancient Peaks Renegade Margarita Vineyard 2012)	109.00	13.33	1,031.26
urb-agro50cl (Urban Family – Agronomy 500ml)	202.00	7.18	1,015.00
cos-alb13 (St. Cosme “Les Deux Albions” Cotes du Rhone 2013)	105.00	13.79	1,196.42
evt-petit66cl (Evil Twin – Imperial Petit Four Break 66cl)	180.00	7.99	885.00
coh-ro14 (Coto de Hayas Rosado 2014)	314.00	4.57	684.25
gue-mure750ml (Gueuze Tilquin – Mure Tilquin A L’Ancienne 750ml)	60.00	23.85	920.00
cos-cdp2012 (St. Cosme Chateauneuf-du-Pape 2012)	37.00	38.66	1,052.65
sti-yacht4paks (Stillwater Contemporary – Yacht – Lager 4paks)	45.33326	31.55	1,175.44
chac-ch13 (Chacewater Chardonnay 2013)	126.00	11.33	1,037.58
evt-copyHalfbarrels (Evil Twin – Copy, Paste Half Barrels)	5.00	285.00	995.00
bel-cs13 (Bellula Cabernet Sauvignon 2013)	213.00	6.67	1,097.28
ven-maz13 (Venta Mazzaron 2013)	142.00	9.99	952.62
pow-chbx14 (Powers Chardonnay 3 Liter Box 2014)	112.00	12.66	1,101.38
pen-vp14 (Penya Rouge 2014)	163.00	8.66	863.83
camo-cs13 (Ca’Momi Cabernet Sauvignon 2013)	106.00	13.30	1,103.47
msc-ro15 (Masciarelli Rose 2015)	175.00	7.99	952.57

anp-sb14 (Ancient Peaks Sauvignon Blanc 2014)	145.00	9.62	962.59
nin-ncs13 (Nine Mile Road Cabernet Sauvignon 2013)	161.00	8.66	965.83
alf-pn14 (Alfredo Roca Pinot Noir 2014)	161.00	8.66	1,022.55
tri-cfca14 (Tricky Rabbit Cabernet Franc/Carmenere Reserva 2014)	209.00	6.67	995.12
sws-cbnv (Sweet Silhouette Creme Brulee NV Moscato)	261.00	5.33	977.91
chr-ge14 (St. Christopher Gewurtztraminer 2014)	188.00	7.33	847.48
luz-ro11 (Luzon Roble 2011)	255.00	5.39	1,329.47
smma-cs13 (Smith Madrone Cabernet Sauvignon 2013)	42.00	32.66	1,029.00
sti-pgw6barrel (Stillwater – Gose Gone Wild – World Tour, Phuket 6 barrel)	11.00	124.55	869.00
sti-folklore4paks (Stillwater Folklore 4 paks 6 to a case)	31.70834	43.12	919.54
valo-mo13 (Valori Montepulciano d'Abbruzzo 2013)	120.00	11.33	832.63
sti-mono4paks (Stillwater Contemporary – Mono 4paks 6 to a case – Hoppy Pilsner)	40.54165	33.28	1,151.18
sti-doorHalfBarrel (Stillwater Cellar Door Half Barrels)	7.00	192.14	903.00
chr-pma15 (St. Christopher Piesporter Michelsberg Auslese 2015)	155.00	8.66	912.87
evt-geyser6barrels (Evil Twin/Two Roads – Two Evil Geyser Gose 6 barrels – Icelan. . .	14.00	95.86	912.00
fre-me15 (Frey Merlot 2015)	106.00	12.66	689.00
sti-money66cl (Stillwater – Money Tree – Gose Style Session IPA 66cl)	197.00	6.79	875.50
sti-nutropic6barrel (Stillwater – NuTropic 6 barrel)	15.00	89.00	930.00
fer-cdr13 (Laurence Feraud Cotes du Rhone 2013)	143.00	9.33	952.26
sti-sunrisekeg30L (Stillwater/Dugges – Tropic Sunrise 30L)	5.00	265.00	950.00
urb-black500ml (Urban Family – Blackberry Harvest 500ml)	166.00	7.98	899.17
sol-rg (Cuvee le Soleiller Rouge)	221.00	5.99	886.00
kaj-pmqua14 (Karl Joseph Piesporter Michelsberg Qualitatswein Mosel 2015)	220.00	5.99	898.00
chr-pms14 (St. Christopher Piesporter Michelsberg Spatelese 2014)	179.00	7.33	957.33
euf-tapo (Casa de Santa Eufemia Tawny Port NV 750 ml)	95.00	13.81	881.25
dar-rg15 (Les Darons Rouge 2015)	131.00	9.99	937.73
cap-br11 (Capanna Brunello 2011)	31.00	41.99	775.00
sti-pine66cl (Stillwater – Pineapple Fields 66cl)	181.00	7.19	889.92
orv-pn10 (Organic Vintners Pinot Noir 2010)	186.00	6.99	1,453.35
omni-nautilus6barrel (Omnipollo – Nautilus (Sour Ale w/Blueberries) 6 barrel)	10.00	130.00	840.00
gue-ti20L (Gueuze Tilquin "Draft" 20 Liter Keg)	4.00	325.00	900.00
sti-bae66cl (Stillwater – Oude Bae (Barrel-Aged Sour Ale) 66cl)	180.00	7.18	885.00
fau-d'0rnv (Serge Faust Carte d'Or NV Brut Champagne)	57.00	22.66	1,269.79
val-vo15 (Chateau Valmer Vouvray 2015)	121.00	10.66	856.21
pey-rg11 (Chateau Moulin de Peyronin Bordeaux Rouge 2011)	211.00	6.02	1,413.32
loc-pndeal12 (Lockhart Pinot Noir 2012)	159.00	7.99	813.45
omni-rasp6barrel (Omnipollo – Raspberry Bianca 6 barrel)	10.00	127.00	890.00
ann-bl14 (Domaine Ste. Anne Bordeaux Blanc 2014)	127.00	9.99	752.50

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
gin-to13 (Gini Toscano Sangiovese 2013)	190.00	6.67	855.71
ofc-growl4pak (Off Color Brewing – Growl 6-4pks)	24.00	52.63	828.00
mey-rg12 (Chateau Roc de Meynard Bordeaux Superieur Rouge 2012)	126.00	9.99	895.35
sti-surround4paks (Stillwater Contemporary – Surround 4paks 6 to a case – Imperia. . .	20.08326	62.26	827.70
sti-tgw6barrel (Stillwater – Gose Gone Wild – World Tour, Tijuana 6 barrel)	10.00	125.00	790.00
luz-alma07 (Alma de Luzon 2007)	52.00	23.99	945.16
don-ra13 (Bodegas Aragonesas Don Ramon Vino Tinto Barrica 2013)	234.00	5.33	819.00
alf-ma15 (Alfredo Roca Malbec 2015)	144.00	8.66	911.97
urb-flat500ml (Urban Family – Flat Earth Theory 500ml)	142.00	8.77	852.00
nin-sh12 (Nine Mile Road Shiraz 2012)	129.00	9.64	948.42
chac-om13 (Chacewater Orange Muscat 2013)	93.00	13.33	868.62
don-im14 (Don Ramon Garnacha Imperial Roble 2014)	206.00	5.99	601.05
pow-cs13 (Powers Cabernet Sauvignon 2013)	142.00	8.66	850.01
camo-zi14 (Ca'Momi Zinfandel 2014)	123.00	9.99	861.00
dado-red12 (Dado Red Blend 2012)	307.00	3.99	1,228.00
cap-ga14 (La Caplana Gavi 2014)	131.00	9.33	849.72
nai-nai15 (Naia 2015)	141.00	8.66	885.56
bat-rbre13 (Sierra Batuco Red Blend Reserva 2013 Estate)	183.00	6.67	883.47
cacc-cc09 (Castello di Cacchiani Chianti Classico 2009)	73.00	16.66	696.15
cas-mo14 (Cascina Castle't Moscato d'Asti 2014)	101.00	11.99	861.06
ofc-wunder750ml (Off Color – Wunderkammer Flanders 750ml)	72.00	16.79	810.00
evt-sang66cl (Evil Twin – Sanguinem Aurantiaco 66cl)	168.00	7.19	826.00
gsm-gsm11 (Game Set Match GSM 2011)	113.00	10.66	855.87
evt-ajesusKeykeg (Evil Twin – Aun Mas "A" Jesus 30L Key Keg)	3.00	400.00	825.00
evt-retro6barrels (Evil Twin – Retro IPA – 6 barrels)	12.00	99.83	828.00
hof-kriek33cl (Brouwerij Hof ten Dormaal – Kriek 33cl)	166.00	7.18	830.00
est-rcarmsycab2013 (Estampa Reserve Carmenere/Syrah/Cab 2013)	119.00	9.99	851.35
mey-bl13 (Chateau Roc de Meynard Bordeaux Blanc 2013)	145.00	8.16	997.40
ofc-apexpredatorhalfbarrels (Off Color Brewing – Apex Predator Half Barrels)	5.00	235.00	825.00
omni-abra6barrel (Omnipollo – Abrahadabra – 6 barrel)	9.00	130.00	756.00
far-br10 (Farina Barolo 2010)	39.00	29.99	858.52
sti-tenacity66cl (Stillwater – Tenacity – IPA w/Wild Yeast 66cl)	177.00	6.58	872.70
har-ca12 (Jana Winery Napa Cathedral Cabernet Sauvignon 2012)	47.00	24.57	1,200.00
fee-car (Fee Brothers Cardamom Bitters)	211.00	5.46	751.34
val-vo13 (Chateau Valmer Vouvray 2015)	108.00	10.66	750.89

fee-cranberry (Fee Brothers Cranberry Bitters 5 oz)	207.00	5.49	735.81
per-can15 (Perlage Canah Brut 2015)	94.00	11.99	767.66
clo-em13 (Los Clop Estate Malbec 2013)	130.00	8.66	791.96
evt-sdk6barrel (Evil Twin – Soft DK 6 barrel – Imperial Stout w/Vanilla)	9.00	125.00	756.00
bbf-summer2016 (Blackberry Farms – Summer Saison 2016 750ml)	94.00	11.92	779.62
sti-giveway16oz (Stillwater/Against the Grain – Giveway 4paks 6 to a case 16oz)	17.95833	62.35	790.17
sti-traba66cl (Stillwater – o Trabalho – Sour Ale 66cl)	156.00	7.18	767.00
fee-cel (Fee Brothers Celery Bitters 5 oz)	203.00	5.49	724.70
evt-yinyang4pak (Evil Twin – Yin & Yang – Imperial Black & Tan- 4paks 6 to a case)	17.91666	62.24	681.66
bbf-new750ml (Blackberry Farms – New World Cuvee 750ml)	93.00	11.99	771.37
inz-zi12 (Inzinerator Zinfandel 2012)	202.00	5.48	1,261.97
fee-ofblg (Fee Brother Old Fashion Bitters 4/5 Pint)	91.00	12.13	823.79
evt-matcha66cl (Evil Twin – Perfect Matcha 66cl)	154.00	7.13	757.17
bbf-blonde750ml (Blackberry Farms – Abbey Blonde 750ml)	92.00	11.91	767.24
per-sa15 (Perlage Marche Sangiovese 2015)	164.00	6.67	769.42
tri-cssy12 (Tricky Rabbit Cabernet Sauvignon/ Syrah Reserva 2012)	164.00	6.67	795.54
cap-ga15 (La Caplana Gavi 2015)	117.00	9.33	715.42
cacc-ros12 (Castello di Cacchiani Toscano Rosso 2012)	86.00	12.66	707.11
kaj-pms15 (Karl Joseph Piesporter Michelsberg Riesling Spatlese Mosel 2015)	148.00	7.33	747.50
har-sy12 (Scott Harvey Syrah 2012)	90.00	11.99	765.00
nai-snaia15 (Naia S-Naia Sauvignon Blanc 2015)	124.00	8.66	714.67
coh-famag (Coto de Hayas Fagus 2010 1.5 liter)	94.00	11.35	437.00
sor-ri13 (Villa Sorono Riesling 2013)	200.00	5.33	703.50
bad-nsc14 (Badger Mountain NSA Cabernet Sauvignon 2014)	99.00	10.66	741.90
loc-dekleine66cl (Local Option/Central Waters – De Kleine Dood (BBA Belgian Stron. . .	120.00	8.79	750.00
sti-classique12oz cans (Stillwater Artisanal Ales Classique 12oz Cans 4 X 6 packs)	32.91667	31.70	762.78
omni-bianca6barrel (Omnipollo – Bianca Mango Lassi Gose 6 barrel)	8.00	130.00	672.00
omni-yellowbelly30L (Omnipollo/Buxton – Yellow Belly 30L – Peanut Butter Biscuit . . .	2.00	520.00	690.00
omni-aniara6barrel (Omnipollo – Aniara (Lemon Pale Ale) 6 barrel)	8.00	130.00	672.00
omni-fatamorgana6barrel (Omnipollo Fatamorgana Double IPA 6 barrel)	8.00	130.00	672.00
evt-missiongose (Evil Twin/Westbrook – Mission Gose 66cl – Gose brewed w/Eucalyptus)	129.00	7.94	698.74
fre-bcs14 (Frey Biodynamic Cabernet Sauvignon 2014)	81.00	12.63	729.00
ros-bnv (Rosa di Rosa Bianca)	102.00	9.99	645.99
har-1869zin13 (Scott Harvey 1869 Zinfandel 2013)	38.00	26.66	760.00
clo-rm09 (Los Clop Reserve Malbec 2009)	169.00	5.99	1,066.37
sti-stereo6barrels (Stillwater Contemporary – Stereo 6 barrels – IPA)	10.00	101.20	699.00

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
cos-cdrwh15 (St. Cosme Cotes Du Rhone Blanc 2015)	66.00	15.33	633.00
evt-ashtray4pak (Evil Twin Ashtray Heart 4 paks 6 to a case)	16.20834	61.63	617.50
bbf-wintersaison750 (Blackberry Farms – Winter Saison – Belgian Strong Dark Ale 7. . .	130.00	7.67	1,080.74
boc-cc12 (Le Bocce Chianti Classico 2012)	81.00	12.31	744.53
puy-rg14 (Puydeval Rouge 2014)	116.00	8.59	844.59
alf-ma14 (Alfredo Roca Malbec 2014)	115.00	8.66	732.19
clo-cs13 (Los Clop Cabernet Sauvignon 2013)	196.00	5.07	760.86
evt-simcoe6barrels (Evil Twin – Imperial Simcoe Slacker 6 barrel)	10.00	99.00	690.00
luz-cr13 (Luzon Crianza 2013)	114.00	8.66	717.47
ama-cs14 (Amavi Cabernet Sauvignon 2014)	51.00	19.33	730.99
cap-rm13 (Capanna Rosso di Montalcino 2013)	59.00	16.66	700.00
bel-ch15 (Bellula Chardonnay 2015)	147.00	6.67	768.80
doc-ensemble50cl (Brouwerij de Dochter Van de Korenaar – L'Ensemble 50cl)	72.00	13.59	720.00
evt-justinBiabear66cl (Evil Twin – Justin Blabaer 66cl)	122.00	7.96	668.32
fee-orgeat (Fee Brothers Orgeat 5 oz)	176.00	5.48	308.00
har-jsb14 (Scott Harvey Jana Sauvignon Blanc 2014)	72.00	13.33	720.00
ofc-hellbroth75cl (Off Color – Hellbroth 750ml)	48.00	19.99	676.00
csj-rb13 (Chateau St. Jean d'Aumieres L'Achimiste 2013)	60.00	15.99	620.00
mla-ries12 (Murphy's Law Riesling 2012)	110.00	8.66	598.29
bbf-rye375ml (Blackberry Farms – Rye Saison 375ml)	120.00	7.93	660.00
ofc-yuzu4paks (Off Color Brewing – Yuzu Fierce 6-4paks)	18.00	52.75	621.00
coh-te14 (Cota de Hayas Tempranillo Cabernet 2014)	163.00	5.82	735.69
mar-iskr09 (Iskra Marina Cvetic 2009)	33.00	28.66	602.06
hof-frambeuse (Hof ten Dormaal – Frambeuse I Chocolate – 33cl)	168.00	5.59	665.00
elc-rg14 (Elicio Rouge 2014)	128.00	7.33	642.60
cos-jos13 (St. Cosme St. Joseph 2013)	38.00	24.66	685.90
pow-ch14 (Powers Chardonnay 2014)	126.00	7.33	642.06
pow-csbx13 (Powers Cabernet Sauvignon 3 Liter Box 2013)	63.00	14.66	659.46
ofc-coffeedino2pak (Off Color – Coffee Dino'smores 12-2paks)	7.99996	115.11	600.00
loc-ch13 (Lockhart Chardonnay 2013)	115.00	7.99	571.88
cos-ch14 (Saint Cosme – Crozes-Hermitage 2014)	38.00	23.99	576.33
omni-mack6barrel (Omnipollo – Mackaper 6 barrel)	7.00	130.00	588.00
fee-mint (Fee Brothers Mint Bitters 5 oz)	164.00	5.50	584.44
evt-erase#3halfbarrel (Evil Twin – Erase & Rewind #3 Half Barrel)	3.00	300.00	675.00
stem-ch13 (Robert Stemmler Chardonnay 2013)	54.00	16.66	659.12

ger-pf15 (Domaine Gerbeaux Pouilly-Fuisse 2015)	45.00	19.99	637.00
sti-loveregret4paks (Stillwater Of Love & Regret Flower Saison 4paks 6 to a case)	26.49999	33.88	740.97
sti-extrahalfbarrel (Stillwater – Extra Dry (Sake Saison) Half Barrel)	5.00	179.00	617.00
ltv-cs14 (Latin Vid Cabernet Sauvignon 2014)	239.00	3.74	807.27
fee-orlg (Fee Brothers Orange Bitters 4/5 Pint)	73.00	12.16	661.70
evt-don66cl (Evil Twin – Don No 66cl)	123.00	7.17	604.76
frs-arn13 (Franco Serra Roero Arneis 2013)	101.00	8.66	475.56
ste-sb14 (Stellar Sauvignon Blanc 2014)	119.00	7.33	558.11
har-port (Scott Harvey Forte Port 2010 Amador County)	36.00	23.99	630.00
cos-ch13 (St. Cosme Crozes-Hermitage 2013)	36.00	23.99	580.20
ann-rg12 (Ste. Anne Bordeaux Rouge 2012)	81.00	10.66	607.50
sti-tuppence66cl (Stillwater/Oliver – Tuppence (Sour Porter) 66cl)	120.00	7.17	590.00
sti-extra6barrel (Stillwater – Extra Dry (Sake Saison) 6 barrel)	10.00	86.00	590.00
evt-food66cl (Evil Twin – Food & Beer 66cl)	119.00	7.19	525.58
evt-msimcoehalfbarrel (Evil Twin Molotov Simcoe Half Barrel)	3.00	285.00	597.00
mil-cc09 (Castello di Cacchiano Millennio Chianti Classico Gran Selezione 2009)	32.00	26.66	606.65
ced-cr15 (Domaine des Cedres Cotes du Rhone 2015)	97.00	8.66	588.00
sti-money6barrel (Stillwater – Money Tree 6 barrel)	7.00	120.00	553.00
gin-cr09 (Gini Chianti Reserva “Il Novecento” 2009)	60.00	13.99	564.67
evt-lowlifehalfkegs (Evil Twin Low Life Half Keg)	5.00	167.00	623.42
nai-lbr14 (Las Brisas 2014)	113.00	7.33	585.42
sti-syrligtkeg30L (Stillwater/Dugges – Syrligt 30L)	3.00	275.00	570.00
nica-ch12 (Nica Chardonnay 2012)	216.00	3.81	864.00
esp-gren15 (Elizabeth Spencer Grenache 2015)	56.00	14.66	644.00
sti-as follows 6 barrel (Stillwater As Follows 6 barrel Keg)	9.00	91.00	558.00
con-kcre13 (Klein Constantia Red Blend 2013)	49.00	16.66	637.73
ofc-jerk750ml (Off Color – Jerk Bird 750ml)	60.00	13.59	575.00
don-im12 (Don Ramon Garnacha Imperial Roble 2012)	134.00	5.99	544.00
omni-noapecankeg30L (Omnipollo – Noa Pecan Mudcake – 30L)	2.00	400.00	590.00
evt-retrohalfbarrels (Evil Twin – Retro IPA – Half Barrels)	4.00	200.00	556.00
vig-cr15 (Villa Gemma Cerasuolo Rose 2015)	75.00	10.66	564.66
sti-bunnyhalfbarrel (Stillwater/AZ Wilderness – Big Bunny Half Barrels)	4.00	199.00	556.00
evt-noherohalfbarrel (Evil Twin – No Hero Half Barrel)	4.00	199.00	556.00
lat-te14 (Latue Tempranillo 2014)	119.00	6.67	479.02
evt-nohero6barrel (Evil Twin – No Hero 6 barrel)	8.00	99.00	552.00
evt-wet6barrels (Evil Twin – Wet Dream 6 barrel)	8.00	99.00	552.00
esp-pn12 (Elizabeth Spencer Pinot Noir 2012)	36.00	21.99	584.00
bat-sb16 (Sierra Batuco Sauvignon Blanc Reserva 2016)	128.00	6.16	610.37
est-carma12 (Estampa Estate Carmenere Malbec 2012)	128.00	6.14	623.50

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
coh-ti14 (Cota de Hayas Tinto (Garnacha-Syrah) 2014)	141.00	5.57	495.30
evt-yin6barrel (Evil Twin 6 barrel Yin Imperial Stout)	7.00	112.00	555.19
ken-me12 (Kenefick Merlot 2012)	25.00	31.33	625.00
har-ovz11white (Scott Harvey Old Vine Zinfandel White Label Reserve 2011)	47.00	16.66	564.00
sti-bae6barrel (Stillwater – Oude Bae (Barrel-Aged Sour Ale) 6 barrel)	6.00	130.00	504.00
sti-cen6barrel (Stillwater/Cigar City – 21st Century Means 6 barrel)	6.00	130.00	504.00
fee-fal (Fee Brothers Falernum 5 oz)	141.00	5.52	246.75
loc-me12 (Lockhart Merlot 2012)	97.00	7.99	512.66
anp-me12 (Ancient Peaks Merlot 2012)	72.00	10.66	590.17
urb-eyes375 (Urban Family Brewing – Through the Eyes of Babes 375ml)	96.00	7.99	560.00
sti-atlantis50cl (Stillwater/Freigeist – Atlantis Gose 50cl)	120.00	6.39	540.00
evt-hopflood4pk (Evil Twin Hop Flood 6 – 4pks per case)	14.54167	52.47	509.94
evt-calypsolager66cl (Evil Twin – Calypso Single Hop Imperial Wheat Lager 66cl)	96.00	7.94	544.00
fre-bm13 (Frey Biodynamic Merlot 2013)	52.00	14.66	468.00
omni-sel6barrel (Omnipollo – Selassie 6 barrel)	4.00	190.00	480.00
urb-citron500ml (Urban Family – Citron Noir 500ml)	106.00	7.17	530.00
urb-voices375 (Urban Family Brewing – Voices Underground 375)	95.00	7.99	553.10
ara-og13 (Aragus Organic Red 2013)	94.00	7.99	379.42
sti-pine6barrel (Stillwater – Pineapple Fields 6 barrel)	6.00	125.00	504.00
evt-helles22oz (Evil Twin – Brett, Yeast, & Helles (Sour Lager) 66cl)	104.00	7.17	461.55
msc-ro14 (Masciarelli Rose 2014)	96.00	7.76	491.27
paz-mo13 (Pazo de Monterrey 2013)	136.00	5.45	851.10
pow-mu14 (Powers Muscat Canelli 2014)	101.00	7.33	501.24
sti-nutropichalfbarrel (Stillwater – NuTropic Half Barrel)	4.00	185.00	516.00
vig-wh15 (Villa Gemma White 2015)	69.00	10.66	537.33
bbf-brune750 (Blackberry Farms – Abbey Brune 750ml)	61.00	11.99	503.25
cov-cr11 (Covila Crianza 2011)	78.00	9.33	520.01
loc-pndeal14 (Lockhart Pinot Noir 2014)	91.00	7.99	502.41
evt-sang6barrel (Evil Twin – Sanguinem Aurantiaco 6 barrel)	5.00	145.00	495.00
evt-matcha6barrel (Evil Twin – Perfect Matcha 6 barrel)	5.00	145.00	495.00
puy-rg13 (Puydeval Rouge 2013)	68.00	10.66	488.81
sor-ri14 (Villa Sorono Riesling 2014)	136.00	5.33	476.00
baci-pink (Baci Dolce Pink Sweet NV)	108.00	6.67	492.75
doc-renaissance50cl (Brouwerij de Dochter Van de Korenaar – Le Renaissance 50cl)	60.00	11.99	470.00

smma-cs11 (Smith Madrone Cabernet Sauvignon 2011)	22.00	32.66	526.43
may-ma13 (Familia Mayol Malbec 2013)	60.00	11.86	495.90
chr-ge15 (St. Christopher Gewurtztraminer 2015)	97.00	7.33	436.08
ecu-gm14 (Domaine de l'Ecu Expressions Granite Muscadet 2014)	48.00	14.66	480.00
evt-food6barrels (Evil Twin – Food & Beer 6 barrel)	5.00	140.00	475.00
bad-boxred16 (Badger Mountain Pure Red 3 Liter Box 2016)	40.00	17.33	453.02
bbf-daily750ml (Blackberry Farms/Full Steam Brewing – Daily Miel 750ml)	51.00	13.59	484.50
per-baca18714 (Perlage Bacaretto 187 ml Prosecco 2014)	198.00	3.50	463.16
evt-falco6barrel (Evil Twin Falco 6 barrel)	7.00	99.00	483.00
urb-erosion500ml (Urban Family Brewing – Signs of Erosion 500ml)	96.00	7.19	480.00
smma-cs12 (Smith Madrone Cabernet Sauvignon 2012)	21.00	32.66	540.00
con-ksb14 (Klein Constantia Sauvignon Blanc 2014)	54.00	12.66	504.01
gin-ch12 (Gini Chianti 2012)	113.00	6.04	558.36
elc-rg13 (Elicio Grenache/Merlot 2013)	93.00	7.33	445.60
clo-rcs10 (Los Clop Reserve Cabernet Sauvignon 2010)	80.00	8.49	496.42
cdm-bbnv (Casas del Mar Blanc de Blanc NV Sparkling Cava Brut)	110.00	6.17	536.48
bbf-cream375ml (Blackberry Farms – Native Yeast Series #2 – Tennessee Cream Ale 3. . .	85.00	7.97	460.42
doc-charbon66cl (Brouwerij De Dochter Van De Korenaar Charbon 66 cl)	60.00	11.19	475.00
caj-pn15 (Casa Julia Bosler Pinot Noir 2015)	67.00	9.99	408.03
cos-con13 (St. Cosme Condrieu 2013)	13.00	51.32	530.15
kee-pecan33cl (Brouwerij Kees – Smoked Pecan Porter 33cl)	139.00	4.78	405.42
ofc-troublesomehalfbarrel (Off Color Brewing – Troublesome – Gose – Half Barrels)	3.00	220.00	465.00
anb-pcnv (A. Barbadillo Pale Cream Sherry NV)	76.00	8.66	356.48
evt-gosling6barrel (Evil Twin/Crooked Stave – Ryan & the Gosling 6 barrel)	5.00	131.00	425.00
evt-helles6barrel (Evil Twin – Brett, Yeast, & Helles 6 barrel)	5.00	130.00	425.00
sti-g-13keg (Stillwater – G-13 (Wild Yeast IPA) 6 barrel)	5.00	130.00	420.00
sti-hopvine6barrel (Stillwater/Hudson – Hopvine Bling 6 barrel)	5.00	130.00	420.00
anz-pg15 (Anziano Pinot Grigio 2015)	108.00	5.99	438.00
stem-pn13 (Robert Stemmler Carneros Pinot Noir 2013)	44.00	14.66	445.00
pyn-rg12 (Peynaud Bordeaux Superieur Rouge 2012)	99.00	6.48	580.93
cov-remag10 (Covila Reserve 2010 Magnum)	24.00	26.66	444.00
cap-ga13 (La Caplana Gavi 2013)	55.00	11.55	343.34
sti-haze6barrel (Stillwater – Tangerine Haze 6 barrel)	5.00	125.00	420.00
sti-whyIBU6 -4pks case (Stillwater Why Can't IBU 4pk 6 to a case)	14.49993	43.06	424.44
ste-pi14 (Stellar NSA Pinotage 2014)	85.00	7.33	400.99
sti-Stateside6barrel (Stillwater Stateside Saison 6 barrel)	7.00	89.00	434.00
cos-con14 (Saint Cosme – Condrieu 2014)	12.00	51.33	440.00
smma-ri13 (Smith Madrone Riesling 2013)	33.00	18.66	466.65

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
gin-to14 (Gini Toscano Sangiovese 2014)	92.00	6.67	408.87
kee-fudgekeg30L (Brouwerij Kees – Caramel Fudge Stout 30L)	2.00	305.00	450.00
urb-eff500ml (Urban Family – Efflorescent Heartbeat 500ml)	84.00	7.19	420.00
evt-pilspastor66cl (Evil Twin – Pils Al Pastor – Imperial Pilsner brewed w/ Pineap. . .	84.00	7.19	413.00
camo-ch15 (Ca'Momi Chardonnay 2015)	60.00	9.99	420.00
evt-pachhalfbarrel (Evil Twin/Two Roads – Pachamama Porter Half Barrel)	3.00	199.00	417.00
evt-pach6barrel (Evil Twin/Two Roads – Pachamama Porter 6 barrels)	6.00	99.00	414.00
tri-ch/vi14 (Tricky Rabbit Chardonnay/Viognier 2014)	89.00	6.67	446.45
urb-morehoney500ml (Urban Family Brewing – More With Honey 500ml)	82.00	7.19	415.00
sti-vacuum4paks (Stillwater Contemporary – Vacuum – Black Smoked IPA – 4paks)	11.08334	52.94	407.28
evt-xmasevehalfbarrel (Evil Twin – Xmas Eve at a NYC Hotel Room Half Barrel)	2.00	292.50	418.00
frs-bars11 (Franco Serra Barbaresco 2012)	35.00	16.66	420.00
ofc-sparkles6b (Off Color – Sparkles Finds Some Trouble 6 barrel)	4.00	145.00	396.00
evt-missiongose6barrel (Evil Twin/Westbrook – Mission Gose 6 barrel)	4.00	145.00	380.00
evt-RonBeast6barrel (Evil Twin Ron and the Beast Ryan with Brett 6 barrel)	4.00	145.00	380.00
pau-pg13 (St. Paul's Pinot Grigio Alto Adige Sudtirol DOC 2014)	58.00	9.99	572.61
evt-cowboy6-4pak (Evil Twin The Cowboy 6-4pks 12 oz)	12.00	47.94	354.08
evt-firewater66cl (Evil Twin – Fire Water – Pale Ale w/Jalepenos 66cl)	72.00	7.99	390.00
kee-peatedstout33cl (Brouwerij Kees – Peated Russian Imperial Stout 33cl)	120.00	4.79	350.00
ilb-pg14 (La Bastarda Pinot Grigio 2014)	107.00	5.33	383.42
evt-amager6barrel (Evil Twin/Amager Bryghus – From Amager with Love 6 barrel)	3.00	190.00	387.00
pal-ri10 (Palazzo Montanari Ripasso Valpolicella Classico 2010)	45.00	12.66	540.49
per-pro13 (Perlage Riva Moretta Prosecco 2015)	57.00	9.99	428.47
evt-xxx66cl (Evil Twin/Beavertown Brewery – XXX – Imperial Mild Ale – 66cl)	108.00	5.17	895.12
fee-mo (Fee Brothers Molasses Bitters 5 oz.)	101.00	5.49	359.91
fre-sa14 (Frey Sangiovese 2014)	52.00	10.66	338.00
sti-projector4paks (Stillwater Contemporary – Projector 4pk)	14.91667	37.05	568.42
hof-zuurvan20L (Hof Ten Dormaal – Zure 20L)	2.00	275.00	390.00
ste-sb16 (Stellar Sauvignon Blanc 2016)	75.00	7.33	354.09
msc-tr14 (Masciarelli Trebbiano d'Abruzzo 2014)	75.00	7.33	389.25
esp-chen14 (Elizabeth Spencer Chenin Blanc 2014)	39.00	13.99	400.00
ecu-ldnv (Domaine de l'Ecu La Divina NV Brut Sparkling)	42.00	12.98	423.32

tri-cfca12 (Tricky Rabbit Cabernet Franc Carmenere Reserva 2012)	81.00	6.67	408.38
gav-extra33cl (Brouwerij 't Gaverhopke Extra)	146.00	3.66	401.50
evt-femfatyuzu (Evil Twin Femme Fatale Yuzu 66cl)	77.00	6.89	436.76
evt-impwheat66cl (Evil Twin – Mosaic Imperial Wheat Lager 66cl)	140.00	3.78	708.44
bbf-classicsaisonKEG20L (Blackberry Farms – Classic Saison 20L)	5.00	105.00	360.00
ofc-sparkles4paks (Off Color – Sparkles Finds Some Trouble 6-4paks)	9.99997	52.47	345.00
cac-ba14 (Cascina Castle't Barbera "Vespa" 2014)	52.00	10.07	443.30
est-rsbchvi12 (Estampa Reserva Sauvignon Blanc/Chardonnay/Viognier 2012)	116.00	4.49	858.00
sti-traba6barrel (Stillwater – o Trabalho – Sour Ale 6 barrel)	4.00	130.00	336.00
sti-fear6barrel (Stillwater – Fear of Ghosts 6 barrel)	4.00	130.00	336.00
sti-rockstar6barrel (Stillwater/Other Half – Rockstar Farmer 6 barrel)	4.00	130.00	316.00
pow-kv13 (Powers Kiona Vineyard Reserve Cabernet Sauvignon 2013)	26.00	19.99	338.00
clos-cs11 (Clos Robert Cabernet Sauvignon 2011)	113.00	4.59	670.26
con-kcre12 (Klein Constantia Red Blend 2012)	31.00	16.66	361.42
urb-history500ml (Urban Family – Imagined History 500ml)	71.00	7.19	355.00
vin-cg14 (Vinicola Priorat Clos Gebrat 2014)	40.00	12.65	388.61
alvdo-px1730 (Alvaro Domecq 1730 Pedro Ximinez NV 375 ml.)	21.00	23.99	353.10
coh-ch14 (Cota de Hayas Chardonnay 2014)	82.00	5.99	290.32
noc-ba13 (Nuova Cappelletta Barbera del Monferrato 2013)	46.00	10.66	352.50
urb-magnolia500ml (Urban Family – Hoppy Magnolia 500ml)	88.00	5.57	309.75
sti-folklorekegs (Stillwater Folklore 6 barrel kegs)	5.00	98.00	330.00
fee-olive (Fee Brothers Olive Brine 4/5 pints)	92.00	5.30	271.40
har-whbarb13 (Scott Harvey White Label Reserve Barbera 2013)	28.00	17.33	362.50
evt-femfatblanc (Evil Twin Femme Fatale Blanc 66 cl)	196.00	2.47	1,079.87
loc-cs13 (Lockhart Cabernet Sauvignon 2013)	60.00	7.99	321.99
evt-gosling66cl (Evil Twin/Crooked Stave – Ryan & the Gosling 66cl)	60.00	7.99	295.00
fee-orglg (Fee Brothers Orgeat 4/5 Pint)	60.00	7.99	216.60
urb-basnakeskin375ml (Urban Family Brewing – Barrel-Aged Snakeskin Jacket 375ml)	60.00	7.99	350.00
kee-export33cl (Brouwerij Kees – Export Porter 1750 33cl)	120.00	3.99	350.00
bbf-fruit375ml (Blackberry Farms – Brett Fruit Blend 2016)	60.00	7.96	325.00
hof-sloe33cl (Hof ten Dormaal – Sloe Sour Ale 33cl)	85.00	5.57	336.46
urb-clouds500ml (Urban Family Brewing – Clouds of Pale Gold 500ml)	59.00	7.99	347.08
vil-an13 (Villa des Anges Cabernet Sauvignon 2013)	64.00	7.33	312.45
atau-cr12 (Dominio de Atauta 2012)	19.00	24.66	379.87
bbf-classicsaisonkeg30L (Blackberry Farms – Classic Saison 30L)	3.00	155.00	327.00
esp-rp15 (Elizabeth Spencer Rose of Pinot Noir 2015)	24.00	19.33	347.07
bbf-brett375ml (Blackberry Farms – Brett Saison 375ml)	58.00	7.99	319.00
sti-kanye66cl (Stillwater – I Miss the Old Kanye 66cl)	65.00	7.11	319.58
ste-me16 (Stellar NSA Merlot 2016)	63.00	7.33	297.81

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
gin-cr06 (Gini Chianti Reserva “Il Novecento” 2008)	33.00	13.99	275.57
dlm-ro15 (Domaine de La Motte Rose 2015)	77.00	5.99	310.00
esc-he12 (Domaine de l’Escates “Heritage” 2012)	30.00	15.33	312.50
vin-cg15 (Vinicola Priorat Clos Gebrat 2015)	36.00	12.66	330.11
har-1869zin12 (Scott Harvey 1869 Zinfandel 2012)	17.00	26.66	360.00
anp-zi13 (Ancient Peaks Zinfandel 2014)	40.00	11.33	337.58
evt-bozobeer (Evil Twin Bozo Beer Imperial Stout brewed with Chocolate)	35.00	12.93	288.75
far-ne11 (Farina Nebbiola d’Alba 2011)	51.00	8.82	405.36
sil-re12 (Sila 2012)	84.00	5.33	525.70
loc-cs12 (Lockhart Cabernet Sauvignon 2012)	56.00	7.99	284.58
sti-door6barrel (Stillwater Cellar Door Keg 6 barrel)	5.00	89.00	310.00
bch-sa15 (Hubert Brochard Sancerre 2015)	29.00	15.33	341.34
ofc-woof4pk (Off Color Brewing – Le Woof 4pk 6 to a case)	8.41666	52.57	290.37
hob-cs14 (Hobo Cabernet Sauvignon 2014)	35.00	12.60	356.48
pep-cs12 (Pepper Bridge Cabernet Sauvignon 2012)	11.00	39.99	320.84
elc-bl14 (Elicio Vermentino 2014)	85.00	5.16	407.29
ofc-woof6b (Off Color Brewing – Le Woof 6 barrel)	3.00	145.00	297.00
ofc-apexpredator6barrel (Off Color Brewing Apex Predator 6 barrel)	3.00	145.00	297.00
evt-biereblanca6barrel (Evil Twin Blanca Biere de Table 6 barrel)	3.00	145.00	285.00
evt-firewater6barrel (Evil Twin – Fire Water – Pale Ale w/Jalepenos 6 barrel)	3.00	145.00	285.00
sti-fear66cl (Stillwater – Fear of Ghosts (Smoked Sour Wheat Saison) 66cl)	60.00	7.19	295.00
man-mano14 (Mano a Mano 2014)	58.00	7.29	292.75
lau-bnnv (J. Laurent Blanc de Noir NV)	13.00	32.39	304.26
urb-citron6barrel (Urban Family – Citron Noir 6 barrel)	3.00	140.00	285.00
sti-surround6barrels (Stillwater Contemporary – Surround 6 barrel – Imperial Whea. . .	3.00	140.00	267.00
urb-redux6barrel (Urban Family – Magnolia Redux 6 barrel)	3.00	140.00	285.00
urb-magnolia6barrel (Urban Family – Hoppy Magnolia 6 barrel)	3.00	140.00	285.00
ofc-hyper4paks (Off Color – Hyper Predator 6-4paks)	7.99997	52.40	276.00
sti-superhalfbarrel (Stillwater – Super Hop Half Barrel)	2.00	209.00	298.00
coh-te13 (Cota de Hayas Tempranillo Cabernet 2013)	57.00	7.33	262.29
vno-vi14 (Villano 2014)	48.00	8.66	278.56
nic-am08 (Nicolis Valpolicella Classico Amarone 2008)	11.00	37.33	308.03
frs-neb15 (Franco Serra Nebbiolo 2015)	44.00	9.33	286.00
cir-rg13 (La Cirque Rouge 2013)	36.00	11.33	257.79

far-baas13 (Farina Barbera d'Asti 2013)	68.00	5.99	409.69
lat-ai14 (Latue Airen Blanc 2014)	92.00	4.43	369.47
hof-orch33cl (Hof ten Dormaal – Orchard 33cl)	73.00	5.57	288.96
evt-justinBiabear6barrel (Evil Twin – Justin Blabaer 6 barrel)	3.00	135.00	255.00
fee-gren (Fee Brothers American Beauty Grenadine Syrup 5 oz)	74.00	5.46	129.50
evt-imbiskeg (Evil Twin Imperial Biscotti Keg 6 barrel)	2.00	200.00	250.00
har-ca10 (Jana Winery Cathedral 2010)	12.00	33.32	300.00
evt-simcoehalfbarrels (Evil Twin – Imperial Simcoe Slacker Half Barrel)	2.00	199.00	278.00
evt-wethalfbarrrel (Evil Twin – Wet Dream Half Barrel)	2.00	199.00	278.00
mat-br07 (Mate Brunello 2008)	11.00	35.99	295.27
mer-gr10 (Chateau Meric Graves Rouge 2010)	29.00	13.53	310.00
est-recsmasy12 (Estampa Reserve Cabernet Sauvignon/Malbec/Syrah 2012)	42.00	9.33	289.67
evt-bigass33cl (Evil Twin – Big Ass Money Stout 33cl)	53.00	7.35	231.84
pau-pn13 (St. Paul's Luzia Pinot Noir Sudtirol Alto Adige 2013 DOC)	38.00	10.17	380.00
ofc-badino12oz (Off Color – Barrel-Aged Dino'smores)	1.99994	191.87	258.00
chr-pma14 (St. Christopher Piesporter Michelsberg Auslese 2014)	44.00	8.66	256.68
arc-cdrrg12 (Arc Cotes du Rhone Rouge 2012)	70.00	5.44	373.34
sor-pn12 (Villa Sorono Pinot Noir 2012)	71.00	5.33	248.50
evt-femfatnoir6barrel (Evil Twin – Femme Fatale Noire – Black IPA w/Brett 6 barrel)	5.00	75.00	475.00
mar-iskr05 (Marina Cvetic Iskra 2005)	14.00	26.66	251.14
tor-golcr11 (Torre de Golban Crianza 2011)	45.00	8.27	338.72
sti-yachthalfbarrel (Stillwater Contemporary – Yacht – Lager – Half Barrel)	2.00	185.00	258.00
camo-kr14 (Ca'Momi Rosso 2014 20L Keg)	2.00	185.00	232.00
cos-lc14 (Saint Cosme – Le Claux 2014)	5.00	73.99	260.00
ros-san15 (Rossignole Sancerre 2015)	24.00	15.33	282.40
hof-muscatelBAdarkale30L (Hof ten Dormaal – Muscatel Barrel-Aged Dark Ale 30L Keg)	1.00	360.00	265.00
vig-mr05 (Villa Gemma Montepulciano d'Abruzzo Riserva 2006)	6.00	59.99	270.00
vig-mr06 (Villa Gemma Montepulciano d'Abruzzo Riserva 2006)	6.00	59.99	278.00
fre-biof15 (Frey Biodynamic Field Blend 2015)	36.00	9.99	246.00
chr-li14 (St. Christopher Liebfraumilch 2014)	60.00	5.99	210.00
sti-projector6barrel (Stillwater Contemporary – Projector – Imperial Rice IPA 6 b. . .	3.00	118.33	241.50
cdf-cr09 (Castillo de Fuendejalon Crianza 2009)	59.00	5.99	240.97
hob-zidr13 (Hobo Dry Creek Zinfandel 2013)	32.00	11.01	325.89
cdm-ronv (Casa del Mar Rose NV)	54.00	6.52	311.67
kee-oyster33cl (Brouwerij Kees – Black Oyster Saison 33cl)	73.00	4.77	212.92
cdf-crcon (Castillo de Fuendeyalon Paper Wrapped Crianza 2011)	58.00	5.99	193.29
pro-re10 (Protos Reserva Ribera del Duero 2012)	13.00	26.66	310.09

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
atau-cr10 (Dominio de Atauta 2010)	14.00	24.66	261.32
pow-chbx15 (Powers Chardonnay 3 Liter Box 2015)	27.00	12.66	252.00
ofc-alfalfa750ml (Off Color/Three Floyds/Wiseacre – Alfalfa Kang 750ml)	24.00	14.02	230.00
dlm-cs15 (Domaine de La Motte Cabernet Sauvignon 2015)	50.00	6.67	224.18
pal-va12 (Palazzo Montanari Valpolicello Classico 2012)	44.00	7.56	308.00
ama-sy12 (Amavi Syrah 2012)	19.00	17.50	270.93
don-ra15 (Don Ramon Oak Aged Tinto 2015)	62.00	5.33	217.00
pow-sy13 (Powers Syrah 2013)	38.00	8.66	227.86
doc-oakembrasse66cl (Brouwerij De Dochter Van De Korenaar – Peated Oak-Aged Embra. . .	24.00	13.59	240.00
hof-bablondjura750ml (Brouwerij Hof ten Dormaal – Jura Barrel-Aged Blond 750ml)	24.00	13.59	240.00
har-angel06 (Jana Winery Angel Ice Wine Riesling 375 ml 2010)	18.00	18.07	315.00
doc-embrasse30L (Brouwerij De Dochter Van de Korenaar Embrasse 30L)	1.00	325.00	225.00
dlm-sb15 (Domaine de la Motte Sauvignon Blanc 2015)	81.00	3.99	371.25
evt-biereblanca66cl (Evil Twin – Blanca Biere de Table 66cl)	135.00	2.38	668.66
urb-temp6barrel (Urban Family – Temporary Permanance 6 barrel)	2.00	160.00	218.00
urb-kriek20156barrel (Urban Family – 2015 Kriek 6 barrel)	2.00	160.00	218.00
bbf-straw375ml (Blackberry Farms – Native Yeast Series – Strawberry Buckwheat Ale. . .	40.00	7.93	216.67
hof-bablondcalvados750ml (Brouwerij Hof ten Dormaal – Calvados Barrel-Aged Blond . . .	23.00	13.59	230.00
fee-rose (Fee Brothers Rosewater)	104.00	2.99	218.40
bbf-summer30L (Blackberry Farms – Summer Saison 30L)	2.00	155.00	218.00
bbf-blondekeg30L (Blackberry Farms – Abbey Blonde 30L)	2.00	155.00	218.00
alvdo-finoNV (Alvaro Domecq La Janda Fino NV)	31.00	9.99	174.30
euf-rupo (Casa de Santa Eufemia Ruby Port NV)	23.00	13.33	187.09
har-jrov13 (Scott Harvey Jana Old Vine Riesling 2013)	35.00	8.57	355.00
cacc-cc11 (Castello di Cacchiani Chianti Classico 2011)	18.00	16.66	210.00
arc-cdrbl13 (Arc Cotes du Rhone Blanc 2013)	48.00	6.23	263.38
cos-lc13 (St. Cosme “Le Claux” Gigondas 2013)	4.00	74.00	277.08
pan-ju14 (Panarroz 2014)	37.00	7.99	187.50
bep-brach14 (Beppe Marino Brachetto Bramusa 2014)	30.00	9.83	320.00
fre-pn13 (Frey Pinot Noir 2014)	26.00	11.33	208.00
evt-RonBeast (Evil Twin Brewing Ron and the Beast Ryan Saison)	68.00	4.29	371.04
evt-xmaseve6 barrel keg (Evil Twin Xmas Eve NY City Hotel Room 6 barrel keg)	2.00	145.00	178.00
ofc-hyper6b (Off Color – Hyper Predator 6 barrel)	2.00	145.00	198.00

sti-tenacity6barrel (Stillwater – Tenacity 6 barrel)	2.00	145.00	168.00
ofc-fierce6barrel (Off Color Brewing – Fierce – Berliner Weisse- 6 barrel)	2.00	145.00	190.00
donum-carpn13 (Donum Estate Carneros Pinot Noir 2013)	6.00	47.99	210.00
alvdo-oloNV (Alvaro Domecq Oloroso NV)	24.00	11.99	191.81
sil-re14 (Sila 2014)	33.00	8.66	215.91
evt-xxx6barrel (Evil Twin/Beavertown Brewing – XXX – Imperial Mild Ale – 6 Barrel)	3.00	95.00	387.00
evt-ryan6 barrel (Evil Twin Ryan and the Beaster Bunny 6 barrel)	3.00	95.00	189.00
bel-ch13 (Bellula Chardonnay 2013)	42.00	6.67	234.51
urb-agro6barrel (Urban Family – Agronomy 6 barrel)	2.00	140.00	190.00
ofc-friend6barrel (Off Color – Little Friend 6 Barrel)	2.00	140.00	168.00
urb-apricot6barrel (Urban Family – Apricot Love 6 barrel)	2.00	140.00	190.00
urb-del6barrel (Urban Family – Delicious Ambiguity 6 barrel)	2.00	140.00	190.00
urb-crimson6barrel (Urban Family – Crimson Fawn 6 barrel)	2.00	140.00	190.00
tur-bb12 (Turkey Flat Butcher's Block Red 2012)	21.00	13.33	209.93
fre-sy15 (Frey Syrah 2015)	28.00	9.99	182.00
ilc-pg15 (Il Cantico Pinot Grigio 2015)	52.00	5.33	164.67
doc-ensemblekeg20L (De Dochter Van de Korenaar – L'Ensemble 20L)	1.00	275.00	195.00
hof-bablondcalvadoskeg20L (Brouwerij Hof ten Dormaal – Calvados Barrel-Aged Blond. . .	1.00	275.00	195.00
omni-bbaagememnon (Omnipollo – BBA Agememnon 375ml)	20.00	13.59	175.00
bon-ap14 (Pierre Boniface Apremont 2014)	34.00	7.99	263.50
cos-cdp2013 (Saint Cosme – Chateauneuf du Pape 2013)	7.00	38.66	187.83
evt-pilspastor6barrel (Evil Twin – Pils al Pastor – Imperial Pilsner w/ Pineapple,. . .	2.00	135.00	178.00
fre-bps13 (Frey Biodynamic Petite Sirah 2013)	21.00	12.66	189.00
har-sy13 (Scott Harvey Mtn. Selection Amador Syrah 2013)	21.00	12.66	196.00
hof-whitegold30L (Hof ten Dormaal – White Gold – 30L)	1.00	265.00	195.00
pow-mu15 (Powers Muscat Canelli 2015)	36.00	7.33	179.85
esp-pn10 (Elizabeth Spencer Pinot Noir 2010)	12.00	21.99	192.02
evt-sourbikini66cl (Evil Twin/Intangible Ales – Sour Bikini Beer)	30.00	8.79	162.50
joi-rg11 (Chateau Joinin Bordeaux 2011)	30.00	8.75	220.00
pow-spec12 (Powers Spectrum 2012)	43.00	6.08	214.78
omni-citra30L (Omnipollo – Ras Soft Citra 30L)	1.00	260.00	185.00
sti-whole6barrel (Stillwater – Whole-icious 6 Barrel)	2.00	130.00	200.00
omni-milkshake30L (Omnipollo/Tired Hands – Milkshake IPA – 30L)	1.00	260.00	185.00
esp-me13 (Elizabeth Spencer Napa Valley Merlot 2013)	6.00	43.33	175.00
sor-pnma (Villa Sorono Pinot Noir Magnums)	30.00	8.66	180.00
ven-maz12 (Venta Mazzaron Tempranillo 2012)	26.00	9.99	174.43
elc-bl13 (Elicio Vermentino 2013)	74.00	3.44	370.00
bat-sb15 (Sierra Batuco Sauvignon Blanc Reserva 2015)	39.00	6.51	189.99

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
fil-real14 (Filon Real 2014)	29.00	8.66	178.83
evt-yinhalfbarrel (Evil Twin Yin Imperial Stout Half Barrel)	1.00	250.00	195.00
evt-yanghalfbarrel (Evil Twin Yang Imperial IPA Half Barrel)	1.00	250.00	175.00
jel-pn12 (Jelu Pinot Noir 2012)	25.00	9.99	172.78
bbf-dubbel375 (Blackberry Farms – Dubbel 375ml)	31.00	7.93	167.92
sol-bl (Cuvee le Soleiller Blanc)	41.00	5.99	166.00
sti-stereohalfbarrels (Stillwater Contemporary – Stereo Half Barrels – IPA)	1.00	245.00	149.00
har-olkre12 (Scott Harvey One Last Kiss Red 2012)	28.00	8.66	150.21
bou-rg12 (Chateau Bousquette St. Chinian "Tradition" Rouge 2012)	26.00	9.24	196.63
cos-vb13 (St. Cosme "Valbelle" Gigondas 2013)	6.00	39.99	225.20
donum-ch10 (Donum Carneros Chardonnay 2010)	12.00	19.99	300.00
evt-dbjesus66cl (Evil Twin – Double Barrel Jesus 66cl)	13.00	17.94	162.50
evt-femfatnoire (Evil Twin Femme Fatale Noir 66cl)	98.00	2.36	533.54
omni-citra11oz (Omnipollo – Ras Soft Citra – Citra IPA 33cl)	48.00	4.79	140.00
don-ra5L (Don Ramon Tinto 5 Liter)	4.00	56.00	160.00
pin-sh13 (Pircas Negras Shiraz 2013)	48.00	4.66	276.00
kee-exportkeg20L (Brouwerij Kees – Export Porter 1750 20L)	1.00	220.00	155.00
min-imum04 (Minimum Cuvee Valencia 2004)	11.00	19.99	366.67
evt-ashtray6barrels (Evil Twin Ashtray Heart 6 barrels)	2.00	109.00	153.00
pow-cv12 (Powers Coyote Vineyard Reserve Cabernet Sauvignon 2012)	13.00	16.66	130.00
fee-ofw (Fee Brothers Orange Flower Water)	72.00	2.99	151.17
ofc-coffeedino6barrel (Off Color – Coffee Dino'Smores 6 barrel)	1.00	215.00	135.00
mar-tr12 (Marina Cvetic Trebbiano Riserva 2012)	8.00	26.66	160.00
esp-sb12 (Elizabeth Spencer Sauvignon Blanc 2012)	20.00	10.66	80.43
coh-ti13 (Cota de Hayas Tinto (Garnacha-Syrah) 2013)	45.00	4.70	163.12
ofc-whiskers750ml (Off Color – Whiskers – Wild Ale 750ml)	12.00	17.59	140.00
sti-vacuum6barrel (Stillwater Contemporary – Vacuum – Black Smoked IPA 6 barrel)	2.00	105.00	157.50
sca-bf12 (Scagliola Barbera "Frem" 2012)	21.00	9.99	210.00
anp-sb15 (Ancient Peaks Sauvignon Blanc 2015)	24.00	8.66	156.51
nob-ch13 (La Noble Chardonnay 2013)	26.00	7.99	147.34
fee-fro (Fee Brothers Frothy Mixer)	41.00	5.00	133.25
fre-bcs13 (Frey Biodynamic Cabernet Sauvignon 2013)	16.00	12.66	144.00
esp-gro14 (Elizabeth Spencer Grenache Rose 2014)	30.00	6.67	240.00
cos-jos14 (Saint Cosme – Saint Joseph 2014)	8.00	23.99	134.00
stb-apf10 (Stellenbosch Anwilka Petit Frere Red Blend 2010)	12.00	15.99	133.58
urb-flowers375 (Urban Family Brewing – The Flowers are Sleeping 375ml)	24.00	7.99	140.00

evt-ryanhalfbarrel (Evil Twin Ryan and Beaster Bunny Half Barrel)	1.00	189.00	134.00
ess-br07 (Antica Fratta Franciacorta Essence Brut 2007)	7.00	26.66	144.98
camo-kw14 (Ca'Momi Bianco 2014 20L Keg)	1.00	185.00	116.00
boh-hm10 (Clos La Boheme Haut Medoc 2010)	6.00	30.66	115.58
doc-belle66cl (Brouwerij De Dochter Van De Korenaar – Belle Fleur – IPA 66cl)	28.00	6.56	163.33
evt-femfatbottle (Evil Twin Femme Fatale Brett bottle)	68.00	2.66	368.32
sca-ch13 (Scagliola Chardonnay 2013)	15.00	11.99	117.18
bbf-fall16 (Blackberry Farms – Fall Saison 2016)	15.00	11.99	123.75
fee-lav (Fee Brothers Lavender Flower Water)	60.00	2.99	123.88
hof-Saison750 (Hof ten Dormaal – Saison 750ml)	74.00	2.38	481.00
ecu-gne14 (Domaine de l'Ecu Expressions Gneiss Muscadet 2014)	12.00	14.66	120.00
kee-exportkeg30L (Brouwerij Kees – Export Porter 1750 – 30L)	1.00	175.00	205.00
male-rg10 (Chateau Malescasse Rouge 2010)	10.00	17.33	143.33
urb-darker500ml (Urban Family – Darker My Love 500ml)	24.00	7.19	120.00
har-zi13 (Scott Harvey Mtn. Selection Amador Zinfandel 2013)	13.00	12.66	121.33
sil-re11 (Sila 2011)	19.00	8.66	118.90
msc-tr13 (Masciarelli Trebbiano d'Abruzzo 2014)	22.00	7.33	47.77
vig-ro14 (Villa Gemma Cerasuolo Rose 2014)	24.00	6.67	228.66
dif-rmpg13 (Mount Difficulty Roaring Meg Pinot Gris 2013)	24.00	6.67	222.22
pep-cs11 (Pepper Bridge Cabernet Sauvignon 2011)	4.00	39.99	116.65
nica-pg13 (Nica Pinot Grigio 2013)	40.00	3.99	160.00
doc-extase66cl (Brouwerij De Dochter Van De Korenaar – Extase – Fully Malted Doub. . .	14.00	11.19	110.83
bbf-brunekeg30L (Blackberry Farms – Abbey Brune 30L)	1.00	155.00	109.00
bbf-fallsaison30L (Blackberry Farms – Fall Saison 30L)	1.00	155.00	109.00
boh-hm12 (Clos La Boheme Haut Medoc 2012)	5.00	30.66	124.99
ofc-alfalfa6barrel (Off Color/Three Floyds/Wiseacre – Alfalfa Kang 6 barrel)	1.00	150.00	99.00
sti-htdarcana (Stillwater/Hof ten Dormaal – Arcana – Belgian Stout 375ml)	76.00	1.97	259.66
ecu-cc13 (Domaine de L'Ecu Cuvee Classique White 2013)	23.00	6.45	176.00
cos-hf14 (Saint Cosme – Hominis Fides 2014)	2.00	73.99	104.00
fee-hi (Fee Brothers Hibiscus Water)	49.00	2.99	102.90
ofc-wari6barrel (Off Color – Wari Chicha 6 barrel)	1.00	145.00	99.00
evt-jamesbarrel (Evil Twin – James Beer – Berliner Weisse brewed w/ Strawberries 6. . .	1.00	145.00	95.00
evt-petitkeg6b (Evil Twin – Imperial Petit Four Break 6 barrel)	1.00	145.00	89.00
har-zi11 (Scott Harvey Amador Zinfandel 2011)	12.00	11.99	102.00
pro-ti12 (Protos Tinto Fino Ribera del Duero 2012)	12.00	11.99	105.33
hof-Blond375ml (Brouwerij Hof Ten Dormaal Farmhouse Blond Ale 375ml)	66.00	2.15	208.98
urb-lime6barrel (Urban Family – Limesicle 6 barrel)	1.00	140.00	95.00

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
ofc-scurry6barrel (Off Color Brewing Scurry 6 barrel)	1.00	140.00	95.00
ofc-troublesome6 barrel (Off Color Brewing Troublesome 6 barrel)	1.00	140.00	95.00
nor-nev10 (Nora da Neve 2010)	6.00	23.33	83.35
fre-bs12 (Frey Biodynamic Syrah 2012)	11.00	12.66	99.00
dos-2007 (Dos Valencia Cuvee 2007)	12.00	11.33	132.00
dlm-sb12 (Domaine de la Motte Sauvignon Blanc 2013)	29.00	4.66	130.50
pau-lag12 (St. Paul's Lagrein Alto Adige Sudtirol 2012 DOC)	20.00	6.67	200.00
cap-rm14 (Capanna Rosso di Montalcino 2014)	8.00	16.66	93.33
bbf-summersaison750ml (Blackberry Farms Brewery – Summer Saison 750ml)	11.00	11.99	90.75
omni-symzonia66cl (Omnipollo – Symzonia 66cl)	12.00	10.97	95.00
doc-crime (Brouwerij De Dochter Van De Korenaar Crime Passionel 66cl – Wheat IPA)	15.00	8.59	87.50
stb-apf13 (Anwilka Petit Frere Stellenbosch Red Blend 2013)	8.00	15.99	83.73
chan-ogb11 (Chateau Chante L'Oiseau Graves Blanc 2011)	24.00	5.33	195.14
est-ressycsme07 (Estampa Reserve Syrah/Cab/Merlot 2007)	24.00	5.33	158.00
fer-se08 (Selection Laurence Feraud CDR Villages Seguret 2007)	19.00	6.67	161.39
sti-kanye6barrel (Stillwater – I Miss the Old Kanye 6barrel)	1.00	125.00	84.00
doc-passepartout33cl (Brouwerij de Dochter Van de Korenaar Passe Partout 33cl)	66.00	1.88	110.00
evt-femfatsudachi66cl (Evil Twin – Femme Fatale Sudachi 66 cl)	26.00	4.61	141.08
pow-cp12 (Powers Champoux Reserve Cabernet Sauvignon 2012)	6.00	19.99	84.00
fee-abqt (Fee Brothers American Beauty Grenadine Quart Size)	12.00	9.99	48.60
zero-ba13 (Zeroincondotta Barbera d'Piemonte DOC NSA 2014)	13.00	9.13	84.50
ecu-gm13 (Domain de L'Ecu Granit Muscadet 2013)	8.00	14.66	85.00
cha-gpn09 (Chaumont Givry Pinot Noir 2009)	11.00	10.66	120.69
kee-wee33cl (Brouwerij Kees – Wee Heavy – Scotch Ale 33cl)	24.00	4.79	70.00
cos-gig13 (St. Cosme Gigondas 2013)	4.00	28.66	85.74
alf-ch14 (Alfredo Roca Chardonnay 2014)	13.00	8.66	77.62
nic-am07 (Nicolis Valpolicella Classico Amarone 2007)	3.00	37.33	94.32
bea-gre15 (Domaine Beausejour Les Grenettes Touraine Sauvignon Blanc 2015)	12.00	9.33	81.25
est-ressbchviog10 (Estampa Reserva Sauv. Blanc/Chard/Viognier 2010)	11.00	9.99	75.57
nica-sb13 (Nica Sauvignon Blanc 2013)	27.00	3.99	108.00
tri-ch/vi15 (Tricky Rabbit Chardonnay/Viognier 2015)	16.00	6.67	76.00
har-jice (Scott Harvey Jana Angel Ice Dessert Riesling 375 ml)	8.00	13.33	148.75
bere-sidre (Sidre – Bere Cider 33cl)	70.00	1.50	140.00
vir-cr14 (Viridiana Crianza 2014)	12.00	8.66	79.70

anb-monv (A. Barbadillo Moscatel Sherry NV)	12.00	8.66	55.63
pow-sh13 (Powers Sheridan Reserve Cabernet Sauvignon 2013)	6.00	16.66	72.00
raf-gr11 (Rafffy Grand Reserve Malbec 2011)	5.00	19.99	79.90
evt-rclassique66cl (Evil Twin – Remix Project in Collaboration w/Stillwater – Cl. . .	14.00	7.07	79.32
evt-cake22oz (Evil Twin/Westbrook – Imperial Mexican Biscotti Cake Break 66cl)	12.00	8.25	99.00
bad-nsc13 (Badger Mountain NSA Cabernet Sauvignon 2014)	9.00	10.66	67.09
gav-koer33cl (Gaverhopke Koerseklakske Spiced Saison 33 cl)	24.00	3.99	58.00
zero-spu14 (Zeroincondotta Spumante Extra Dry NSA 2014)	10.00	9.33	65.00
sca-br09 (Scagliola Brachetto 2010)	6.00	15.33	60.00
misc-kegcode (Miscellaneous Keg)	3.00	30.00	90.00
est-rsbchvi14 (Estampa Reserva Sauvignon Blanc/Chardonnay/Viognier 2014)	9.00	9.99	63.00
inz-zi13 (Inzinerator Zinfandel 2013)	9.00	9.99	67.50
sti-WhyIBUkegs (Stillwater Why Can't IBU 6 barrel kegs)	1.00	89.00	62.00
evt-cowboy6barrel (Evil Twin The Cowboy 6 barrel)	1.00	89.00	63.00
sti-yacht6barrel (Stillwater Contemporary – Yacht – Lager 6 barrel)	1.00	89.00	62.00
vig-wh14 (Villa Gemma White d'Abruzzo 2014)	7.00	12.66	65.33
fre-bs13 (Frey Biodynamic Syrah 2013)	7.00	12.66	63.00
ste-pi16 (Stellar NSA Pinotage 2016)	12.00	7.33	56.28
cac-ba15 (Cascina Castle't Barbera 2015)	10.00	8.66	85.26
luz-bn15 (Luzon Blanco 2015)	14.00	5.99	49.18
esp-halfcs14 (Elizabeth Spencer 375 ml. Cabernet Sauvignon 2014)	5.00	16.66	62.50
fee-jasmine (Fee Brothers Jasmine Water)	27.00	2.99	56.19
vil-mo11 (Villadonna Montepulciano d'Abruzzo DOC 2011)	12.00	6.67	52.49
coh-fa14 (Cota de Hayas Fagus 2014)	6.00	13.33	56.00
dur-pn13 (Durerweg Pinot Nero 2013 Alto Adige Sudtirol DOC)	8.00	9.99	57.34
loc-medeal1 (Lockhart Merlot 2011)	10.00	7.99	49.90
far-ne12 (Farina Nebbiolo 2012)	6.00	12.66	48.15
fre-me13 (Frey Merlot 2013)	6.00	12.66	39.16
est-recscarmPV09 (Estampa Reserve Cab Sauv/Carmenere/Petit Verdot 2009)	13.00	5.84	85.58
evt-come33cl (Evil Twin/Buxton – Come Again – Sour Ale 33cl)	7.00	10.71	20.13
evt-boulmpbisbrk (Evil Twin Bourbon Barrel-Aged Imperial Biscotti Break 66cl)	4.00	18.39	48.33
esp-gren13 (Elizabeth Spencer Grenache 2013)	5.00	14.66	55.00
ofc-glasses33cl (Off Color – 33cl Glassware 6-pack)	3.00	24.00	54.00
mat-br09 (Mate Brunello 2009)	2.00	35.99	81.21
loc-cs14 (Lockhart Cabernet Sauvignon 2014)	9.00	7.99	46.98
alf-ma11 (Alfredo Roca Malbec 2011)	9.00	7.99	49.24

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
chr-li13 (St. Christopher Liebfraumilch 2013)	12.00	5.99	42.00
fre-sy12 (Frey Syrah 2014)	7.00	9.99	44.80
lcr-cs10 (Ledgewood Creek Cabernet Sauvignon 2010)	7.00	9.99	60.68
ven-sy12 (Ventura Syrah 2012)	14.00	4.99	78.91
alvdo-creamNV (Alvaro Domecq Cream NV)	8.00	8.66	50.42
sti-remixatg66cl (Stillwater – Rio de Sauvin (Remix of Against the Grain Rico Sau. . .	12.00	5.59	68.00
not-to10 (Notro Torrontes 2010)	10.00	6.67	33.67
msc-mo12 (Masciarelli Montepulciano 2012)	9.00	7.33	54.00
frs-br10 (Franco Serra Barolo 2010)	3.00	21.99	48.00
pro-re09 (Protos Reserva Ribera del Duero 2009)	2.00	31.99	45.94
nic-seri11 (Nicolis Valpolicella Classico "Seccal" Ripasso 2011)	4.00	15.99	45.66
cha-gb12 (Chaumont Givry Chardonnay 2012)	6.00	10.66	64.67
sti-debutante4paks (Stillwater Debutante Biere de Garde 4paks 6 to a case)	3.83337	16.44	118.70
frs-arn14 (Franco Serra Roero Arneis 2014)	7.00	8.66	31.50
evt-femfatbre6b (Evil Twin – Femme Fatale Brett 6 barrel)	1.00	60.00	95.00
smma-cs06 (Smith Madrone Cabernet Sauvignon 2006)	2.00	29.99	39.96
hof-Amber375ml (Brouwerij Hof Ten Dormaal Farmhouse Amber Ale)	44.00	1.32	139.34
ess-ro09 (Antica Fratta Franciacorta Essence Brut Rose 2009)	2.00	28.66	40.00
ofc-proCAT750ml (Off Color/Side Project – ProCATstination 750ml)	5.00	11.40	56.25
aba-db11 (Abad Dom Bueno Bierzo Roble 2011)	5.00	11.33	40.00
piq-ro14 (Pique Poul Rose 2014)	12.00	4.66	78.00
kaj-pmkab13 (Karl Joseph Piesporter Michelsberg Riesling Kabinett Mosel 2013)	8.00	6.67	36.00
may-ma12 (Familia Mayol Malbec 2012)	5.00	10.66	41.33
luz-cr11con (Luzon Crianza 2011 Seleccion 12)	12.00	4.25	72.49
con-vc09 (Klein Constantia Vin de Constance 2009)	1.00	48.66	38.34
nav-no08 (Navarrsotillo "Noemus" Rioja Red 2008)	7.00	6.67	32.35
mas-rg09 (Massamier Rouge 2009)	10.00	4.66	52.93
pep-tri10 (Pepperbridge Trine 2010)	1.00	43.99	32.50
raf-he14 (Raffy Hedera Malbec 2014)	5.00	8.66	32.45
doc-XOnoblesse66cl (Brouwerij de Dochter Van de Korenaar – Noblesse XO 66cl)	6.00	7.19	29.50
var-lb (Varaldo Bricco Libero Barbaresco 2003)	1.00	42.66	28.75
lat-ai13 (Latue Airen Blanc 2013)	6.00	6.67	24.09
nav-no14 (Navarrsotillo "Noemus" Rioja Red 2014)	6.00	6.67	28.00

tur-ro14 (Turkey Flat Rose 2014)	3.00	13.33	29.22
lau-brnv (Jean Laurent Brut Rose NV)	1.00	39.99	24.67
pog-cc10 (Poggio Amorelli Chianti Classico 2010)	4.00	9.99	28.28
til-rg13 (Tinto Lena Rouge 2013)	19.00	1.99	91.83
pie-andrcnp (Domaine – Pierre Andre Chateauneuf du Pape 2012)	1.00	36.66	40.62
sun-sb15 (Sunday Mountain Marlborough Sauvignon Blanc 2015)	4.00	8.66	25.34
ban-ge14 (Banyan Gewurtztraminer 2014)	4.00	7.83	20.55
mar-ch10 (Marina Cvetic Chardonnay 2010)	1.00	26.66	20.00
har-1869zin11 (Scott Harvey 1869 Zinfandel 2012)	1.00	26.66	16.60
chr-pma12 (St. Christopher Piesporter Michelsberg Auslese 2012)	3.00	8.66	17.48
alf-ch15 (Alfredo Roca Chardonnay 2015)	3.00	8.66	21.45
per-alt15 (Perlage "Altana" Rosato Cabernet Frizzante 2015)	3.00	8.66	16.25
nai-snaia13 (Naia S-Naia Sauvignon Blanc 2013)	3.00	8.66	18.08
est-cabpv10 (Estampa Estate Cab Sauvignon/Petit Verdot 2010)	3.00	8.66	15.24
fre-prme13 (Pacific Redwood Merlot 2014)	3.00	8.66	16.45
esp-cs11 (Elizabeth Spencer Cabernet Sauvignon 2011)	1.00	24.67	18.00
god-rt11 (Gode Il Rosso Toscano 2011)	4.00	5.99	24.35
vit-cc11 (Viticcio Chianti Classico 2011)	2.00	11.33	19.66
ann-rg11 (Ste. Anne Bordeaux Rouge 2012)	2.00	10.66	14.99
ann-bl13 (Domaine Ste. Anne Bordeaux Blanc 2014)	2.00	9.99	11.67
vit-cr10 (Viticcio Chianti Classico Riserva 2010)	2.00	9.99	27.50
clo-rm08 (Los Clop Malbec Reserve 2008)	2.00	8.66	15.98
est-viogch2013 (Estampa Estate Viognier/Chard 2013)	2.00	8.66	10.00
raf-mr11 (Bodegas Raffy Malbec "Reserve" 2012)	1.00	16.66	10.99
ani-vdprose14 (Annibals VDP Rose 2014)	3.00	5.33	21.83
urb-pine500ml (Urban Family – Pineapple Milkshake 500ml)	3.00	5.00	15.00
ste-sh14 (Stellar NSA Shiraz 2014)	2.00	7.33	9.38
bbf-fallsaison (Blackberry Saison – Fall Saison 2015 750ml)	2.00	7.13	20.62
sti-aut4pk (Stillwater Autumnal 4pk 6 to case)	0.29167	47.93	8.46
des-picp12 (Domaine Del Sol Picpoul de Pinet 2012)	2.00	6.67	9.00
evt-mjesus66cl (Evil Twin – Bourbon Maple Even More Jesus 66cl)	1.00	12.50	12.50
evt-mbabiscotti66cl (Evil Twin – Bourbon Maple Imperial Biscotti Break 66cl)	1.00	12.50	12.50
evt-ajesus33cl (Evil Twin – Aun Mas "A" Jesus – Imperial Stout 33cl)	3.00	4.00	11.25
har-zi12 (Scott Harvey Mtn. Selection Amador Zinfandel 2012)	1.00	11.99	12.75
evt-disco (Evil Twin Brewing Disco Beer- Double IPA and Chardonnay blend)	1.00	11.99	6.10
coh-ch13 (Cota de Hayas Chardonnay 2013)	2.00	5.99	7.26
aba-go12 (Abad Dom Bueno Godello 2012)	1.00	11.33	7.67
ilb-pg12 (La Bastarda Pinot Grigio 2012)	2.00	5.33	7.11
evt-flama22oz (Evil Twin – La Flama Blanca 66cl)	2.00	5.00	9.83

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Description	Jan-Dec 2019		
	Qty	Avg Price	COGS
cof-prNV (Corte alla Flora Prosecco NV)	1.00	9.99	6.70
nic-va12 (Nicolis Valpolicella Classico 2012)	1.00	9.99	7.00
far-mo13 (Farina Moscato 2013)	1.00	9.99	6.86
ven-maz11 (Venta Mazzaron Tempranillo 2011)	1.00	9.99	6.71
bbf-1976bottle (Blackberry Farms – 1976 Anniversary Ale (Imperial Saison) 750ml)	1.00	9.50	9.50
bbf-king750ml (Blackberry Farms – King of Falling Fruit 750ml)	1.00	9.50	9.50
plu-bl07 (Plume Bleue 2009)	1.00	9.33	3.20
nav-no12 (Navarrsotillo “Noemus” Rioja 2012)	2.00	4.66	9.33
ced-cr12 (Domaine des Cedres Cotes du Rhone 2012)	1.00	8.66	6.00
evt-404ale (Evil Twin Brewing Ale 404)	1.00	8.00	6.67
chr-pms13 (St. Christopher Piesporter Michelsberg Spatelese 2013)	1.00	7.33	5.35
est-rcarmsycab (Estampa Reserve Carmenere/Syrah/Cab 2012)	1.00	7.00	6.98
har-jrov12 (Scott Harvey Jana Old Vine Riesling 2012)	1.00	6.67	10.00
coh-ti12 (Cota de Hayas Tinto (Garnacha-Syrah) 2012)	1.00	6.67	3.62
lcr-pqch11 (Ledgewood Creek PQ Chardonnay 2011)	1.00	6.67	4.28
far-do11 (Farina Dolcetto 2011)	1.00	6.67	6.06
evt-turkish66cl (Evil Twin – Turkish Delight – Brown Ale w/Coffee 66cl)	1.00	6.39	5.42
coh-ro13 (Coto de Hayas Rosado 2013 (Garnacha-Cabernet))	1.00	5.99	3.16
est-cabpv11 (Estampa Cab Sauv/Petit Verdot 2011)	1.00	5.50	5.33
sti-ggw4pak (Stillwater – Gose Gone Wild 6-4paks)	0.16667	33.00	5.42
urb-stellar500ml (Urban Family – Stellar 500ml)	1.00	5.42	5.42
clo-cs10 (Los Clop Cabernet Sauvignon 2010)	1.00	5.33	3.75
fil-ti13con (Filon Tinto 2013)	2.00	2.51	6.41
urb-hex500ml (Urban Family – Hexaploid 500ml)	1.00	5.00	5.00
evt-brandyjesus (Evil Twin – Brandy Barrel-Aged Aun Mas A Jesus 33cl)	1.00	5.00	4.79
hof-htdbadarkMadeira (Hof Ten Dormaal Barrel Aged Dark Madiera #10)	1.00	5.00	10.00
hof-blond33cl (Hof ten Dormaal Blonde 33cl)	1.00	2.00	2.00
evt-femfatkab66cl (Evil Twin – Femme Fatale Kabosu)	1.00	2.00	5.42
hof-wgold33cl (Hof ten Dormaal – White Gold 33cl)	1.00	2.00	1.67
est-rescarmcscf08 (Estampa Reserve Carmenere/Cab Sauv/ Cab Franc 2008)	1.00	2.00	6.87
dug-rudolf (Dugges Rudolf Winter Ale)	1.00	1.00	4.00
alf-mm12 (Alfredo Roca Malbec Merlot 2012)	0.00	0.00	0.00
arc-vv13 (Arca Nova Vinho Verde 2013)	0.00	0.00	0.00
asl-al13 (As Laxas Albarino 2013)	0.00	0.00	0.00
atg-londonballing12oz (Against the Grain – London Balling – Barleywine 12oz)	1.00	0.00	6.06

Case 9: Columbus Auto Parts[1]

Columbus Auto Parts (CAP) encountered the problem of latent defects in some of its purchased catalytic converter component housing assemblies. The defects did not show up until after the housing assembly reached a specific temperature level in the final inspection department. The catalytic converter is a recall replacement part for the 2015 through 2019 Chevy Impala LX.

When the defects were discovered in a final heat test, the assembly line was stopped immediately and the defected converter housings were repaired. Even with this process, almost 15% of the incoming housings ended up in the scrap bin. Specifically, 13,400 housing assemblies had to be purchased to produce 10,000 good housing assemblies. The housing assemblies cost $312 each from the housing assembly supplier. A more serious problem associated with the defective converter housings and high scrap rates were the assembly work stoppages. These assembly disruptions were costly. The sales department was also concerned about the firm's inability to meet delivery commitments. Marketing claimed that many sales were cancelled as a result of this failure.

George Casto, the production manager, and Terry Eilts, the vice president for marketing, asked Bob Cooper, the purchasing manager, to evaluate the total costs of the defective housing problem.

The internal cost of repairing the defective housings was approximately $250 per defective housing. This repair cost included $100 of direct labor and $150 of overhead. The accounting department estimated that overhead, which was 150% of direct labor, consisted of 50% variable and 50% fixed costs. No estimate was available on the cost of the disrupted assembly line.

Bob contacted five major housing suppliers in an attempt to generate a more reliable source. Only one supplier, Cleveland Foundry, showed interest. Of major concern to all the foundries was the $800,000 to $1,000,000 setup cost. Cleveland Foundry was willing both to invest in the necessary equipment and to guarantee delivery of up to 1,200 units (with no defects) per month, provided Columbus Auto Parts would contract with it as the sole source for the housing assemblies for the next 3 years. The price per housing would be $400 for the first year, with an annual increase in price tied to an appropriate economic index.

Bob was faced with the problem of deciding whether to recommend contracting with Cleveland Foundry for housing assemblies, continue buying housing assemblies with defects, or developing a more reliable alternative. Columbus Auto Parts was currently operating at 80% to 90% capacity, but it was not easy to estimate the demand for housing assemblies over the next 3 years. The decision of whether to switch suppliers was of major importance to Columbus Auto Parts because the firm used at least 10,000 finished castings per year and anticipated that this usage would continue for each of the next 5 years.

Assignment Questions

1. Should Bob select Cleveland Foundry as the housing assembly supplier?
2. What would be the savings if Cleveland Foundry was the supplier? What are the risks involved if Cleveland Foundry becomes the sole source for Columbus Auto Parts' housings?
3. Who in the company is responsible for making the final decision?
4. Write a report explaining the solution methodology given in Questions 1 and 2. The report should include an analysis of the potential savings from the current inventory control system.

Case 10: Custom Doors, Inc.[1]

Dave Fields, plant manager for the doors and molding department at Custom Doors, Inc. (CDI), was concerned about the company's lumber stockroom operations. There was no way to know what was available before you got to the lumber storage area. There was usually a 50% chance of obtaining the needed lumber for a job. The stockroom situation was interfering with productivity.

Company Background

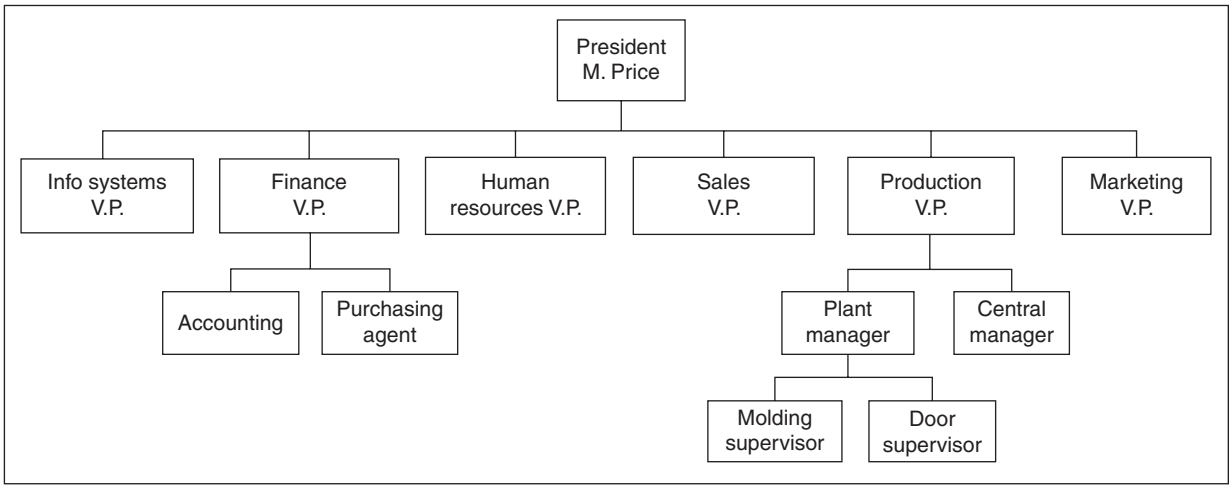
Custom Doors, Inc., was started in 2010 by Michael Price (see Figure C.1). With the fast-growing custom home industry in Texas, he realized the need for custom-manufactured doors. He began manufacturing doors in his garage until 2011, when he moved the facility to Waco, Texas. As the company began to grow, Price relocated to downtown Austin in 2012 and then to the present location in the Silicon Hills development in Austin. The current facility has over 90,000 square feet of production, warehouse, and showroom space and employs 120 people. The production process is shown in Figure C.2. The 9,000-square-foot showroom displays their vast selection of quality handcrafted and manufactured custom door products, which include a complete line of doors, moldings, decorative hardware, and entry systems. They are the only company in Texas that manufactures custom doors.

CDI's primary customer base is composed of custom builders in Austin, Dallas, Houston, and Fort Worth. CDI has a sales staff for in-stock and special orders and a fleet of delivery trucks that deliver within a 50-mile radius of Austin. They also make regularly scheduled visits to the Dallas–Fort Worth area and Houston.

Competitive Priorities

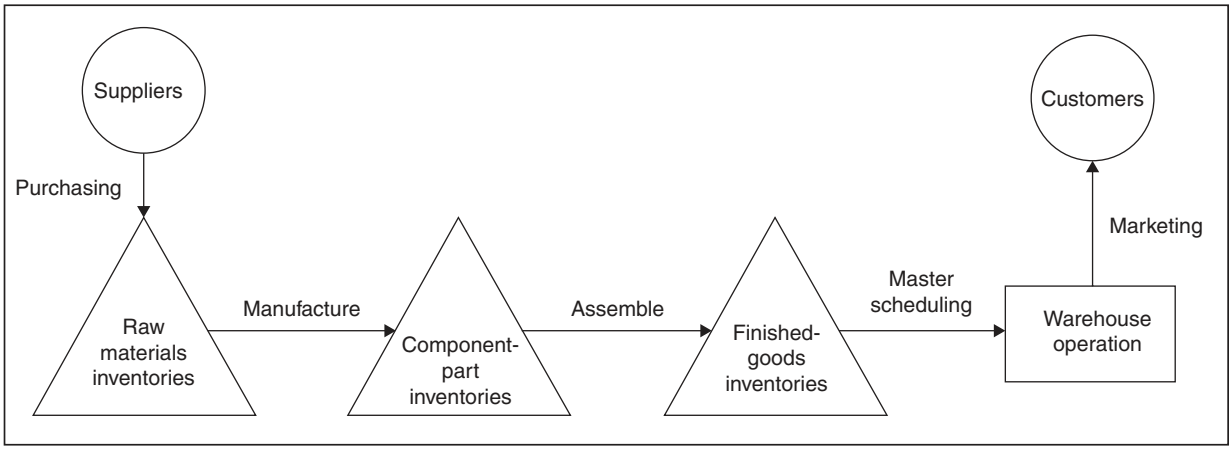
CDI competes on a high level of service and the idea that they are very flexible. If it can be made of wood, then they will produce it. Plant manager Dave Fields prides himself on the fact that a customer can ask them for anything and he or she will receive it. For example,

FIGURE C.1
Organizational Chart



[1] Names and data have been disguised Copyright 2020 W. C. Benton Jr. All rights reserved.

FIGURE C.2
Process Flowchart



a customer last year asked them for three insulated redwood doors. Not only did Dave know what these doors were, but he had a reliable high-quality supplier for the requested material promptly. It would be utterly impossible to walk into a large home improvement store and find anyone with the knowledge or resources to fit such an order. In addition to custom-made doors, CDI can make any type of wood molding. For approximately $420, customers can have special knives made to make custom molding to fit the décor for the custom home.

CDI feels that along with this "anything for the customer" attitude is an exceptional sales and service staff. They have their own in-house sales staff that can assist customers in choosing the door design they prefer. They also provide delivery for their custom door assembly; this can lead to higher service, shorter lead times, and more reliable shipment.

To ensure their customers are satisfied, CDI offers a wide variety of hardware with their doors. CDI stocks many items, from hinges to locks, required to install the door. CDI knows from experience that the faster the door is shipped and installed, the less likely it is to be damaged and returned to the factory.

CDI is also innovative when it comes to how they make their molding and what kinds of doors they can produce. Five years ago, they purchased a specialized digital molding machine that allowed for an unlimited number of molding designs. The digital molding machine is used to make a variety of molding patterns, and the cutting knives could be custom cut to fulfill the customers' design expectations. Last year, three finish carpenters were sent to Florida for training on the specialized molding machines. This may be looked on as an unnecessary cost to some custom door manufacturers, but CDI wanted to provide the customers with the opportunity to have individualized custom molding.

The peak manufacturing period is from February to November. The highly seasonal and cyclical product line is closely tied to the construction industry in Texas. During this time, the company operates two 10 1/2-hour shifts 4 days per week, Monday through Thursday. Each production worker is paid for a 10-hour day. The 120 production workers are paid, on average, $20.35 per hour. Fringe benefits are about 30%.

CDI also installs the glass in the doors as they are being manufactured. Other companies use subcontractors to install the door glass. Mr. Fields stated that the manufacturer cannot control the quality and workmanship that subcontractors do.

Current Inventory Situation

CDI currently does not have a formal inventory management system for the raw materials and finished goods they maintain in their warehouse. CDI conducts a complete inventory of raw materials and finished goods once each year. It requires 36 workers to inventory the items. The inventory count takes 2 days to complete, from 7:00 in the morning to 5:00 in the evening. After speaking with the plant manager, Dave Fields, it is easy to see that CDI does not place a high priority on maintaining accurate inventory records. The president, Mr. Price, believes that since CDI is the only custom-door manufacturer in Texas, they do not need to compete on costs; therefore, there is no need to reduce inventory costs. The 2019 sales revenue was $51,020,000. The average price per door assembly ranged from $4,650 to $10,250.

A second reason not to worry about the lumber stockroom is based on the nature of the demand. According to the vice president of production, Mary Smith, the demand for the different types of wood varies from one year to the next. Since approximately 95% of their sales come from custom orders, it is difficult for CDI to predict what styles and types of wood will be in demand for any given year. Custom order sales depend on the trends and preferences of the annual custom home shows. This factor makes it difficult for CDI to predict which types of wood to maintain in stock on a consistent basis and which ones to special order. Inventory turnover is the most important measure of inventory performance because it relates inventory levels to the product's sales volume. Mary Smith estimates that inventory was turned one and a half times each year.

Lumber Purchasing

Lumber represents approximately 90% of all purchases and dollar value; fasteners, hinges, and miscellaneous materials represent the remaining 10% of annual purchases. Wood is purchased based on discounts, deals, and rebates offered by lumberyards. As orders are received, the wood is then allocated to the various orders. The estimated value of the wood inventory is approximately $31 million.

A Typical Day's Operation

The production shift begins at 7:00 a.m. Those workers needing lumber at this time request permission to pick up lumber from the lumber store. In most cases, the lumber and other items have been kitted for the specific job catalog. If no kits have been prepared, the workers usually take the necessary items without bothering to record the withdrawals. Approximately 51% of the kits are available for the workers. All workers are required to return the remnants from their kits of materials before the end of the shift.

The Decision

At a recent management meeting, the president announced that the production levels would increase by 25% during the next month. Dave was anxious to resolve his production problems.

Case 11: Delta Construction Systems (DCS)[1]

Delta Construction Systems (DCS) has added 20 employees a year, reaching its current employment level of just over 500. Of the 500 employees 30 are engineers. Robbin Nelson, the granddaughter of the founder, attributes most of the growth to the company's informal operating procedures. According to Robbin, the employees know how to take the initiative to solve complex problems. DCS is an international company that develops, manufactures, and sells precision estimating devices for large bridge contractors. The estimating equipment is used to provide accurate cost estimates for major bridge projects throughout the world. Recently, as a result of innovations in the industry and declining profits, top management was considering implementing a more formal system for controlling its cost of materials.

The company's product line includes 22 digital estimating devices, ranging in size from handheld laser units and printers to high-quality jobsite laser platforms that cost up to $30,000. Most of the products are made in a number of different models, so that the total number of individual products was about 100. About half were standard models whose design had not changed significantly in the last 10 years; others were subject to considerable technological change; a few involved customized features for major tunnel contractors, sometimes including specialized accounting and job costing software. Some of the more complex software was supplied with or without the required coding and refinements.

DCS's market share in the industry was approximately 22%, which depended on its ability to stay ahead of its competitors in design, quality of product, customer service, and pricing. It was the responsibility of the purchasing manager to obtain the component parts, materials, and laser platforms. Laser platforms were purchased in the exact quantity required for a specific order. On the highly standard material, more than enough for one order would be purchased, and in most cases the materials were bin items. Standard fasteners, cables, and similar items were usually purchased in standard commercial quantities, but even here the quantities did not greatly exceed immediate requirements, and frequently even these items were purchased by the piece. Molded plastics and special fittings and branding labels were sometimes purchased in excess of immediate needs, especially when costs of small-quantity purchases were prohibitive.

The purchased materials were checked off and transferred to the storeroom, to the production floor, or, if they were finished component parts, to assembly. Little attempt was made to schedule work to the shop, and the production foreman was free to work on any orders on which materials had been received. It was up to him to keep the production employees and equipment busy and to meet the estimated due dates. As fabricated platforms were completed they moved on to assembly, where they were kitted with other parts accumulated based on the specific order. When all parts were completed, assembly could take place. The finished estimating units were then placed in stock in the shipping room or were shipped directly to the customer.

The completed order was not posted to the sales and production record until the entire order was finished. Some of the units were often assembled well in advance of the completion of the entire order. The sales and production record frequently indicated earliest delivery as some time in the future when, in fact, completed estimating platforms were actually in storage in the shipping room. In some instances these orders were cancelled by the customers. Many booked orders became lost sales. The company had no formal inventory planning and control system. There were no records for materials, purchased parts, or manufactured parts on hand. An informal tabulation of finished goods, the sales and production record, was

[1] Names and data have been disguised.

maintained for each estimating platform unit. This showed the balance on hand, the number of units currently being manufactured, orders received, customers' names, and shipment dates. In the last year, the minimum stock balance and the manufacturing quantity on most items had been revised upward because of a substantial increase in volume, shipment delays, and more frequent manufacturing runs. A typical manufacturing run required about 3 to 8 weeks, most of which was consumed in obtaining platform assemblies. Actual processing in the plant required 1 to 4 weeks. Recently, it was found that jobs were frequently sold before completion and a second order started before the first order was finished. Currently, about 30 to 40 shop orders were initiated each month.

The plant superintendent was familiar with the manufacturing process and setups involved, knew the price breaks on materials, and had a general knowledge of probable future demand. The traffic function was performed by the plant warehouse manager's secretary. Receiving and warehousing were performed by three young employees who were more or less under the control of the warehouse manager. Normally, when an incoming shipment arrived, the foreman would oversee its receipt. The purchasing manager reported to the plant superintendent.

The finance and marketing VPs felt that the company should establish a more systematic control over materials, manufactured and finished parts, and finished goods and inventories. They pointed to the lost orders and the purchasing waste, producing in small quantities, and production disruptions. These concerned executives also felt that DCS might be able to make significant savings through a systematic sales and operations planning system. Both VPs expressed concern over the amount of money spent on transportation. Inventory losses could not be measured. Transportation cost were estimated to be 16% of the cost of purchased material. The plant superintendent and the production foreman opposed changing the current inventory control procedure. They pointed out the risks of obsolescence in any inventory accumulation and, more importantly, the amount of funds that might be tied up in inventory and the space that would be necessary if substantial stocks of materials, parts, or finished assemblies were to be built up. They resisted the introduction of changes in the areas of production planning and control, receiving, warehousing, and traffic. They also pointed out that other uses of company buildings, equipment, and research and development would yield greater profitability.

Assignment

Write a report explaining your analysis and solution approach addressing the DCS executive team's concerns. The memo should include an analysis of the potential savings from a formal inventory control system.

Case 12: Great Lakes University[1]

In May 2019, Joan Middleton took over as director of purchasing at Great Lakes University (GLU), a large state university located in Cleveland, Ohio. Ms. Middleton is a 2012 graduate of the Ohio State University, where she majored in purchasing. Joan worked for 7 years as a buyer for Honda of America. Upon arrival at GLU, she discovered that her staff was spending too much time and money on more than 180 spend categories. Consequently, she wanted to develop methods of increasing the effectiveness and efficiency of the 180 spend categories. To accomplish this goal, she plans to move down the list of the spend categories beginning with the highest spend category and ending with the least significant spend category.

The University

Great Lakes is a metropolitan university providing a rich environment for engaged learning in a dynamic location. Great Lakes' students consider the entire city as their campus for study, practical experience, and recreation. And the university's pledge to each student is an engaged learning experience in the real world, for the real world, among a diverse student body. More than 1,000 courses support 200 major fields of study at the undergraduate and graduate levels, as well as professional certificate and continuing education programs. Programs are offered in business administration, education and human services, engineering, law, liberal arts and social sciences, science, and urban affairs.

As nearly 60% of Great Lakes' students work full or part time, flexible academic programming and convenient class times are offered. Of the institution's 25,000 students, approximately one third are in graduate-level programs and about half attend part-time.

The Purchasing Department

The purchasing department is directed by Ms. Middleton. Her primary responsibility is to manage the acquisition of the services and materials requested by all university departments. Ms. Middleton's current purchasing staff consists of herself, her administrative associate, and 10 buyers—three senior buyers and seven junior buyers. All three senior buyers applied for the director of purchasing position. The senior buyers frequently had lunch with some of the larger lawn care suppliers. Within the first few weeks on the job, Joan found it difficult to do her work well and decided to take action. In order to understand 180 major purchasing categories, Joan decided to start with a category near the middle of the list. Joan selected the lawn care category. The 2019 lawn care subcategories and spend are shown in Table C.1. The purchasing staff processes approximately 4,000–5,000 requisitions per month for more than 2,000 suppliers. The lawn care suppliers and spend are given in Table C.2.

TABLE C.1
Category/Spend

Category	Spend
Irrigation and drainage	$177,878.00
Snow	$435,990.00
Machinery and maintenance	$263,890.00
Lawn care services (basic landscaping)	$288,054.00
Chemicals/foods	$11,040.00
Gravel/mulch/soil/turf	$69,173.00
Plants/shrubs/trees/seeds	$460,332.00
Landscape design and construction	$134,804.00
Athletic field	$52,753.00
One-stop shop (3+ services provided)	$25,623.00
Supplies and equipment	$89,669.00
Total spend	$**2,009,206.00**

TABLE C.2
Supplier/Spend

Supplier	Spend
Bogner Construction Co.	$242,776.43
Field Turf	$153,019.90
Advanced Turf Solutions, Inc.	$110,064.49
Agrium Advanced Technologies	$103,662.35
Enviroscapes	$84,538.25
Arms Trucking Co, Inc.	$60,449.87
Petersons Lawn Care & Landscape Maintenance	$56,393.42
Ahlum & Arbor Tree Preservation	$54,830.00
Contemporary Tree SVC	$52,783.21
John Deere Landscapes	$47,545.08
JA Hitchcock Excavating	$47,175.00
Impullitti Landscaping, Inc.	$40,860.00
Winnscapes, Inc.	$39,953.09
Precision Mulching, Inc.	$39,015.00
Berta's Lawn Service	$38,486.64
Vermeer Sales & Service	$35,137.58
Hill Co., LLC	$33,960.00
Century Equipment, Inc.	$33,791.61
Central Farm & Garden Inc.	$26,487.46
Buckeye Landscape SVCS, Inc.	$26,173.84
Taylor & Sons Equipment Co.	$25,979.90
Kurtz Bros, Inc.	$24,849.98
Proscape Landscaping	$24,347.50
Arms Turf Products	$24,343.60
JD Equipment, Inc.	$22,063.23
Delhi Landscape	$20,065.00
Helena Chemical Co.	$18,600.00
Barnes Nursery, Inc.	$18,188.00
Oakland Design Associates	$17,567.55
Michaels Lawn Care	$14,935.00
Briarwood Landscape Service Inc.	$12,392.50
Ohio Mulch	$12,362.50
Dryject Ohio	$12,021.09
Enviro Recycling Group, LLC	$11,685.00
Turfgrass Inc.	$11,340.00
Reynolds Farm Equipment	$11,236.72
Golf Preservations	$11,040.00

Supplier	Spend
Hilliard Lawn & Garden	$10,949.00
Rausch Enterprises	$10,710.70
Fred Azar Landscaping	$10,648.00
Rico Construction, Inc.	$10,012.50
Boyd Turf, Inc.	$9,950.00
Oberfield's, Inc.	$9,839.18
Greenscape Horticultural Services	$8,920.22
Shearer Equipment	$8,588.77
Tag Lawn Services, LLC	$8,410.00
Edge Group	$8,075.00
Brickman Group Ltd.	$8,026.50
R&R Products Co.	$7,944.54
Harrell's, LLC	$7,770.95
Klingstone Paths, LLC	$7,394.30
Schmidt, Thomas	$7,152.20
Shepherd's Shoreline Construction	$6,810.00
On-Course Management, LLC	$6,745.00
Acorn Farms, Inc.	$6,709.90
Wyandot Tractor & Implement Co.	$6,281.65
Clark's Wood Recycling, Inc.	$5,955.00
Midwest Turf Consultants	$5,810.00
Columbus Equipment, Inc.	$5,795.89
Willoway Nurseries, Inc.	$5,699.64
Jones Fish Hatchery	$5,636.18
Baker Vehicle Systems	$5,563.25
Estate Lawn Care, Inc.	$5,465.65
Buckeye Tractor & Implement	$5,120.41
PRM Enterprises, LLC	$5,056.00
Daniels Landscaping	$5,000.00
Adgate Garden Center	$5,000.00
Deep Roots Aerification Services	$4,875.00
Hill, Michael R.	$4,575.00
LESCO, Inc.	$4,321.62
Franklin Equipment	$4,167.94
Mccoy Landscape Services, Inc.	$4,074.86
Orrville Trucking	$4,032.56
Greenscapes Landscape Co.	$3,946.00
Jarvis Outdoor Services	$3,800.00

Supplier	Spend
Fast Eddys Ground Maintenance	$3,782.28
Nationwide Exterior Solutions	$3,675.00
Sunbelt Rentals	$3,371.22
Trupointe Cooperative	$3,302.46
Mulch 1st Ltd.	$3,285.00
WOW Painting & Contracting, LLC	$3,200.00
Lavy Enterprises Turfgrass	$3,146.50
EE Johnson Property Services, LLC	$3,021.80
Park Enterprises Construction	$3,000.00
Hudson Landscaping	$2,950.00
Harold Tatman & Sons	$2,822.50
Forestry Suppliers	$2,718.08
Treeline Products Co, Inc.	$2,664.00
Pat's Lawn Care Service	$2,652.50
Seed Center	$2,525.00
Straders Garden Centers, Inc.	$2,499.50
Central Power Systems	$2,414.16
Textron Financial Corporation	$2,367.00
TurfTec International	$2,285.94
Central Farm and Garden I	$2,247.50
CLC Labs	$2,226.15
Dayton Garden Labels	$2,093.56
Fred C. Gloeckner & Co.	$2,006.65
AG Design	$2,000.00
Ohio Valley Teen Challenge	$1,935.00
AM Leonard	$1,932.82
Bearing Distributors	$1,919.97
Wolf Creek Co.	$1,771.55
KLYN Nurseries. Inc.	$1,568.70
Lang Stone Co.	$1,507.50
Strategic Turf Systems, Inc.	$1,500.00
Fox Stone Products, Inc.	$1,417.87
Vinecourt Landscaping	$1,407.04
Sabic Polymershapes	$1,388.20
Murphy Tractor & Equipment	$1,353.35
Davis Tree Farm & Nursery, Inc.	$1,305.00
Mid-Ohio Electric Co., Inc.	$1,260.93
East of Eden	$1,236.25
Woodland Mulch	$1,234.40
Green Thumb Gardening	$1,220.00

Supplier	Spend
Mid-Amer Sports Advantage	$1,219.00
Shemin Nurseries, Inc.	$1,142.00
Prairie Creek Lawnscapes	$1,130.00
WG Dairy Supply, Inc.	$1,129.86
Walker Brothers Lexington	$1,125.00
Stabilizer Solutions, Inc.	$1,080.00
Vinyl Guard	$1,061.00
Buckeye Power Sales	$1,054.66
Hawksridge Farms	$1,029.00
Willoway Wholesale Distribution Center	$993.05
Feikert Sand and Gravel	$979.01
Zarlinski Landscape Service	$914.25
Mid-West Landscape, Inc.	$903.00
Romich Sales and Service, LLC	$895.84
Shamrock Asphalt Sealcoating & Repair	$880.75
Piskula, Sean	$870.00
Menards	$861.42
BFG Supply Co.	$844.14
Baker Vehicle Systems, Inc.	$826.87
Orlo Auto Parts	$823.44
Silico Turf	$800.00
Trugreen Chemlawn	$800.00
Total Tennis, Inc.	$750.00
Wrights Tree Service, LLC	$750.00
Tanks, Leonard	$747.00
AM Leonard, Inc.	$727.00
Lifetime Fencing	$711.50
Davey Tree Expert Co.	$685.31
Contracting Solutions	$675.00
MTC Horticultural Services, LLC	$666.59
Herman Losely Son	$607.75
Mid Ohio Tree Service	$600.00
JW Raden Enterprises, Inc.	$600.00
Shaefer Landscaping NUR	$596.50
R&B Supply Co., Inc.	$566.93
Lakeside Greenhouse	$554.00
Trent, Charles	$512.77
Mast-Lepley AG Hardware	$503.77
Reel Turf Equipment Co., LLC	$493.00

(*Continued*)

(Continued)

Supplier	Spend
United Rentals	$489.45
Herman Losely & Son, Inc.	$472.50
W W Grainger 916	$447.50
Columbus Fasteners Corp.	$429.08
Freestyle Consulting	$399.98
Dayton Nurseries	$394.11
Smith Material Supply, Inc.	$386.44
Jones Topsoil	$377.82
Stone Creations	$375.00
Fore-Par Group	$366.43
Frye, Brandon L	$360.00
Miller Lawn & Power Equipment	$359.30
Dannaher Landscaping, Inc.	$359.00
Interstate Battery System of Columbus	$339.00
Lowes #01696	$331.06
Lowes #00264	$329.17
Golden West Industrial Supply	$319.22
Morrison Custom Welding, Inc.	$293.92
Discount Drainage Supplies	$288.00
Olena Sales	$282.04
Michigan Co., Inc.	$262.14
Interstate Batteries	$252.90
Zollinger Sand & Gravel	$246.75
CWS	$245.00
Mcdonnell Sales & SVC Co.	$242.85
Tractor Supply Co. #0675	$215.33
Como Mower Service	$206.05
Knot and Rope Supply, Inc.	$201.15
Stone Creation	$200.00
Kauffman Tire Center	$185.00
Wooster Rural King Supply	$179.80
The Home Depot #3866	$172.99
Barnes Nursery-Huron 2	$145.96
Hite Parts Exchange, Inc.	$145.00
Nortrax	$126.00
Paradise Lawn Care, Inc.	$107.25
Jurkiewicz, Michael	$105.00
Ditch Witch of Ohio	$103.25
Walmart	$101.86
Olen Corporation Plant 1	$72.33
H and H Lawncare Equipment, LLC	$69.80
Ramco Rental, Inc.	$65.00
OSU Petty Cash-Fawcett Center	$64.41
Madison SWCD	$60.00
Derringers, Inc.	$60.00
Johnston Supply-Ashland	$56.44
Columbus Builders Supply, Inc.	$54.00
Nourse Farms, Inc.	$53.05
Lake County Nursery	$51.00
Ads, Inc.–Wooste	$50.00
Sherwin–Williams Co.	$49.86
Corso's Flower & Garden	$49.00
Wayne's Country Market	$48.00
The Greenhouse Shoppe	$47.99
Irrigation Supply of Columbus	$47.60
Pymnt to Employees	$44.80
Brown County–OSU Extension	$41.20
Lowes #01175	$31.40
Fackler Equipment Company	$29.44
Schlabach Engine Ltd.	$21.00
W. W. Grainger	$20.50
Grand Total	**$2,009,209.11**

Lawn Care and the Spend

Joan's research, covering a 12-month period of the university's purchasing activity, revealed that more than $2 million was spent for lawn care services and that the control and coordination for these purchases was uneconomical. Joan discovered there were no performance criteria associated with the spend category. In some cases, the work was never formally finalized or documented, even though the invoice was paid. There was little internal or external

accountability. To gain control of the purchasing department, Joan formed a committee that consisted of two buyers and two associates from the accounting department. She informed the committee that their report would serve as a model for the evaluation of the remaining spend categories.

While considering possible alternatives, Joan recalled how in a recent seminar she learned that service purchasing may be more difficult for people to visualize and measure. In general, "service-level agreements" and "statements of work" may not have been as precise and finely tuned as specifications for manufactured goods. There is a general belief at GLU that service quality and performance are easy to measure. The service providers are frequently relied on to create the statements of work. Within the realm of the lawn care spend at Great Lakes, there is practically no reference to what the other spend categories are doing. This lack of a unified approach makes it difficult to understand the true scope of service purchases or to improve the management of materials and service purchases at GLU.

Assignment Questions

1. Analyze the lawn care spend at GLU. Your analysis should be thorough and convincing given the data and lessons learned from the textbook.
2. What are the strengths and weaknesses of the purchasing department?
3. Write a two page memo outlining your recommendations for each of the businesses.

Case 13: GRC Systems, Inc.[1]

Molly Miller, the director of purchasing for GRC Systems, Inc., was becoming increasingly concerned about the quotes she received today for electronic condensers. GRC is a $100 million multinational firm that manufactures customized pressure testing equipment. The manufacturing operation is divided into two separate divisions: fabrication and assembly. The fabrication division consists of 20 departments, and the assembly division is a paced assembly line consisting of 30 workstations. The fabrication department uses the 340-condenser and the assembly workstations use the standard 2-C-condenser.

Last year the contract provided complimentary consulting for the 340-condenser users but had an increased rate on the 2-C-condensers. Shirley Simko and other personnel in the assembly department were complaining about the high costs of the 2-C-condenser. With the high costs of the 2-C-condenser, many of the workstation managers in the assembly department were worried they would go over budget for the year. This is exactly what occurred last year. The two prequalified suppliers are Haddock and Wallace. The most recent quotes are given in Figure C.1. Last year Molly selected the supplier with the lowest total cost.

Assignment Questions

What should Molly's decision be for the current quote in Figure C.1?

Write a two-page memo to Molly discussing your analysis and decision for the current condenser quotes. Make sure your analysis is thorough and convincing.

FIGURE C.1
Condenser Quotes

	Haddock	Wallace
2-C-condenser	$1,125,000	$1,145,000
340-condenser	$1,180,000	$1,135,000

[1]

Case 14: Industrial Heating Systems[1]

"Mike, this is Bill Simpson from engineering. What's going on with the prices of the 541, 234, 567, and 876 capacitors this year? At this rate, we're spending the department's budget twice as fast as we did last year."

"Look, Bill, we got an excellent price on several solenoid parts from a new supplier, but we had to accept higher prices for your components. Overall, the company will save more than 60% on more expensive components."

"Thanks for the lesson in purchasing. For your information, we don't use solenoids. Furthermore, I can get better prices online. I thought the purchasing department was supposed to save us money."

"Bill, you are correct. Purchasing must look at the overall budget, not just yours."

Mike Watkins is the director of purchasing for Industrial Heating Systems Corporation. He is solely responsible for purchasing all material items throughout the company. Mike has had various experience in materials management prior to joining Industrial Heating Systems. After earning a bachelor's degree in business management with an emphasis in retailing at Crawford State University in West Texas, Mike has more than 35 years of industrial purchasing experience.

As a summer purchasing intern with Industrial Heating, Todd Evans was assigned to shadow Mr. Watkins.

Company Background

Industrial Heating Systems is an industrial heating company established in 1949. The company is an innovator of flexible heating products, especially with its knit and braided heating elements. This heating element is a multistranded resistance wire that is knit and braided with fiberglass and is the base technology for almost all of Industrial Heating System's products. The company also produces control devices and heating cable and is known throughout the industry as being the highest-quality flexible heat supplier. Industrial Heating Systems has enjoyed first-mover advantages for quite some time, and the industry recognizes Industrial Heating Systems as the innovator of flexible heat. They have several patents that support the company in sustaining market share, while their patented grounded heating element provides additional safety that other flexible heating elements cannot provide. Industrial Heating System's competitive advantage stems from the quality of its products, which are able to maintain higher, safer temperatures that are more flexible than other products on the market.

Products at Industrial Heating Systems

All products that Industrial Heating Systems produces are solutions to industrial heating applications. Industrial Heating Systems manufactures roughly 50% standard products and 50% custom orders. Each product line can be designed to meet custom applications. While variability of materials is substantial between product lines, all products essentially perform the same function. Industrial Heating System's custom products can be applied to virtually all industries that require heating products.

The standard products can be divided into eight basic product lines. Most of the product lines are enhanced versions of an existing product line. For example, a silicone heating blanket

[1] Names and data have been disguised.

is several flexible heating tapes sandwiched together between layers of silicone. This blanket can be used in areas where more coverage is needed, for example, a hopper tank. Each product line can be associated with a particular application; for example, flexible heating tape and heating cable are ideal solutions for freeze protection. The product line from Industrial Heating Systems that contributes the greatest portion of sales revenue is the cloth heating jacket. This product is commonly used in the semiconductor industry to prevent condensation in the gas pipes that are critical in the semiconductor process. Industrial Heating System's heating jacket can maintain higher temperatures than the competition's and is superior in a clean room setting. However, the silicone heating jacket alternatives offered by competitors are less expensive. This is mainly due to how the two products are produced. The cloth heating jacket requires intensive labor to sew the cloth, whereas the silicone jacket is manufactured with the help of machines.

Cloth heating jackets are the most labor-intensive and costly item to produce but, at the same time, are the largest revenue producer for Industrial Heating Systems. The labor required to produce a cloth heating jacket is highly skilled, thus making it difficult for other companies to duplicate the quality achieved at Industrial Heating Systems. In addition, since the product is made to fit, the cloth heating jackets tend to be custom designed, resulting in added engineering costs.

Industrial Heating Systems operates exclusively in a business-to-business environment, supplying the semiconductor, food processing, medical, and petrochemical industries.

Industrial Heating Systems has multiple competitors, who vary among different industries. The companies that they compete with generally offer less-expensive substitutes that tend to be of lower quality. Mateen Electric Manufacturing Company, Bailey Heating, and Cole Heating are a few of their many competitors.

Industrial Heating Systems has annual revenues of approximately $100 million. Of that $100 million, $40 million, 40% of revenue, goes into the annual spend on material items. Another 20% of the revenue goes to direct labor. Overhead takes up the majority of the potential profit margin: 20% for direct overhead and 5% for indirect overhead, which includes selling and administration. The high overhead is a concern but appears to be unavoidable for a small company trying to grow. A sales call center was implemented over a year ago, which adds 10 more members to the payroll along with a marketing person who creates all of the written literature and designs marketing campaigns. This leaves a margin of about 15% for profit. This number can fluctuate due to negotiations with customers. Industrial Heating Systems keeps approximately $14,000,000 of supply inventory on hand at any given point. This gives Industrial Heating Systems approximately four inventory turns per year. Industrial Heating Systems is constantly looking for ways to improve its financial status but appears to be overall stable with over 35 years in the business.

Purchasing According to Mike Watkins

"Todd, I will teach you everything I know about purchasing during your internship. . . . We will first start with an overview of purchasing at Industrial Heating."

"Mr. Watkins, thanks for allowing me to learn from you." Todd pulled out his pad and began to take notes.

Todd observed that Mike Watkins was a one-man purchasing department. Over the past 30 years, Mike has formulated an opinion of how materials management and purchasing should be conducted. For instance, he outlined for Todd his five most important criteria

for qualifying a supplier. The number one criterion was *on-time delivery*. His belief is that if the product is not in possession of the manager, the other factors are irrelevant. The second criterion was *quality*. Mike's definition of quality refers to both material quality and information quality from the supplier. He then restated that the number one criterion is on-time delivery. The third criterion is *value*. The fourth criterion is the *responsiveness of the supplier's organization*. According to Mike, supplier responsiveness is based on how quickly and accurately the supplier can change the order to meet Industrial Heating System's requirements. Finally, Mike places emphasis on the supplier's *financial stability*. What good is it to develop a relationship with a supplier if they will not be around tomorrow?

Mike views partnerships as an important part of materials management and purchasing, especially with small companies. With partnerships, Industrial Heating Systems is able to call on short notice and have their orders fulfilled, a lot of the time without expediting charges. Companies would be less likely to help Industrial Heating Systems if it was not for Mike taking the time to get to know the suppliers' representatives on a personal level. Mike gave as an example the time he was in the hospital, when many of his suppliers' representatives actually visited him. He stated that "this kind of a relationship is not made overnight," and even though he has personal relations with his vendors, he is still stern and fair in negotiations. He said this is done through honesty and integrity, which he claimed as the secret ingredient to being an effective purchasing manager.

Mike's enthusiasm for purchasing and supply chain management was easily observed by Todd. Mike's views on purchasing standards continue in the following section.

Purchasing Process at Industrial Heating Systems

Mike is the only person that handles purchasing at Industrial Heating Systems, which is all right with Mike since he likes the power. Typically, Mike sends out approximately 75 purchase orders a day. He bases his OEM purchase decisions on the following:

1. *MRP action report.* The primary method used to determine what needs to be ordered is based on Industrial Heating System's MRP-SAP inventory management system, and its MRP action report. Each morning when Mike arrives at his office, he prints the MRP action report, which is typically around 8–10 pages, and manually reads it. His decisions are driven exclusively by the MRP system report actions:

    - Cancel: No purchase is required.
    - Purchase requisition: Purchase order should be placed.
    - Slide: Purchase could be pushed back.
    - Short—no open orders: Parts are needed and suggested order date is due.

Mike then examines the report and quickly looks for things that jump out to him, such as accelerate, low number of inventory, high number required, and so forth. Once he has a grasp of what needs to be ordered, he prints out a material analysis report that gives detailed information about each product. This report can be up to 80–100 pages. He then manually goes through both reports to sort out the requirements with different vendors and then creates the purchase order for each supplier. He prefers to go through this process manually because the SAP inventory management system has its limits as to listing the primary and secondary suppliers, creating problems later. He also likes to be in control and see which

supplier should get the business and not let the computer decide it. After completing the manual analysis, he then prioritizes which suppliers should be called first. He manually phones or e-mails his purchase order to the supplier.

2. *Current inventory level.* Mike stated that every few days, he performs a detailed analysis of inventory in addition to the MRP action report. He looks for trends that may constitute larger-volume buying or reduction in inventory that the MRP action report would not recommend. Sometimes when a volume discount exists, he then consults with the Chief financial officer (CFO), since it involves a significant amount of capital. Industrial Heating Systems might have to carry additional inventory, but the cost may be offset by an attractive purchase price. According to Mike, every discount decision is the same. Mike, along with the CFO, decides the most profitable alternative for the company.
3. *Interaction with people that use the parts.* Mike is not one who likes to stay in his office. He spends a great deal of time on the plant floor talking to the production workers. If a need exists, a requisition form will be filled and the purchase will be made. The key players that typically requisition are members of the engineering team, especially for custom products; each engineering manager is responsible for forecasting, quality, and controlling cost for his or her specific section.

He does this routine every day, which is very time-consuming, not to mention all of the paper being used. Although the use of an SAP/MRP program helps, that is, by preparing the MRP reports, ultimately, Mike relies on his memory to make decisions.

Inventory Management

Since on-time delivery is critical, having products in inventory is important. Along with this, it is also important that the inventory be accurate in the computer system. The inventory part activity can be checked on the computer. A manual count of inventory is necessary to assure its accuracy. Material is constantly being used, and it is important to keep track of where the inventory is going and how much is used. Industrial Heating Systems remedies this situation with an inventory requisition form that is manually filled out by anyone that takes material out of the stockroom.

Recently, the material manager requested 25 pounds of a specific chemical substance, based on the bill of materials. The price at this level would have been $93 per pound. Mike purchased 500 pounds at only $45 per pound. According to Mike, this was successful because the product would not become obsolete and it is used on a regular basis. "This points out the disadvantage of SAP inventory management; it is not able to recommend volume buying because it looks solely at the bill of materials."

Supplier Relationships

Currently, Industrial Heating Systems maintains more than 800 suppliers in the database system. However, there are approximately 50–100 active suppliers. Some component parts and materials are acquired from more than one supplier. Mike does keep very good relations with his suppliers; oftentimes they will expedite their orders for him at no charge.

Industrial Heating Systems, more specifically Mike, has the philosophy that multiple sourcing is better than single sourcing. Since they are a small company with a little buying power, a competitive environment is the key to negotiating better prices. According to Mike,

there are two dilemmas with single sourcing. On one side, by maintaining single sourcing, you can cut down on administrative costs, have better integration with suppliers, and receive larger quantity discounts. However, when uncertainty occurs and the supplier cannot fulfill its requirement, the buyer is scrambling to fulfill the requirement with an alternate supplier that has been cut off from the supply chain. Since on-time delivery is so critical to Mike, he chooses to pay the premium to have a stable of suppliers. In addition, with 50–100 active suppliers, keeping relationships with all of them is not impossible or excessively expensive.

When it comes to qualifying suppliers, Mike uses his five criteria, as mentioned earlier: *on time delivery*, *quality*, *value*, *responsiveness*, and *financial stability*. Mike has a clear idea who will be included in Industrial Heating Systems' supplier base. Mike uses his judgment, intuition, knowledge, and network to qualify a supplier. He then looks for the criteria just mentioned in the suppliers. If they fulfill all the criteria, then the supplier is qualified.

Negotiations

According to Mike, to be a great buyer, you must be a great negotiator. Mike explains that a purchasing agent is measured on price variance. In other words, this is the difference in what the cost was and what the cost is now with savings. He has a goal to save at least 10% annually. An example at Industrial Heating Systems is the cost negotiated from a chemical supplier. In 2019, it cost $102 per container for 1,000 barrels. Currently, the cost is $90 per container for 2020, and the quality has dramatically increased. This was a savings of $10,200 for 2020. Another example of negotiation that many buyers are not aware of is with United Parcel Service. Some inexperienced buyers think it is a set price; however, if large volume is done, the cost can be negotiated. Industrial Heating Systems uses UPS and FedEx for inbound and outbound; therefore, they were able to negotiate better prices.

The most important characteristics Mike emphasized in negotiating with suppliers are honesty and integrity. This comes along with the quality of communication. Not only is it important for the supplier to communicate honestly, but it is also important that the purchaser is honest too. This allows both sides to know exactly what is expected, and trust can be gained. In addition, Mike says it is necessary to become an expert on what you buy. The more you know, the easier you can negotiate.

Another scenario where Mike used negotiation had to do with heating cable. When he first arrived at Industrial Heating Systems, the supplier was charging $1.10 per linear foot. He first began reducing cost by using a volume discount. Then he began researching and found another reliable supplier that was less expensive. He used this information to negotiate an even more favorable price with the current supplier. The result was a huge cost savings while still keeping the reliability of the current supplier.

Conclusion

This is precisely what happened in the case of Bill Simpson's situation earlier today. Total annual usage of the solenoid amounted to $120,000. The total usage of capacitors was $32,000. A new low-cost supplier, B&B, was selected to supply the solenoid component. Mike also agreed to add the capacitor requirements to the deal. The annual total for the combined purchase contract was $150,000 [$100,000 (solenoid) + $50,000 (capacitors)]. The company also will receive a 10% rebate at the end of the year.

Case 15: The K-Car Airbag Assembly[1]

Charlie Harris, air bag assembly buyer at K-Car of America, faced a tough negotiation problem. K-Car needed air bag assemblies for a new low-priced ($18,000) automobile platform designed to improve K-Car's share of the low-priced automobile market. Of course quality and reliability criteria are also important. But so are rock-bottom costs. Not a penny could be wasted.

In fact, purchasing and engineering had developed a cost program for suppliers, which they felt was tight but fair. Harris emphatically was told to stay within the maximum they had worked out. The figure was $2,600 per air bag assembly unit broken down thus:

Estimated Vendor Costs	
Material	*$1,000*
Labor	*$800*
Overhead and profit	*$800*
	$2,600

Harris first asked himself, *What if we make our own air bag assemblies?* But he discarded this idea when he found out that air bag assembly tooling costs could easily be twice those of outside suppliers. Meantime the marketing department was flowing with enthusiasm, hoping Harris would come through.

Sales Target	
1st year	*50,000*
2nd year	*150,000*
3rd year	*300,000*
4th and 5th years	*200,000*

Harris figured the sales projections were impressive enough to make the air bag assembly contract very attractive to the potential suppliers. So he invited three well-known airbag suppliers to review the specifications and submit informal proposals for 50,000 units.

Joe Wilson of BMT Company presented setback No. 1. He said that his company could not go lower than $2,800 per assembly. He stated that manufacturing and testing costs were higher than Harris specified. If a 3-year contract for 50,000 assembly units per year was negotiated, Wilson thought he could spread tooling costs and get the price down to $2,780 per assembly.

Sam Newson of IND Company was disappointment No. 2. Newson offered a 100% return policy on rejects and quoted $2,960. Newson said that anything cheaper would just be unsafe and that Harris wouldn't dare put it on the market.

George Withers of IRT Company would not quote at all. Withers told Harris that he thought the engineering department was pulling his leg. Withers suggested that Harris and Angie Boggs, K-Car's marketing VP, get together to review the specifications and the figures.

Harris told the three air bag suppliers he would think over their proposals and get in touch with them soon. Then he wrote a summary of the current situation and showed it to Donald Kingman, purchasing director. Kingman reiterated the fact that if they could not get $2,600 air bags, the new low-cost K-Car platform would be dead (and so would Purchasing!). Kingman felt the suppliers were a pretty shortsighted crowd, and maybe purchasing should teach them a lesson. In any event, K-Car needed acceptable $2,600 air bags—and fast!

[1] Names and data have been disguised.

Case 16: The Kemper Engine Plant[1]

Ms. Melinda Soto, purchasing manager at Kemper Engine Plant, was responsible for the purchase of crankshafts and bearings for low-pressure assemblies in the company's engines. She had handled numerous crankshaft procurements and had found that the designs were subject to considerable variation. Therefore, whenever Melinda was required to initiate procurement of a new design, she found it helpful to estimate the probable cost of the item based on historical costs of similar equipment, her own wide experience with machine shop practices, and conditions in the industry. She found that this method enabled her to question suppliers' cost estimates effectively and to negotiate good prices even on initial procurements, with a corresponding savings in subsequent purchases of the same item.

In February, Melinda received a purchase request for 10,000 crankshafts of a new design. The engineering department was proud of the new design, which called for a crankshaft made largely of improved alloy materials. The design replaced an older type of material that involved a number of casting and machining processes. The last procurement of the old crankshaft in November had been at a unit price of $264. It was anticipated that substitution of the new process would result in a considerably lower unit price.

Because Melinda realized that prospective suppliers for the procurement would include a group different from her usual suppliers, she decided for that reason to make an even more careful estimate of the expected cost. After performing research and analyzing the processes and materials to be used, she arrived at a figure of approximately $174 per unit as a reasonable price for the item, made up as follows:

Material	$44.80
Direct labor	$34.40
Manufacturing overhead	$51.60 (assumed to be 150% of direct labor)
Tooling	$19.20
General and administrative	$7.52 (assumed to be 5% of total cost)
Profit	$15.76 (assumed to be 10% of total cost)
Selling price	$173.28

Meanwhile, requests for proposals were sent to 18 companies. The closing date for submission of proposals was set for May 1. By the middle of April, Melinda had received 16 proposals, of which 12 were in the range from $184 to $208 per unit, while the other four ranged from $232 to $304. Melinda was pleased with the indication that her estimate had "pegged" the low range of quotations. As the quotations came in, she examined each supplier's cost breakdown to determine points for questioning and negotiation. Between April 20 and 23, however, two more companies submitted proposals. One of these, the Hyco Machining Company, quoted a unit price of $123.20, and the other, the Kindle Mechanical Company, quoted $148.80. Melinda was surprised, to say the least, at these low figures and was inclined to think they represented unrealistic estimates. Upon investigation, however, she found that both suppliers were large, well-established metal forming companies with good reputations for satisfactory performance on previous contracts. The cost breakdowns for the two low proposals are reproduced in Table C.1.

TABLE C.1
Cost Breakdowns

	Hyco Machining		Kindle Mechanical		Ms. Soto's Estimate	
Direct material	$34.40		$40.80		$44.80	
Subcontracted parts	$8.00		-		-	
Direct labor	$28.80		$40.00		$34.04	
Manufacturing overhead	$29.60	(103%)	$30.40	(76%)	$51.60	(150%)
Tooling	$10.40		$23.20		$19.20	
General and administrative	$6.40	(6%)	$2.40	(2%)	$7.52	(5%)
Profit	$5.60	(5%)	$12.00	(9%)	$15.76	(10%)
Selling price	$123.00		$148.80		$173.28	

Case 17: McGruder Pavers, Inc.[1]

McGruder Pavers is a family-owned company incorporated in 2003. The founder, David McGruder, works in the general Cleveland area. The office and equipment is located in North Olmstead, Ohio. The company employs 20 laborers, 5 working supervisors, and an office manager. During the peak construction season, the company has four construction crews working.

The company's primary focus is heavy highway, but it also does city work and an occasional commercial job for Cleveland State University and the Cleveland Clinic. McGruder Pavers is known for high-quality work that is finished on time. In January 2020, McGruder was the low bidder on a curb and gutter job for the city of Cleveland. The $756,232 project is significantly larger than the average job size of $259,000. The project is scheduled to begin on July 20, 2020, and must be completed by September 1—prior to the first Browns regular-season football game. There is a liquidated damages clause in the contract that requires McGruder to pay $30,000 per day for every day beyond September 1, if the job is not finished. To achieve the appropriate level of productivity, David decided to purchase a curb and gutter machine. The machine selection was narrowed down to the 5700-C concrete curb and gutter machine. The 5700-C curb and gutter machine is considered to be the number one curb and gutter machine in the world.

The Curb Machine Acquisition Process

The 5700-C machine's compact size and versatility allow contractors to achieve high levels of productivity. It gets in and out of tight spots quickly, making tight radius work in parking lots much quicker. In addition to curb and gutter work, the machine pours highway safety barriers, bridge parapets, sidewalks, golf cart paths, agricultural foundations, irrigation ditches, and stadium risers. According to the sales literature, the 5700-C will triple a normal day's production with less manual labor.

There is an additional feature that could boost productivity even higher. The 5700-C is equipped with a Smart Amp control system package that offers the simplicity of an analog system but with the features of a digital system. The machine operator has greater flexibility for sensitivity adjustment. Display screens on the operator's panel will show fault codes if there is a problem with a sensor, board, or toggle switches. Of course, the operators will be required to attend a 2-week, on-the-job training course.

Pricing Schedule

The pricing schedule for the lease and purchase options is given in Table C.1.

David McGruder's Viewpoint

As he examined the pricing data, David considered the lease-versus-purchase choice as a subsidiary consideration. He focused on understanding the cost structure and the expected operating environment as a means of establishing a range for negotiating down the published price schedule. If he was able to make a recommendation in favor of acquiring the Smart Amp, he wanted the contract to reflect the best possible terms for McGruder Pavers. He speculated that the supplier's costs were essentially sunk costs and

[1]

TABLE C.1
Pricing Options

	Purchase	Monthly Lease[a]	Monthly Maintenance Training[c]
Curb machine	$203,300	$15,300[b]	$1,000
Smart Amp	$70,030		
Total	$273,330	$15,300	

[a] A minimum of 12 months.
[b] Includes the Smart Amp.
[c] Training—To be determined.

that, if purchased, the supplier had agreed to extend the warranty to 12 months. Therefore, under a lease, the seller should be willing to absorb maintenance costs. The initial purchase was planned to be for the Cleveland job. His colleagues expected a recommendation within a few days.

PNC Bank is willing to loan David McGruder 80% of the purchase price at 5% interest with annual payments due at the end of each of the next 5 years. The bank will also require McGruder to sign a 5-year $1,000 maintenance contract with Miller Equipment Maintenance.

Assignment Questions

1. Should the 5700-C curb machine be acquired for the Cleveland job?
2. Should the 5700-C be leased or purchased?
3. Write a two-page memo discussing your analysis and recommendations. Be sure to discuss the risk associated with accepting the project. Your analysis should be thorough and convincing.

Case 18: Medical Laser Equipment, Inc. (C)[1]

"Helen, I've been thinking about our procurement policies on those VA 22 beam laser assemblies."

Dr. Wilson was speaking to his production manager, Helen Gellar. Dr. Wilson had been reviewing the purchasing procedures on one of the strategic company components.

Medical Laser Equipment (MLE) is a small (188 employees) producer/distributor of laser equipment and supplies, located in Columbus, Ohio, founded 5 years earlier by Dr. Wilson. Current sales volume was approaching $20,000,000 annually. The prosperity of MLE was fostered partly by the increasingly aging baby boomer generation. It also was due in no small measure to the personality and managerial capability of Dr. Wilson. He is also a successful and well-known surgeon in Columbus. He realized that just because he knew how to repair heart valves did not qualify him as an effective manager, so he decided to attend the executive business program at the Dublin College of Business.

The VA 22 beam laser assembly, which he was discussing with Helen, was a component of one of MLE's best-selling line of five portable laser units. Allen Enterprises manufactured the laser platform in Fort Worth, Texas. At MLE, the platform, along with other components, was assembled to form the complete device, which consisted of chassis, chip assembly, laser/generator and controls, cable, the grip, and wiring.

Wilson continued, "I think we have too much money tied up in the VA 22 assembly inventory. Helen, please explain how you determine when to place orders. How much do you order at one time? How many assemblies are we using per year? Are we getting any discounts? Should we be using a just-in-time system?"

Helen replied, "At the current time, I do not know the answer to any of your questions. I will collect the relevant data and address your concerns in a memo by Friday."

The next morning, Helen pulled out a stack of old purchase orders for the VA 22. She was able to estimate that the direct labor cost for placing an order was approximately $155. Next she obtained the following costs from the accounting department: cost of capital, 10%; obsolescence, 9%; handling, 12.5%; and annual storage cost, 11%. The VA 22 cost $1,240 to manufacture. It is now Thursday, and Helen is completely confused and wondering how to analyze the data she collected. She then remembered a concept, called the EOQ, that she had studied at City College. Helen reviewed her old textbook and realized that she was missing one vital component needed for the EOQ approach. She needed to estimate annual demand.

That afternoon, Helen collected data on the VA 22 beam laser assembly. The inventory database for the first 100 working days is shown in Table C.1. She estimated that this sales rate was typical of what could be expected for the 200 remaining working days.

From the records, she also determined that the inventory policy for the VA 22 beam laser assembly consisted of examining the level of assemblies every Monday morning and placing an order (by the Internet or phone) to raise the level of laser assemblies on hand. If a stock-out had occurred, enough VA 22s were ordered to eliminate the backlog and bring the level to 8 units. She noted that the assemblies ordered on a Monday always arrived in 1, 2, or 3 days. A stock-out resulted in production delays, rescheduling of work crews, and delays in shipments of completed laser devices. The shipment time depended on weather, traffic, and other factors. Therefore, she also assigned a stock-out cost of $450.

[1] Names and data have been disguised.

TABLE C.1
Inventory Database

Day	Beginning Inventory	Order Received	Demand	Ending Inventory
1*	4	0	0	4
2	4	0	0	4
3	4	0	0	4
4	4	4	2	6
5	6	0	1	5
6	5	0	1	4
7	4	0	1	3
8	3	0	0	3
9	3	7	1	9
10	9	0	0	9
11	9	0	5	4
12	4	0	0	4
13	4	0	2	2
14	2	6	0	8
15	8	0	1	7
16	7	0	0	7
17	7	3	1	9
18	9	0	2	7
19	7	0	2	5
20	5	0	0	5
21	5	0	2	3
22	3	5	0	8
23	8	0	2	6
24	6	0	0	6
25	6	0	0	6
26	6	0	2	4
27	4	0	0	4
28	4	0	0	4
29	4	5	0	9
30	9	0	2	7
31	7	0	0	7
32	7	0	1	6
33	6	0	0	6
34	6	4	2	8
35	8	0	0	8
36	8	0	2	6
37	6	0	0	6
38	6	2	1	7
39	7	0	2	5
40	5	0	2	3
41	3	0	1	2
42	2	5	1	6
43	6	0	0	6
44	6	0	0	6
45	6	0	0	6
46	6	0	0	6
47	6	0	0	6
48	6	0	0	6
49	6	2	1	7
50	7	0	0	7
51	7	0	1	6
52	6	0	0	6
53	6	1	2	5
54	5	0	0	5
55	5	0	1	4
56	4	0	0	4
57	4	0	0	4
58	4	0	0	4
59	4	4	1	7
60	7	0	0	7
61	7	0	0	7
62	7	1	1	7
63	7	0	0	7
64	7	0	2	5
65	5	0	2	3
66	3	0	2	1
67	1	5	1	5
68	5	0	1	4
69	4	0	0	4
70	4	0	0	4
71	4	0	2	2
72	2	0	0	2
73	2	0	0	2
74	2	4	1	5
75	5	0	0	5
76	5	0	0	5
77	5	0	0	5
78	5	0	2	3
79	3	3	1	5
80	5	0	2	3
81	3	0	0	3
82	3	5	1	7

Day	Beginning Inventory	Order Received	Demand	Ending Inventory
83	7	0	0	7
84	7	0	0	7
85	7	0	2	5
86	5	0	0	5
87	5	3	1	7
88	7	0	0	7
89	7	0	0	7
90	7	0	1	6
91	6	0	1	5

Day	Beginning Inventory	Order Received	Demand	Ending Inventory
92	5	0	0	5
93	5	2	0	7
94	7	0	2	5
95	5	0	0	5
96	5	0	1	4
97	4	3	2	5
98	5	0	0	5
99	5	0	1	4
100	4	0	1	3

*Order Placed

Case 19: Michigan City Tractor (MCT), Inc.[1]

The use of in-house capabilities to make a product is often desirable when an item is critical to a company's performance, time-sensitive, or prone to frequent design changes. In all of those cases, tight control over production and logistics is essential if the manufacturer must be certain that the product will always be available when and where it is needed and that it meets quality requirements. Alternatively, companies opt to buy a product or a set of manufacturing processes for making a product—in this context, by outsourcing.

The Make Option

Michigan City Tractor (MCT) encountered the problem of defects in its purchased tractor engine block castings. Approximately 100 block castings components per month are required for the 940-tractor engines. The 940 engine components consists of the block engine casting, engine head, manifold, fuel injectors, and other engine components. When defective engine block castings are discovered, the entire engine assembly must be disassembled in order to repair the engine block casting. It takes a machinist approximately 8 hours to disassemble and repair defective engine block casting. Approximately 10 out of every 100 engine blocks were repaired, and 40% of the repaired engine block castings were scrapped. Each engine block casting costs between $3,050 and $3,900, depending on the supplier. There is also a cost of downtime associated with interruptions on the shop floor. The average cost of assembling the components into engine-block casting is approximately $959. The estimated overhead, which was 150% of direct labor ($21.50), consisted of 33% variable and 67% fixed costs; the shop floor disruption cost was estimated to be $769 for each disruption. Nancy Menendez, the operations manager, discussed the engine block casting quality concerns with Ron Bentz, the plant manager.

The Buy Option

The next day, Ron released a request for quote (RFQ) for the 940 engine blocks to a list of prequalified engine block suppliers. However, only one supplier, Ball Manufacturing, Inc., showed an interest in providing a completely assembled 940-engine block. Ball was a small startup company that was looking for work. In order to produce engine blocks, an investment in precision machinery of more than $1,603,000 would need to be made. Ball was willing to both invest in the necessary machinery and guarantee at least 100 engine blocks per month—provided MCT would contract with it as the sole source of MCT blocks for the next 3 years. The price per engine block would be $4,570 the first year, with an annual increase of 3%. MCT anticipated that they would need at least 1,000 finished engine block assemblies per year for the next 5 years.

Assignment Questions

As the operations Manager for MCT, how would you analyze this make-or-buy decision? (Make sure your analysis is complete.)

Write a report to Mr. Bentz with your analysis, recommendations, and implementation plans. The report must be complete and convincing.

Case 20: Microfuse, Inc. (B)[1]

Time: 3:42 p.m.
Date: Wednesday, April 22, 2020
Place: Office of the VP for Manufacturing

"Val, our orientation has always been one in which control is a critical part of maintaining our market leadership position, hence vertical integration. The guiding belief throughout the company is that, by being able to say that we actually make the products, we project a certain level of proficiency and expert knowledge that customers themselves lack and thus look for when choosing a supplier. In addition to using our vertical structure as a marketing tool, we at Microfuse also regard ourselves as the best providers of quality manufacturing because of our long-standing quality and reliability tradition. Such control translates into greater power, especially in terms of profits, yet it comes at a cost. I understand that our inventory levels are too high. High inventory levels are a price we pay for us to add value to our vertically integrated business model. It should be noted that Microfuse operates a very efficient inventory system, but there is always room for improvement in this area. Although, in general, the company is open to outsourcing, our vertically integrated orientation will remain intact until a supplier comes along that can provide equal or better value to our products and the company. So, Valerie, along with Bob James, please develop a business case for a limited outsourcing strategy involving some of our noncore products with this guideline in mind. I would like a report on my desk by Monday, May 4."

As stated, Tom Cecil, VP of Microfuse's manufacturing division, asked Valerie (Val) Simmons, purchasing manager, to investigate the implementation of an outsourcing approach to solve a problem that had rapidly become the center of attention of the company's operating executives. Ms. Simmons would be working with Bob James, the plant superintendent.

The problem is as follows. The current industry trend is to cut costs by outsourcing more than 40% of their manufacturing capabilities. Outsourcing is being done by all of the major competitors. In the past year alone, XFfuse, Micofuse's closest competitor, has reduced their labor force by 50%.

The Microfuse Industry

To truly understand the operational decisions Microfuse makes, it is necessary to be familiar with the industry. Microfuse's primary industry, driven by technology, is the production of circuit protection products. It is a highly competitive industry in which firms from around the world compete, and survival is not just a matter of competing on quality and value-added functions but also on price. This translates into a need to be innovative and competitive at the same time. There is always a threat of becoming viewed as a commodity product; thus, the goal of many companies is to provide unique and valuable products that attract and retain customers. Obsolescence is the norm for the industry.

Company Background

Microfuse is the industry leader, offering the broadest line of circuit protection in the world. They offer seven major circuit protection technologies (more than twice their nearest competitor) that span three industries: electronics, automotive, and electrical (see Table C.1).

TABLE C.1
Competitor Comparison

COMPANY	FUSES	POLYMER PTC'S	MOV'S	GAS TUBES	DIODES	THYRISTORS	POLYMER ESD	TOTAL TECHNOLOGIES
MICROFUSE	X	X	X	X	X	X	X	7
XFFUSE		X		X		X		3
BUSSMAN	X						X	2
RAYCHEM		X				X		2
EPCOS			X	X				2
AVX	X		X					2
ST MICRO					X	X		2
VISHAY					X			1
TECCOR						X		1
WICKMANN	X							1
BEL FUSE	X							1

Microfuse's technology is a critical component in many of the products people use daily, such as cell phones. Nearly 90% of automobiles, industrial machinery, computers, and virtually any other devices using electrical energy include Microfuse's products. The diverse product line is coupled with a worldwide presence. However, because of the characteristics of the industry, Microfuse is facing increased competition and pressures to remain innovative and efficient.

Wednesday, April 29: New Information

During the data collection phase of Val's research, she discovered that Microfuse currently has one site in central China and another facility located in southern China through a recent acquisition. Initially, the Chinese acquisition was driven by the fact that many more customers are setting up in China. For instance, the automotive sector in China alone is expected to increase from 4.4 million automobiles sold this past year to selling 10 million in 2020. Val was wondering how this new information would impact the outsourcing business case. The company was also projecting that almost all European functions may be required to move to lower-cost sites in the near future. More specifically, there appears to be an increased focus

on moving the European Division to Vietnam. Because of the increase in global business, Microfuse expects that, in the future, 70% of production will be done abroad. Domestically, a reduction in operations is forecasted. According to Val's interviews with some of the operating executives, while most of the forecasted shifts in manufacturing are contingent on many factors, there is a strong possibility of realization. However, there is a common belief that the foundry site in Champaign-Urbana, Illinois, will never be completely relocated due to the fact that it is the base for planning and development and is heavily involved in the manufacturing function. The reasoning behind this belief is that the control-orientated mentality of the company would make moving all manufacturing away from headquarters unlikely. However, at the same time, it is not an impossibility.

Assignment Questions

As Valerie Simmons:

Drawing from the case facts and the lessons learned from the strategic outsourcing chapter, critically evaluate the business case *for* or *against* an outsourcing strategy at Microfuse. In a report, addressed to Mr. Cecil, summarize your overall analysis of the case *for* or *against* an outsourcing strategy.

Case 21: Morgan Summerfield (CCS)[1]

Morgan Summerfield was promoted from associate buyer to chemical buyer for Circle City Systems (CCS). She is solely responsible for purchasing all of the chemicals throughout the company. After earning an associate's degree in business management with an emphasis in purchasing from Houston Community College, Morgan went on to gain more than 5 years of industrial purchasing experience at H-Town Specialty Chemicals.

On Monday, June 20, Morgan received a call from SanChem, one of CCS's preferred chemical suppliers. Bob Talley, the SanChem sales manager, was disappointed with last week's bid letting. Hoosier Pride was low bidder for the fifth year on a specifically formulated chemical for CCS. Last month Morgan requested bids for the annual requirements of 7,000 55-gallon drums of the Mixture-A chemical. According to Bob, the setup costs associated with the manufacturing process for Mixture-A falls within the range of $800,000 to $1.1 million. He asked Morgan how it was possible for Hoosier Pride's estimates to be $3 to $5 lower than the next bid over the past 5 years. As a result of her conversation with Bob, Morgan decided to request setup costs from all the bidders. All of the bidders except Hoosier Pride listed setup costs between $700,000 and $1.2 million. Hoosier Pride's setup cost was around $200,000. The bid estimate and the setup costs for the 2020 Mixture-A are given in Table C.1.

After reviewing the total estimate and the setup cost range between the lowest and highest bidder, she decided to research the 5-year bid history for Mixture-A. Each year Hoosier Pride was the successful bidder with prices $3 to $15 lower than the unsuccessful bidders. Morgan lost confidence in Hoosier Pride's pricing strategy. She decided to perform an in-depth analysis before awarding the 2020 Mixture-A contract.

Assignment Questions

1. Under what conditions does competitive bidding result in the selection of the best supplier?
2. As Morgan, write a two-page memo to the VP of purchasing justifying your analysis and recommendations for the 2020 Mixture-A award.

TABLE C.1
Comparison of Setup Costs

Supplier	Price per/55 Gal. Drum	Total Setup Costs	Total Estimate for 7,000 Annual Requirements (F.O.B.)
Hoosier Pride	$364.28	$202,005	$2,550,000
SanChem	$367.14	$753,000	$2,570,000
Wabash Chemicals, Inc.	$368.67	$802,908	$2,580,690
Talbert Products	$371.42	$910,000	$2,600,000
Nashville Specialty Chemicals	$377.14	$950,000	$2,640,000

Case 22: Natural Construction[1]

Your company, Natural Construction, has decided that it needs to expand in order to compete in the new heavy highway construction market. After carefully examining several alternatives, you decide that the best course of action was to acquire a new CAT 140-M Motor Grader. The Motor Grader, which has an expected useful life of five years, costs $200,000. The Huntington Bank is willing to loan you the $200, 000 at 7% interest and requires a down payment of $40, 000 and annual which are due at the end of each of the next five years. Since you do not have the proper facilities, the bank would also require you to sign a maintenance contract with Columbia sales. The contract, would good for five years of maintenance, would require annual $8, 000 payments at the end of each year.

Following your negotiations with the Huntington bank, Columbia Heavy Highway Equipment, Inc. offered you a counter proposal for the same 140-M Motor Grader. Columbia is willing to lease you the Motor Grader for three years. Since your cash situation is very tight, Columbia structured the lease with the $58, 718 payment due at the end of each year. In addition, Columbia has agreed to:

- Perform all maintenance during the lease period
- Give you the right to buy the Motor Grader at the end of three years for the prevailing market price (estimated to be $80,000)
- Allow you to buy a maintenance contract for the remaining two years on the Motor Grader for $6,000 annually, payable at the end of years four and five.

Given that you expect to need the Motor Grader for its entire 5 year life, decide whether to lease or borrow and purchase. Your analysis should be through and convincing. Consider the following alternatives in your case analysis.

1. Discount rates of 7% and 10%
2. Tax rates of 35% and 45%

Case 23: Pendleton Construction, Inc.[1]

Henry Royce, purchasing agent for Pendleton Construction, Inc., is currently in the process of selecting a steel supplier/fabricator for a major highway project.

Company Background

Pendleton Construction, located in Bloomington, Indiana, is one of the largest heavy-highway construction firms in the Midwest. Additionally, the company builds bridges, high-rise office towers, power plants, government buildings, and roads. Pendleton has a reputation for high-quality standards, on-time project completion, and reasonable prices. The company has expanded rapidly during the past 20 years, keeping pace with the heavy-highway sector.

Reinforced steel is used in almost all of Pendleton's projects. The steel itself is purchased from one of several large steel mills in the region. During the past 18 months, the fabrication (bending) required in preparation for steel placement had been done by Mohawk, a small local disadvantaged business enterprise (DBE) specialty steel fabricator. Pendleton's total steel-bending requirement for the most recent fiscal year was approximately 5,000 tons. Mohawk had charged identical prices per ton for both small and large steel fabrication jobs. Prior to bidding on a project, Royce requested a telephone quotation from Mohawk, and, invariably, the price per ton quoted was the same as the previous bid. Mohawk is also a supplier of specialty steel. Royce has an exclusive agreement with Mohawk to supply specialty steel items on short notice. This arrangement has worked very well for Pendleton. Mohawk also owns a major share in a detailing firm that did approximately 70% of the reinforced detailing work for Pendleton. According to Royce, Mohawk has done an excellent job supplying high-quality specialty steel to Pendleton. At the same time, he stated that Mohawk's fabrication work was pretty good. Pendleton is also required to have DBE participation on all federal projects.

Recently, Pendleton was awarded the I-69 finish line project in southern Indiana that will require more than 4956 tons of reinforced steel for 3 consecutive years. Because of the size of the project, Royce decided to solicit quotes from other sources for the fabrication work. However, Pendleton's successful bid included Mohawk's fabrication estimates. Royce received three quotes for the fabrication work item. All three estimates were lower than Mohawk's bid quote. The quotes were $7, $8, and $9.50 per ton lower than the Mohawk estimate. The supplier with the best estimate, $9.50 lower than Mohawk's estimate, had recently filed for bankruptcy. However, the remaining two suppliers checked out as being well run and financially healthy. Baker Steel quoted a price that was $8 lower per ton F.O.B. the jobsite. Baker is a major steel fabricator located in Cleveland, Ohio, which is approximately 350 miles from the project site. The quote was made on the condition that all transport shipments be full loads, with no emergency short shipment transport charges. Royce had carefully checked out Baker's business capability and reputation and found that it had performed quite well throughout the Midwest.

Royce's Selection

Royce felt that he needed to make a rational decision. He now wondered if he should place the steel-bending contract with Baker or whether he should stay with the Mohawk bid. What are the implications of his decision?

Write a two-page memo discussing your analysis and recommendations. Be sure to discuss the risk associated with accepting the project. Your analysis should be thorough and convincing.

Case 24: Philadelphia Aircraft Equipment, Inc.[1]

In January 2020, Emily Wang, the purchasing manager for Philadelphia Aircraft Equipment (PAE), Inc., received a call from their Tier 1 power generator supplier in New Jersey informing her that effective June 30, 2020 they would discontinue production of the Series 10 power generator. The Series 10 generator is currently used as the auxiliary power source in 90% of PAE's products. Emily was in shock! After recovering from the initial trauma, Emily began calling all possible supply sources. After talking with more than 10 potential supply sources, she found Texas Generators, Inc., located in Mansfield, Texas. Texas Generators submitted the following price scheduling:

Units Unit Price

$$Q \leq 100 \ldots\ldots\ldots \$\ 480$$
$$100 > Q \leq 200 \ldots\ldots\ldots \$470$$
$$Q > 200 \ldots\ldots\ldots\ldots \$455$$

Texas Generators' prices are significantly higher than the New Jersey supplier. The traffic department informed Emily that the transportation cost per hundredweight is $6 for carloads of 50,000 pounds. The less-than-carload rate is $9 per hundredweight. The replenishment cycle normally takes one week.

Background

Emily was concerned because PAE used 10 Series 10 generators each working day of the month. (PAE operated on a 20-day-per-month schedule.) Each generator weighs 500 pounds. Generator orders are currently placed every Monday morning. For the past 10 years, the Series 10 generator had been produced in New Jersey. Ms. Wang felt fortunate that the New Jersey producer was located approximately 60 miles from her facility. The New Jersey supplier offered just-in-time delivery service at no charge to PAE.

PAE implemented lean manufacturing in 2015. The kanban-controlled JIT production system was implemented based on the premise of minimizing work-in-process inventories (waste) by reducing lot sizes to increase production efficiency and product quality.

Emily's Decision

Ms. Wang compiled cost and warehouse capacity data on the Series 10 generator from the accounting department (see Table C.1). She wonders what effects these new developments will have on her cost structure.

Assignment Questions

1. What were PAE's total costs per year prior to the new price structure when the Series 10 generator's price was $410? Was PAE using the EOQ method?
2. With all-units quantity discounts and warehouse constraints, what is the best ordering quantity?

[1] Names and data have been disguised.

TABLE C.1
Cost and Warehouse Capacity

Cost of unloading engines into warehouse	$0.35 (per 100/wt.)
Order processing cost per requisition	$120
Warehouse capacity	150 units
Outside warehouse costs	$49 per year per unit*
Expediting cost per requisition	$30
Inventory carrying cost	30%

*There is existing space in the warehouse for 200 units. Additional space must be leased for a year. If an order is more than 150 units, part of the order must be stored in leased space.

3. With purchase discounts and different rates, how are costs and EOQs affected?
4. How will these changes impact the lean manufacturing philosophy at PAE?
5. Determine the cost impact of using the Texas supplier. How will the change in supplier for the Series 10 generator affect PAE's sales? Your analysis must be thorough and convincing.

Case 25: Precision Manufacturing Systems, Inc.[1]

Recently, Horace Canti, the production control manager at Precision Manufacturing Systems, Inc., read an article on time-phased requirements planning. He was curious about how this technique might work in scheduling Precision Manufacturing Systems' engine assembly operations and decided to prepare an example to illustrate the use of time-phased requirements planning.

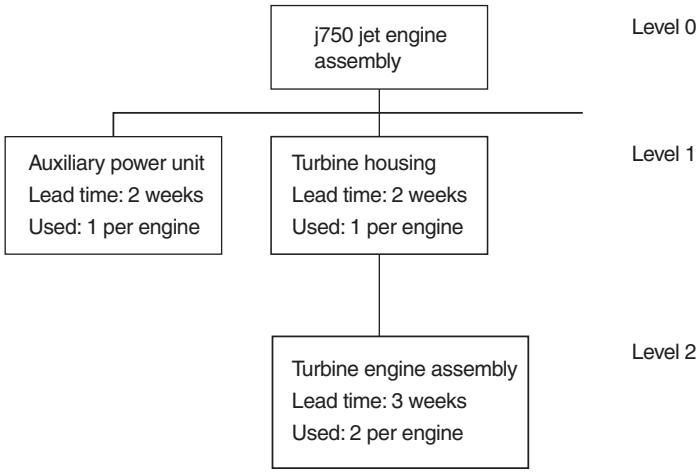
Horace's first step was to prepare a master schedule for one of the engine types produced by Precision Manufacturing Systems—the J750 jet engine. This schedule indicates the number of J750 jet engine units to be assembled each week during the next 12 weeks, shown in Figure C.1. Next, Horace decided to simplify his requirements planning example by considering only two of the many components needed to complete the assembly of the J750 jet engine. These two components, the turbine housing and the 562 turbine assemblies, are shown in the product structure diagram in Figure C.2. Horace noted that the turbine housing is assembled in the turbine shop and is subsequently sent to the main jet engine assembly line. The turbine assembly is one of several component parts manufactured by Precision Manufacturing Systems needed to produce a turbine housing subassembly. Thus, Levels 0, 1, and 2 are included in Figure C.2 to indicate the three manufacturing stages involved in producing a J750 jet engine: the jet engine assembly department, the turbine shop, and the machine shop.

The manufacturing lead times required to produce the turbine housing and the turbine assembly components are also indicated in Figure C.2. Note that 2 weeks are required to

FIGURE C.1
J750 Jet Engine Master Schedule

Weeks	1	2	3	4	5	6	7	8	9	10	11	12
Quantity	75	25	35	50	0	45	100	50	0	40	10	80

FIGURE C.2
J750 Jet Engine Product Structure



[1] Copyright 2020 W. C. Benton Jr. All rights reserved.

produce a batch of turbine housings and that all of the turbine housings must be delivered to the turbine assembly line parts stockroom before Monday morning of the week in which they are to be used. Likewise, it takes 3 weeks to produce a lot of turbine assemblies, and all of the assemblies needed for the production of turbine housings in a given week must be delivered to the subassembly department stockroom before Monday morning of that week.

In preparing the MRP example, Horace planned to use the attached worksheets and to make the following assumptions:

1. Eighty-five turbine housings are on hand at the beginning of Week 1 and 25 turbine housings are currently on order to be delivered at the start of Week 2.
2. Two hundred turbine assemblies are on hand at the start of Week 1 and 120 are scheduled for delivery at the beginning of Week 2.

Assignment Questions

1. Prepare the MRP example for Horace. If the ordering costs are negligible for the two product components, determine the sequence of planned orders for the turbine housing and the turbine assembly components over the next 12 weeks.
2. Horace would like to include the ordering and inventory carrying costs for the turbine housings and the turbine assemblies in this example and has supplied the following data:

	Turbine Housing	Turbine Assembly
Ordering cost	$650.00	$700.00
Inventory carry cost (per unit per week)	$7.00	$5.00
Average weekly demand	50	100

Using the economic order quantity (EOQ) and period order quantity (POQ) procedures, determine the planned orders for the turbine housing and turbine assembly components. Assume orders are received into beginning inventory. Indicate advantages and disadvantages of using each of the suggested procedures.

MATERIAL REQUIREMENTS PLANNING WORKSHEET

J750 Jet Engine Assembly Master Schedule

Week	1	2	3	4	5	6	7	8	9	10	11	12
Quantity												

TURBINE HOUSING REQUIREMENTS

Week	1	2	3	4	5	6	7	8	9	10	11	12
Gross requirements												
On-hand inventory*												
Scheduled receipts**												
Net requirements												
Planned order release												

*Measured at the end of each week.
**Received at the beginning of each week.

TURBINE ASSEMBLY REQUIREMENTS

Week	1	2	3	4	5	6	7	8	9	10	11	12
Gross requirements												
On-hand inventory*												
Scheduled receipts**												
Net requirements												
Planned order release												

*Measured at the end of each week.
**Received at the beginning of each week.

Case 26: Sage Imaging Center, Inc.[1]

The Sage Imaging Center is a multihospital system located in Columbus, Ohio. Over the past 10 years, Sage has grown from 2 radiologists to 15. There are currently five MRI machines and three CT scanning machines onsite. Today, Sage specializes in imaging services, which include MRI and CT scans. In 2019, Sage performed an average of 20 images per machine per day. Seventy-five percent of the images were from referrals from physician offices. Another 20% of the image work was outsourced from the Ohio State University, Wexner Medical Center. The remaining 5% were walk-in patients who practiced nontraditional health care. Sage bills approximately $1,450 per image. The fee for service includes diagnosis and the required report by the radiologists. The Sage CEO has projected a 25% increase in imaging based on the health care reform. The board of directors recently approved the acquisition of another MRI machine.

Sage Imaging has two choices: (1) buy a refurbished MRI machine or (2) lease a new MRI machine for 3 years. The MRI machine has a useful life of 5 years and costs $350,000. Franklin County Bank is willing to loan Sage Imaging $315,000 at 5% interest and requires a down payment of $35,000 and annual payments due at the end of each of the next 5 years. Since Sage Imaging does not have the proper maintenance capabilities, the bank will require them to sign a maintenance contract with Wade International. The contract, good for 5 years of maintenance, requires annual payments of $7,000. Wade International made Sage Imaging a proposal that competes with the bank's offer. Wade International is willing to lease Sage Imaging the same MRI machine for 5 years. Since Sage Imaging's cash situation is tight, Wade International has structured the lease with the $80,841 payment due at the end of each year. In addition, Wade International is agreeing to

- perform all the maintenance during the lease period,
- give Sage Imaging the right to purchase the MRI machine at the end of 5 years for the prevailing market price (estimated to be $80,000), and
- allow the organization to buy a maintenance contract for 2 years on the MRI machine for $7,000 annually, paid at the end of Years 4 and 5.

Case 27: Simpson Hospital Systems[1]

Simpson Hospital Systems is a manufacturer of emergency power supply systems for hospitals. Simpson's sales exceed $2 billion per year. They have a commanding market share of more than 60% of the U.S. hospital market. Many buildings and facilities experience power interruptions caused by utility outages, equipment failures, testing, and maintenance. Most of the time the power outages are easily resolved. However, power outages due to natural disasters and unexpected events are much more difficult to manage, and in some cases, the entire facility has to rely solely on the emergency and standby power systems to continue operating for several days.

Unlike most standard commercial buildings, delivering emergency and standby power to a health care facility is a major undertaking due to its complexity and size. It involves many different systems consisting of alternate sources of power, switching equipment, controls, and distribution equipment. Hospitals must be available for service at all times; their failure could cause major injury or death to patients, staff, or visitors. Simpson is the world's leading supplier of alternative power systems for hospitals. The transformers for the emergency power systems are purchased from a Chinese manufacturer. The TRT-6 transformer is the primary component for the systems that support hospitals with more than 500 beds. The TRT-6 transformer is also considered to be the most reliable transformer in the emergency power industry. TRT-6 transformers are used in 80% of Simpson's emergency power supply systems.

Specification and Supplier Selection

Product specifications are defined based on the hospital's needs and requirements. The design information includes reliability, load rating, physical size, and transformer life expectancy. The transformer must be specified to supply uninterrupted power for a 500- to 800-bed hospital. Furthermore, the integrated switching system must be automated and seamless. The service quality of Simpson's transformer is critical in the supplier selection decision. The TRT-6 transformer supplier must be reliable and carefully selected. DC-Wang is the current supplier. Simpson selects its transformer supplier through the competitive-bidding pricing process. After the best suppliers are identified, a formal negotiation is conducted with at least two suppliers. The DC-Wang contract terms are given in the next section.

Contract Terms and Type

The current 5-year contract agreement with DC-Wang has been in effect since January 2019. Upon the expiration of the initial term, the agreement will renew for successive 1-year periods. However, after the expiration of the initial term, either party can terminate with 60 days' written notice.

The key terms of the current contract with DC-Wang are these:

1. *Product changes.* Once DC-Wang was selected, and the agreement date is in effect, the transformer specifications cannot change unless Simpson gives approval.
2. *Pricing.* Product prices are fixed for the term of the agreement. A 60-day notice must be given before a price change can occur.

[1] Names and data have been disguised

3. *Delivery.* On-time delivery is defined as a shipment received by Simpson 7 days after the order is placed. DC-Wang is required to pay for late charges and the cost of expediting.
4. *Delivery performance measures.* DC-Wang is expected to achieve a 99.99% service rate.
5. *Quality standards and goals.* Quality measures are expressed as nonconforming PPM.
6. *Indemnification.* DC-Wang shall indemnify Simpson against any and all losses, damages, liabilities, costs, and expenses.
7. *Insurance.* DC-Wang shall at its sole cost and expense maintain for the term of this agreement and for the period of any obligation general liability insurance. General liability insurance shall cover bodily injury, property damage, and personal injury in the amount of $1,000,000.
8. *Acceptance.* The current 5-year agreement with DC-Wang has been accepted and signed by the authorized representatives of each party.

Simpson's current transformer buying process is efficient. Maintaining good supplier relationships with its suppliers is critical to Simpson's success. Quality, price, delivery, flexibility, and service are considered in making sourcing and purchasing decisions. Simpson remains competitive in the increasingly global and competitive markets.

Recent Developments

Simpson's vice president of operations is concerned about the low TRT-6 transformer inventory. There is currently a 20-day supply of transformers. A 90-day supply is the normal inventory level. Simpson has not received a transformer shipment in 2 months. Last week when Simpson discussed the problem with DC-Wang, it was told that the contract price would increase by 300% and that the current contract with Simpson is invalid because of the new Coronavirus Pandemic.

Simpson also found out in its conversation with DC-Wang that the transformer industry has been experiencing significant shortages. The demand has been larger than expected based on the increased demand from Tan Woo, a Chinese emergency health care systems company. Tan Woo has recently been specifying the TRT-6 transformer for its new Super-2 emergency power system. According to the DC-Wang salesperson, in the future DC-Wang would be required to allocate more of its capacity to support the health care industry in China.

Case 28: Tom & Jerry (T&J) Construction, Inc.[1]

Tom & Jerry (T&J) Construction finished its fifth year in business and has completed nearly 48 jobs. The company specializes in excavating, concrete, and trucking. It is certified as a disadvantaged business enterprise (DBE) by the Indiana Department of Transportation (INDOT). However, T&J has worked primarily in the private sector. The company has done some trucking jobs for the INDOT market, but it's very seldom that T&J works as a contractor on INDOT projects. The company currently has 12 full-time employees including the owner: six employees in the field and five in the home office. There are also two estimators who work as independent contractors and get paid a flat 5% commission on all sales that meet a minimum 8% net profit. As independent contractors, they don't receive company benefits. Subcontractors are used for at least 30% of all projects.

Last year, the company did $2,124,945 in sales. Next year, T&J is projecting a 15% increase in that number. Last year, T&J estimated a 10% net profit but actually made only 2.5%. The goal for next year is to meet that 8% profit.

The good news is that Tom is in excellent health, and he is now the sole owner of the business. Of course, this came about because of the unfortunate death of Jerry last month from the Coronavirus. Tom & Jerry Construction is known throughout Indianapolis for quality work at competitive prices. Tom stated that he does not believe in recessions and had never participated in one. Tom and his late partner made the business what it is, and it's considered a model construction company. The additional case facts follow:

- Tom is married with five kids and is expecting twins! Last night, Tom's wife told him that she's signed them up for marriage counseling. She thinks there should be something more to life than having and raising children. The two youngest children got bad grades on their most recent report cards, and the 15-year-old son received a 3-day suspension from school for acting like a bully. Tom's wife thinks that he needs to spend more time at home with the children and less time working.
- T&J's best-working foreman, Sam Jones, who has been with the company since day 1, came into Tom's office yesterday morning requesting a 10% raise. His current salary is $80,000. He says if he doesn't get the 10% raise, he's moving on. One of the female employees that works for him is considering filing a sexual harassment suit against the foreman and the company. In the middle of his conversation with Sam, the phone rang and Tom promised to get back with Sam next week.
- The phone call was from a Huntington Bank loan officer. Just a friendly reminder that the payment on the 2020 Mercedes is 2 months late!
- Last Thursday Tom was notified that the building that houses his office has been sold. The company must be out in 45 days. T&J has been paying $2,000 a month rent, and Tom knows that the rent anywhere else will be more than 26% higher. Tom estimated that it will cost him approximately $7,500 to move the business to a comparable location.
- Jerry left behind several hundred thousand dollars of personal bills, and the only asset his estate shows is a 49% ownership in Tom & Jerry Construction. Fortunately, Tom

[1] Names and data have been disguised

and Jerry had a buyout agreement that guaranteed the surviving partner could buy out the other partner's stock in the company for $1. Tom executed the contract clause on the day before Jerry's wake. At the time of Jerry's passing, Tom and Jerry were each paid an equal salary.

- The attorney for Jerry's estate called to say that it would not be wise to use money from Tom & Jerry Construction, Inc., to pay any more company bills until he has had a chance to audit the corporate books. He did not explain why; he just mumbled something about an illegal agreement and the IRS. He stated that he could work the audit into his schedule sometime in the next 3 to 4 weeks.
- The company had key person insurance, but Tom did not know whether the bookkeeper paid the premiums when they were due last year. Furthermore, Tom cannot find the file for the insurance policies. Jim Sousa, the bookkeeper, is on vacation in Jamaica and cannot be reached. He has been gone for 5 weeks and will not return for another 2 weeks. Tom wondered how he can afford such a trip on what he earns as a full-time bookkeeper.
- A local truck dealership called yesterday morning to tell Tom that he just got a 2-year-old tri-axle dump truck with only 10,342 miles on it. He only wants $85,000 for it, and the company desperately needs another dump truck. Tom didn't plan for a new dump truck in the current budget. The loan officer says he can make a loan to Tom for a payment of $1,586 per month for 5 years, with a 10% down payment. The truck dealer also offered to arrange a 3-year lease for about $1,723 per month, and it would have a $43,000 buyout after 3 years.
- The company was recently hit with two lawsuits for separate auto accidents. Both of the company drivers were cited. Tom's attorney says both accidents will cost a minimum of $10,000 in legal fees, which she wants upfront. Both lawsuits are frivolous, so says T&J's attorney, and Tom is advised not to worry about them—yet!
- The insurance agent that handles the company's workers' compensation insurance just called. He said T&J's rates will be 80% higher next year. Tom had a brief discussion about why that would be; since T&J has a relatively good safety record, the agent said he would look into it. He told Tom not to worry. However, he was going on his 3-week vacation Wednesday. The new premiums are due next week.
- The company's top estimator, Bob, has been having some personal problems lately. Tom noticed that Jerry approved a couple of draws against future sales, and Bob's account is now $19,500 in the red. He has not estimated a job for almost 4 weeks and has not been the successful bidder in over 3 months. Tom has been looking for Bob's contract with the company but cannot find it. The bookkeeper is in Jamaica!
- The company picnic is scheduled for 2 weeks from Saturday, and the event will cost at least $4,500.
- The company has three jobs in progress, with a total volume of $720,934 when completed.
- Tom has decided that since he has the full burden of running the company, he will give himself a raise, his regular owner's salary plus one quarter of Tom's salary, starting immediately.

Table C.1 shows the overhead costs for the company as of December 31, 2019, as best as Tom can determine without the assistance of the bookkeeper.

TABLE C.1
Overhead Review: Tom & Jerry Construction, Inc.

Overhead		Expense ($)
1.	Advertising	$52,899
2.	Sales and estimating	$225,146
3.	Office expenses	
	Office staff	$255,544
	Rent	$7,200
	Office equipment	$22,645
	Computer and peripherals	$25,290
	Telephone	$1,829
	Office supplies	$1,423
4.	Job Expenses	
	Construction equipment (trucks/excavator used 100 hours per year)	$429,772
	Job supervision	$228,696
	Tools and equipment	$32,192
	Customer service	$9,257
	Cell phone	$6,116
5.	General expenses	
	Owner's salary (as partner)	$105,798
	General insurance	$18,515
	Interest expense	$7,290
	Bad debts	$18,000
	Contractor's association	$26,500
	Licenses and fees	$7,290
	Accounting fees	$5,819
	Legal fees	$16,232
	Education/training	$4,761
	Entertainment	$13,645

Case 29: Worldwide Auto Manufacturers, Inc.[1]

In 2019, Worldwide Auto Manufacturers, Inc., relocated to the United States from Seoul, South Korea. Located in Columbia, South Carolina, Worldwide supplies headlights, taillights, lid lamps, center high mounts, and front-turn assemblies to GM, Honda, Ford, and Toyota. These four companies account for 78% of Worldwide's annual capacity. In addition, service (aftermarket) products are made for foreign and domestic demands. Specifically, weekly shipments are made to Canada, Japan, and Mexico.

Operations at Worldwide Auto Manufacturers

Worldwide has five distinct operations centers. The East plant manufactures light assemblies. Manufacturing I produces headlights and front-turn assemblies. Manufacturing II assembles taillights, lid lamps, center high mounts, and aftermarket products. The West plant provides components to assembly and external sales. Manufacturing III is a sanitization and coating process for lenses, reflectors, and extensions. Manufacturing IV is a die injection molding facility producing reflectors, lenses, and housings. Finally, a halogen bulb department provides the majority of the bulbs used in production.

Assembly in the East Plant

Approximately 40 lines supply different makes, models, and types of lighting products. Dedicated lines run multiple shifts to meet OEM production for current-year Honda and Toyota vehicles. OEM production for the Honda Odyssey minivan runs on one-shift dedicated lines. OEM requirements may exceed 1,200 units daily. Fourteen lines run to meet aftermarket demand. These lines are interchangeable among different GM models. Aftermarket assemblies are made 10–20 years after OEM production. Service requirements range from 30 to 10,000 units per month.

West Plant Operations

Manufacturing III is an isolated sanitization area for coating processes. Products are cleaned, prepared, and either aluminized or hard-coated. Aluminization provides a reflective coating to components such as reflectors and extensions. This process allows a plastic-molded part to reflect the light at the designed angles. Lenses are hard-coated to protect against chips and cracks.

Manufacturing IV, the focus of the upcoming outsourcing decision, molds parts for finished assembly and sales. Lenses, reflectors, and housings are molded from resins and fiberglass-reinforced plastics. Die injection molding machines range from 60 to 900 tons of pressure. These machines are adaptable to produce multiple parts by interchanging the die molds. Worldwide Auto Manufacturers has recently acquired the two largest molding machines in the world. The productivity of these machines will aid in the upcoming decision regarding further expansion. Worldwide is reducing inventory in the West plant Material Order Center (WESTMOC) to possibly expand operations by three machines.

Worldwide manufactures halogen bulbs for in-house production and external sales. The halogen bulb department (HB) is capable of producing 60,000 bulbs per week. HB runs a continuous three-shift operation until weekly production quotas are met.

Purchasing at Worldwide

Purchasing for Worldwide is decentralized. The purchasing department at Worldwide U.S. consists of nine full-time associates. The purchasing manager assists in decision-making and controls administrative duties. Six buyers are responsible for obtaining materials to meet production requirements. One buyer supplies the HB department, and one is solely responsible for MRO purchases. The other four buyers are responsible for specific suppliers. Each buyer oversees all products purchased from 8 to 10 different suppliers. The two other purchasing associates are specifically assigned to supplier evaluation and incoming quality conformance.

Current Situation at Worldwide

Last month Worldwide was awarded OEM production for the lighting on the 2018 models. Two days ago Worldwide was awarded a contract by Ford to supply deck housings for the 2020 Ford F-150 trucks. The VP of operations is currently focusing on the procedures and decisions involved in supplying the deck housings for the upcoming production of the F-150. Specifically, the executive team lead by the VP of operations is studying the business case for outsourcing the F-150 deck housing production.

Housing Definition and Supply

Housings are fabricated through die injection molding. A resin is melted, injected, and stamped into the die mold. The housing's function is to attach to the body of the vehicle, protect internal components (e.g., cords, bulbs), and hold components in place so that the light functions as designed. The F-150 has unique housing specifications with regards to size, durability, holes, and necessary attachments to perform these duties.

As stated earlier, Worldwide has the ability to produce housings in the molding division; however, of the approximately 240 parts presently molded in Manufacturing IV, only 11 are housings. Worldwide also outsources production of housings to four central South Carolina molding firms: FPE, the South Carolina Plastics Company (SCPC), Central South Carolina Plastics (CSCP), and Charleston Custom Plastics (CCP).

New Product Development: Defining Requirements

The customer, internal departments, and potential suppliers contribute to designing quality into molded parts. Due to strict quality requirements and just-in-time inventory systems, nonconformance results in high costs, hinders customer relations, and endangers prospective contracts. Departments included in the product definition and development stages include product design, purchasing, quality assurance, sales, die molding engineering, manufacturing, plant management, quality control, production control, and materials management.

The first stage in new housing development is gathering model information from the customer via the sales department. Based on this information, the first drawings of the housing are completed and evaluated. Worldwide considers the application of new technology, alternate manufacturing processes, and new inputs to production for all new model components. Project leaders and project members, representing the aforementioned departments, are selected for the development team.

Quality assurance reviews the initial drawings. The review encompasses simplifying fabrication by eliminating components and processes and searching for alternative methods of tooling and production. The design review is then sent to manufacturing departments, die mold, purchasing, quality assurance, and quality control. A follow-up meeting is conducted involving representatives from all departments. Development conferences with manufacturing personnel are held to inform team members of schedule updates, quality targets, costs, and responsibilities. The periodic meetings are held as needed to ensure that members are aware of revisions to plans. A constant flow of information is emphasized to continuously improve processes.

After product development is completed, Worldwide defines the specifications for the fixture (die mold) measurements. The fixture is designed for accuracy, ease of use, and cost efficiency. A rough sketch of the fixture and the required materials is drawn. Purchasing and engineering personnel from Worldwide must approve the concept. Upon approval, the fixture manufacturer submits a design drawing to quality assurance. Worldwide purchases and retains ownership of the die mold fixture regardless of the outcome of the make-versus-buy decision.

The initial trial run of the product, always performed in-house, is done to verify that the fixture is capable of meeting drawing specifications and minimizing the rejection rate. Statistical process control charts are kept for resin input and output quality. If the process is deemed out of control, a modification schedule for a new trial run is scheduled. An evaluation meeting is held to inform all departments about potential problems. Cause-and-effect judgments are made and reconciled via modification request sheets. Target finish dates also are established at this meeting.

The Make-Versus-Outsourcing Decision

As can be seen, new-product development is an involved process. Recently, more and more of Worldwide's production has been outsourced. Using the assumptions given next, please analyze the make-or-buy decision. Please write a detailed report recommending either the make or buy decision.

Assumptions

1. Manufacturing information is shown in Table C.1. Internal production costs were obtained from manufacturing and cost accounting; information on the cost to buy was gathered from journals, historical pricing, supplier information, and engineering estimates.
    - OEM demand is estimated at 250,000 units per year over the next 3 years (1,000 units/day, 250 working days/year).
    - The resin usage is 454 grams (1 pound).
    - Variables include cycle time, labor costs, overhead costs, material costs, transportation costs, and profit margins.
    - Difference in quality levels of in-house and procured parts is negligible.
    - Annual order processing cost is $5,200.

TABLE C.1
Manufacturing Data

Output	Demand/year	250,000 units/year
Resin	Resin/unit Cost/unit	454g $1.73
Molding machine	Purchase cost Capital allocation period	$360,000 3 years
Labor	Employees/molding housing Output/employee/8 hr. day Wages/hour Work hours/year	5 200 units/day $23.40/hour 2,000 hours
Plant capacity	Square footage of West plant Space required for new machine and operating space	100,000 sq. ft. 1,000 sq. ft.
Overhead rate	Allocation basis Direct labor rate	150% of direct labor costs $23.40

TABLE C.2
Outsourcing Data

Housing	Units purchased/year Cost/unit	250,000 $4.17
Purchasing criteria	Cost per order Order size Number of order releases per year	$52.00 2,500 100

2. What are the costs to society when well-established firms like Worldwide outsource when they clearly have the capability to produce the good or service?
3. How should the outsource provider be selected if the outsource option is chosen? Please give a step-by-step approach to the selection and evaluation process (see Table C.2).

Glossary

80/20 single sourcing approach Supplier A and Supplier B supply 80% and 20% of the requirements, respectively.

acceptance A draft on which the debtor indicates by the word *accepted* his or her intention to pay or honor.

account number Number assigned to a specific type of service or commodity. It coincides with category code.

acknowledgment A standard form used by a vendor or supplier to advise that the purchase order has been received.

actual weight Gross shipping or transport weight.

addendum A document used to modify bid documents prior to receipt of bids. An addendum is incorporated into the formal contract.

ad valorem The total value of goods or materials against which tariff rates are imposed.

advice of shipment A notice sent to the purchaser from the seller advising that the shipment has gone forward; usually contains details of packing, routing, delivery date, and so on.

agency Implies a relationship between two parties in which one is empowered to perform certain functions or business transactions for the other.

agent An agent is authorized by the principal to act in the principal's behalf and interest. An agent's actions generally bind the principal as if the principal had acted directly.

agreement A consensus by two or more parties. The term is synonymous with contract. An example of this is the agreement between owner and contractor.

air freight To transport or ship goods by air.

airbill A shipping or manifest document used by airlines for air freight; contains shipping instructions to the airline.

airway bill Document used for shipment and transport of air freight by air carriers; lists the materials shipped along with instructions, costs, and other specific details.

amendment A revision or change made to a document.

approve To accept and endorse as satisfactory; implies that the object approved has the endorsement of the approving agency or body. However, the approval may still require confirmation by another party.

arbitration The process by which parties agree to submit their disputes and claims to the determination and resolution of a third impartial and unbiased party (referred to as the arbitrator), rather than pursuing their claims in a court of law.

as is Indicates that the materials and equipment offered for sale are without warranty or guarantee. The purchaser has no recourse on the vendor or supplier for the quality of the materials and equipment.

assignment The transfer of rights or title to another party, frequently involving rights originating from a contract.

back order The part of an order that cannot be delivered at the scheduled date but will be delivered at a later date.

banker's acceptance draft A document or draft used in financing a foreign transaction, making possible the payment of cash to an exporter, covering all or partial payment for a shipment made by the exporter.

bargain Agreement on the terms and conditions of a purchase. Purchase of articles at a price favorable to the buyer.

barter The process of exchanging one kind of article for another, as opposed to trading by use of money.

bid A complete and properly executed proposal to perform work or supply goods or services that have been described verbally or in the bidding documents and submitted in accordance with instructions to bidders. A bid is an offer.

bid bond A form of bid security purchased by a bidder; provided, subject to forfeit, to guarantee that the bidder will enter into a contract with the owner for construction of the facility within a specified time period.

bid opening A formal meeting held at a specified place and time at which sealed bids are opened, tabulated, read aloud, and made available for public inspection.

bidding documents Documents that typically include the advertisement or invitation to bidders, instructions to bidders, bid form, form of contract, forms of bonds, conditions of contract, specifications, drawings, and any other information necessary to completely describe the work for which bidders can prepare bids for the owner's consideration.

bill An invoice the freight carrier uses to show consignee, consignor, shipment description, weight, freight charges, and other relevant information.

bill of exchange A formal written document used to settle and pay for an existing obligation.

bill of lading A transport company's contract and receipt for materials and equipment; agreement to transport from one location to another and to deliver to a designated individual or party.

bill of materials A list of all permanent materials required for a product on a construction project. The bill of materials list consists of all items described on a drawing and specification.

binder A temporary but binding commitment by an insurance company to provide insurance coverage.

blanket order Provides for the vendor or supplier to furnish certain materials for a certain period of time and at a predetermined price; acts as a master purchase order, reducing the number of smaller purchase orders.

boiler plate A term used to describe the terms and conditions on the back of a purchase order or the specific clauses described in a contract.

bonds Formal documents given by an insurance company in the name of a principal to an obligee to guarantee a specific obligation. In the construction industry the main types of bonds are the bid bond, performance bond, and payment bond.

breach of contract The failure to perform any of the obligations stated within the terms and conditions of the contract.

breakeven The point in time when total income from all jobs sold, built, and collected equals the total expenses.

budget year The company's fiscal year.

bulk materials Materials bought in lots; purchased from a generic description or standard catalog description and bought in medium to large quantities for issue as required. Examples are pipe fittings, conduit, cable, timber, and stone.

bulletin A document used to request pricing for a modification to the design after a contract is issued. If pricing is acceptable, a change order to the contract incorporates the requirements of the bulletin into a project.

burden In construction, the cost of operating a home office or field office with staff other than operating site personnel. Also means federal, state, and local taxes, fringe benefits, and other union contract obligations. In manufacturing operations, burden typically means operating overhead costs.

business process outsourcing (BPO) Hiring other suppliers (providers) to handle specific processes.

buyer The buying staff negotiates and processes purchase orders, providing assistance to end users. Their mission is to support the departments in obtaining the best products for the best price. Their role in the procurement processes can include troubleshooting vendor, invoice, and payment problems where appropriate.

buying Procuring items for resale.

buying green Buying products that are made from recycled or remanufactured materials.

cancellation of order Annulment or cessation of order.

capacity management A systematic process of matching planned system outputs with the necessary capacity requirements.

capital item requisition (CIR) A form used by a hospital department or unit to request capital equipment for patient use.

capital leases A type of lease that cannot be cancelled during the lease period without a significant penalty.

cash discount A deduction allowed by some sellers of goods or by some providers of services to motivate customers to pay within a specified time.

centralized purchasing The coordination of all purchasing activities for the entire plant through one central location.

certificate of material compliance A written statement signed and approved by an authorized person stating that the materials comply with the material specification.

certificate of need (CON) A proposal written by the hospital unit justifying a specific capital equipment item.

certificate of origin A document, issued by the appropriate authority in an exporting country, that certifies the origin of the equipment, materials, or labor used in the manufacture of the equipment or materials being exported to another country.

certification letter A form completed by vendors that supplies the company with key vendor information, including taxpayer ID, remit-to address, type of business, and minority status.

channel separation A process where the company develops various marketing techniques and strategies to service a large customer base.

claim A request for additional payment.

COD Cash on delivery.

comment A brief statement intended as an explanation or illustration.

commercial terms The terms and conditions of a purchase order or contract that relate to the business and commercial aspects of the purchase order or contract. The price, quantity, and delivery date are the main elements covered under the commercial terms.

commitment The feeling of being emotionally impelled.

commodity A standard article of trade or commerce. Similar goods or services purchased within the company. Excellent candidates for reverse auctions.

compensatory damages Damages awarded to compensate the injured party by granting a monetary value equal to the loss or injury encountered.

competitive advantage Something that makes a company superior to its opponents in terms of value, differentiation, and focus.

competitive bidding The offer of proposals by individuals or organizations competing for a purchase order or contract to supply specific materials, equipment, or services.

competitive bidding trap Incomplete bidding documents with missing provisions and information may result in increased costs for the buying organization.

competitive priority A key determinant of the importance given to different criteria in purchasing material.

competitive strategy The plan created to implement a company's unique advantages over competitors in a specific industry.

compliance Action without inherent desire.

conditional sale A sale made with the knowledge that title will not pass to the buyer until some stated condition has been achieved.

conditions of the contract A document describing the rights, responsibilities, and relationships of the parties to a contract.

conflict Tension between two or more social entities that arises from incompatibility of actual or desired responses.

conflict of interest When an employee is in a position to influence the conduct of a project for personal gain due to responsibilities or to arrangements with an outside entity.

consequential damages Payment for loss or damage that is not directly attributable to a wrongful action on the part of another party but is the result of one or more of the consequences of the action.

consideration A term used to describe the value that shall be reimbursed to one party to a contract by another party in return for services or articles rendered.

constant sum A situation where payoffs add up to a constant figure for any outcome. One player's payoff is the same for any outcome.

consultant A participant, either internal or external to the company, whose participation requires a subcontract.

containerization The use of road and marine transportation containers normally 20 or 40 feet in length. Shipment of large sealed freight containers via rail, air, truck, or water to optimize transit time, security, packaging, and turnaround time.

continuous improvement The ongoing improvement of products, services, or processes through incremental improvements.

continuous systems Produce standardized products through an assembly line.

contract An agreement between two or more parties that is written and enforceable by law.

contract administration Administering contracts and purchase orders to protect the interest of a specific organization and to satisfy the conditions and requirements of the contract and/or purchase order.

contract documents A term applied to a collection of related documents (contract, specifications, drawings, and any additional data) that define the extent of an agreement between two or more parties.

contract manufacturers A manufacturer that contracts with a firm for components or products; contract manufacturing is not the same as outsourcing.

contractual incompleteness A contract is incomplete if either its value-sharing scheme or its actions are not completely specified.

contribution To give or supply for a common purpose.

cooperation Implies internal agreement with actions.

core carriers A set of carriers that a shipper organization has identified as business partners that execute on mutually agreed performance and price commitments.

core competencies The collective learning in an organization.

cost of goods sold Cost of materials in addition to the cost of labor input to create a product.

cost of quality Costs related to (1) preventative, (2) appraisal, (3) internal failure, and (4) external failure.

cost plus A contract or pricing method in which the purchaser agrees to pay the supplier an amount determined by the actual cost incurred by the supplier to provide the materials, equipment, or services purchased, plus a fixed percentage of that cost or a fixed sum as profit.

counteroffer To decline an offer by submitting a new offer with conditions or terms different from the original offer.

countertrade The exchange of goods for goods in full or partial payment of a sales transaction.

currency exchange rate The value of one nation's currency versus the currency of another nation or economic zone.

customer service The fraction of customers' demand that is satisfied without delay or received as promised; also known as service level or fill rate.

customs-duty fee entry The process to procure an instrument or apparatus from another country that must pass through U.S. customs.

debit notice An invoice used to offset a previous overpayment, showing the difference between the previous invoice and the payment.

decentralized purchasing The authority and responsibility for supply-related functions are dispersed throughout the organization.

deliverable A product or report that must be delivered to satisfy a contractual obligation.

delivering carrier The carrier that transports and delivers the materials and equipment to the purchaser.

delivery The act of transferring possession; applied to shipping, occurs when lading is surrendered and title, materials, and equipment pass to the receiving party.

demurrage A charge made on freight cars, vehicles, or ships held by or for a consignor or consignee for subsequent loading or unloading.

department A distinctive division of a large organization.

dependent demand The demand for a good or service that is derived from a second product or service.

depreciation The reduction of the value of an asset with the passage of time.

detail specification A description of the requirements for a specific item or material or equipment.

direct costs Expenses relating to the actual units of production (e.g., labor, materials).

direct materials A group of materials finally incorporated or part of the finished product or project.

discount An allowance or deduction given by the seller to the buyer that reduces the cost of the item purchased when certain conditions are met by the buyer (e.g., prompt payment within a stipulated period).

dispatch The process of releasing the order to the vendor. Dispatch methods include printing the purchase order for mailing, faxing the purchase order, and placing the order by phone.

distribution The broad range of activities targeted at the efficient movement of finished materials and equipment from the end of the production line to the eventual end user or consumer.

distribution channel The network of system components from the manufacturer to the final consumer and the pipeline or linkages that tie the components together.

distributive bargaining The total gains from the situation must be divided between the two parties involved, and each party usually wants as much as it can get.

dock (1) The loading or unloading ramp or platform at an industrial facility or factory. (2) Pier, jetty, or wharf for the receiving and embarking of ships.

draft A legal document instructing one individual to pay another.

due date The date when purchased materials and equipment will be available for installation at the project location.

dunnage Protective matter used around materials or equipment to prevent movement, damage, or breakage while in transit.

durable goods Consumer products that are used repeatedly over a period of years (e.g., household appliances, vehicles).

duty The charge assessed by a government on materials and equipment imported or exported.

early purchasing involvement (EPI) A practice that involves purchasing professionals in the purchasing process or in a new product development process from the beginning.

early supplier involvement (ESI) A practice that brings together one or more selected suppliers with a buyer's product design team early in the purchasing process or in a new product development process. The objective is to utilize the supplier's expertise and experience in developing a product specification that is designed for effective and efficient purchasing.

earnest money Money that one party gives to another at the time of entering into a contract to "seal the deal." Earnest money can be forfeited if a contract is not formalized.

electronic data interchange (EDI) The direct computer transmission of orders and other transaction information in a specific standardized format.

emergency authority The ability to act in the event of an emergency answering point that has not been officially designated.

end user The person in the unit who is responsible for obtaining goods and services.

e-procurement A specialized software system used to communicate with vendors.

error and omission excepted Printed on invoices or other statement(s) to safeguard the originator's right to amend or modify the value if found to be incorrect.

escalation The value of adjustment permitted by an escalation clause. An allowance for an anticipated increase in the cost of equipment, materials, and labor as a result of continuing price inflation experienced over time.

escalation clause A contract clause that provides for a price adjustment based on specific changes.

ex (Ex mill, Ex factory, Ex warehouse, Ex dock) Prefix used to denote point of origin. When a seller quotes a price Ex, the seller proposes only to make the materials and equipment available at the Ex point of origin and includes no transportation costs in the quoted prices.

excess freight Freight in excess of that indicated on the original freight carrier billing.

exchange bill of lading A bill of lading compiled and exchanged for another bill of lading.

excise tax A tax on the manufacture, sale, or use of certain articles made, sold, or used within a country.

export Shipment of materials or equipment to a foreign country.

export permit A permit given by the government of an exporting country allowing a party within that country to export the materials and equipment to another country.

express authority The authority the principal has explicitly given to the agent whether orally or in writing.

facilitation A system to decrease the time of international cargo transportation through the use of the latest customs methods, duty and tariff collection, and other related functions of international traffic activities.

factor An agent selling goods or materials on a commission basis for his or her principal.

fair and reasonable A determination that a price is fair and reasonable is really a conclusion that the proposed price is fair to both parties, considering the quality, delivery, and other factors.

fair market value The value of an article as determined by negotiation between buyer and seller; considered acceptable as a basis of a purchase and sale of the particular article.

FAS (free alongside) When a seller quotes a price FAS, the price includes the cost of transportation and delivery alongside the oceangoing vessel and within reach of the vessel's loading equipment. The price does not include costs for any export permits or the payment of any export duties or tariffs.

field inspection A thorough examination of the equipment and materials shortly after delivery to determine if they meet the requirements of the specifications and to find any hidden defects or damage.

field purchase order A purchase order used in field construction situations where authority to make the type of purchase involved is usually restricted or has a predetermined not-to-exceed value.

FIFO An accounting procedure based on a first-in, first-out treatment of stock or inventory; the articles that are received earliest are used first. The opposite of this procedure is LIFO (last in, first out).

Firm offer An offer that will remain open for a certain period or until a certain time or occurrence of a certain event, during which it is incapable of being revoked.

F.O.B. A delivery term meaning "free on board" at a named place. The named place is where merchandise title passes from the seller to the purchaser. This is an important, and often negotiated, aspect of the purchase agreement because whoever holds title in transit is responsible for damages and losses and the filing of claims.

F.O.B. destination Title of merchandise passes to the purchaser at the time of delivery; however, transportation and freight charges are prepaid by the vendor and added to the invoice.

F.O.B. origin A delivery term that places liability with the purchaser once the freight leaves the dock, but the vendor is going to pay the shipping costs.

F.O.B. shipping point The location at which title to the articles passes from the seller to the buyer. The seller is liable for transportation costs and the risks of loss or damage to the goods up to the point where title passes to the buyer. The buyer is liable for such costs and risks after the passing of the title.

F.O.R. Free on rail.

force majeure Circumstances beyond an individual's control; pleadable as an excuse for the nonfulfillment of a contract or purchase order.

foreign trade zone A designated area where goods can be stored within the U.S. boundaries without payment until the goods are passed to the buying company.

forward purchasing The purchase of quantities exceeding the immediate requirement, that is, in anticipation of any significant price increase or market shortage.

F.O.T. Free on truck.

freight forwarder Some freight forwarder organizations act as agents on behalf of shippers in organizing the transportation of articles without handling any of the articles. Others act as freight carriers in consolidating small and midsized shipments and delivering them to the purchaser.

game theory The science of strategy, or near optimal decision-making of independent and competing decision-makers in a strategic setting.

general liability insurance A broad form of liability insurance covering claims for bodily injury and property damage.

generic A term used to generally describe a group, type, or class of materials and equipment, rather than name a specific trade name or source of manufacture.

goods received note A document detailing all equipment and materials after they have been audited and checked for quantity at the receiving point.

gross margin The difference between the price of the job and the costs to build a job.

gross ton 2,240 pounds of weight.

gross weight The total weight of a shipment, including containers, packaging, and miscellaneous materials.

guarantee A promise, pledge, or formal assurance given as a pledge that another's obligation or debt will be fulfilled.

hedging A method of selling for future delivery whereby the parties protect themselves against potential loss.

hold order A purchaser's order to hold a particular delivery at a designated location for a specific period of time.

hold points Inventory or warehouse areas set aside for storing semicomplete articles.

hundredweight In U.S. measurement and domestic transport, 100 pounds; in UK measurement, a hundredweight, or "cwt," is 112 pounds or one-twentieth of a long ton of 2,240 pounds.

hurdle rate The minimum rate of return on a project or investment required by a manager or investor.

implied authority Under contract law, the ability to make a legally binding contract on behalf of another person or company.

implied contract A contract formed when parties express, through their conduct, their agreement to be bound to its conditions and terms. An agreement is inferred and understood without express statements.

incremental savings A systematic reduction or elimination of the cost of a recurring expense (e.g., paying on a monthly school loan).

indemnification An obligation contractually taken on or legally imposed on one party to protect another party against any loss or damage from specific liability.

indemnity A responsibility of one person to make good a loss or damage incurred by another. A payment for damage, loss, or expense incurred.

independent demand The demand for end items (e.g., distribution items, finished goods, spare parts).

independent-demand purchased items Demand for an item that is unrelated to demand for other items.

indirect cost Also known as facilities and administrative costs. The cost of operations that cannot be assigned to specific projects, such as electricity and central administrative services; sometimes referred to as *overhead*.

indirect materials A group of materials used in making a product that are not incorporated into or part of the finished product.

information processing theory Contends that greater complexity is associated with the need for more expansive coordination mechanisms.

inland bill of lading A bill of lading used in transporting materials and equipment overland to the exporter's international transporter. A through-bill of lading can be used in some circumstances; however, it is usually necessary to prepare both an inland bill of lading and an ocean bill of lading for foreign export of materials and equipment.

inland carrier A transportation organization that moves export or import materials and equipment between seaports and inland locations.

inquiry A request for information related to the schedule, location, availability, interest, cost, or quantity of construction-related items.

inspection plan A procedure that defines the material or equipment requiring inspection and describes the method and order of performing the tests or inspections.

Institute for Supply Management A professional association with a mission to provide national and international leadership in purchasing and material management, particularly in the areas of education, research, and standards of excellence. Membership is individual, not institutional, with local affiliates in Southwest Michigan and Central Michigan. See http://www.ism.ws.

institutionalization The process through which the system becomes incorporated as an ongoing part of organizational activities.

instructions to bidders A document that is part of the bidding requirements, usually prepared by a design professional, architect, or engineer. Instructions to bidders describe specific instructions to the potential contractors on procedures, requirements of the owner, and other necessary information for the preparation and submission of bids for consideration and review by the owner.

integrated buying model A model used by the buyer organization in making purchasing decisions; buying the right material at an acceptable cost and quality level within a reasonable lead time.

integrative bargaining Two parties with areas of mutual concern and complementary interests.

integrative materials management The planning, acquisition, and conversion of raw materials and component parts into finished goods.

intellectual property A created work or invention protected under copyright or patent.

intermittent systems Produce nonstandardized products through a job shop.

inventory Items of materials and equipment that are in the storeroom or warehouse, or work-in-progress consisting of raw materials, fabrication elements, components, parts of intermediate materials and equipment, and finished materials and equipment ready for distribution and sale. Physical inventory is ascertained and established by actual count. It includes materials and equipment physically available for allocation and distribution and stored and controlled in a warehouse.

invitation to bid Written notice of an owner's desire to receive competitive bids for a particular construction project where a select number of contractors are invited to submit bids.

invoice The seller's itemized bill of quantities and prices of materials, equipment, and/or services that have been delivered to the purchaser.

joint agent An official designated to act for two or more principals.

joint venture An organization in which two or more parties join together to form a business operation with the legal characteristics of a partnership to achieve a specific goal.

justification A statement of account to demonstrate or prove to be just, right, or valid.

just-in-time (JIT) system System in which materials are purchased, transported, and processed "just in time" for their use in a subsequent stage of the manufacturing process; an operations management philosophy whose objectives are to reduce waste and cycle time. Operationally, JIT minimizes inventory at all levels.

kanban card A card that contains the part number, the part description, the type of container, and various workstation information.

kanban production control system A system using simple, visual signals to control the movement of materials between work centers, as well as the production of new materials to replenish those sent downstream to the next work center.

kitting The process of sending components of a total assembly to another location in a kit form for assembly.

labor and material payment bond A contract between a contractor and a surety in which the surety, for a premium payment by the contractor, agrees to reimburse subcontractors, vendors, and material suppliers any amounts due for their materials and services, should the contractor default in payment to them.

lading The act of loading, or the contents of a specific shipment.

lead time The period of time required to perform a specific activity of work.

learning curve Method used to measure and predict the efficiencies of increasing outputs.

lease A contract whereby an individual or organization lets another use property or equipment for a definite term and for an agreed rental cost. The lessor retains title to such property or equipment.

legal tender Money issued by the government to satisfy a debt or obligation.

less-than-truckload (LTL) shipment Handle small shipments below 10,000 pounds.

letter of credit A letter addressed by a bank to a correspondent bank certifying that an individual or organization named therein is entitled to draw upon an account.

liability A state of being under obligation; exposure to a potential claim by which an individual or organization may be subject to pay for compensation for loss, damage, or other acts to another individual or organization.

lien A legal claim on the assets or property of another.

LIFO (last in, first out) An accounting practice of determining the cost of stock inventory used in a manufactured product or process.

liquidated damages A sum of money agreed to by the contracting parties as to damages to be given in case of a failure to meet the obligations of the contract.

litigation To engage in a lawsuit; the process by which parties submit their disputes to the jurisdiction of federal or state law courts for resolution.

lot size The amount of specific materials and equipment items ordered from a vendor.

lot-sizing procedure Process based on the minimization of the sum of ordering and inventory carrying costs subject to meeting all requirements for each period.

LTL Less than truckload.

lump sum An amount or value used in a proposal, bid, or contract representing the total cost that an organization is prepared to contract to perform an item of work.

maintenance repair and operations (MRO) A category of indirect purchasing used for critical maintenance of equipment and purchase of manufacturing equipment.

make-to-order (MTO) A manufacturing process in which manufacturing starts only after a customer's order is received.

make-to-stock (MTS) A traditional production strategy used by businesses to match the inventory with anticipated consumer demand.

make-versus-buy Determination of the product or service to provide as well as determining the in-house capability for producing the product or service.

manifest A list of the cargo loaded in ships, trucks, containers, and the like; an oceangoing transportation, referred to as a ship's manifest.

market pricing The current price at which a good or service can be bought or sold.

markup A percentage that can be added to the total of all direct costs to determine a final price or contract sum. Allows the contractor or subcontractor to recover the costs associated with overhead.

material requirements planning (MRP) systems Material requirements planning is a production planning and control system used to manage manufacturing processes.

materials management A concept whereby all materials and equipment procurement functions are combined under one management function, including contracting, purchasing, quality assurance, quality control, inspection and expediting, trafficking, and receiving.

mechanic's lien A type of lien filed by an individual or organization that has performed work for which payment is either in dispute or remains unpaid.

minimum carload weight A minimum weight for which a carload of materials and equipment can be charged.

minority business enterprise A company that is at least 51% owned, managed, and controlled by one or more minority persons. Minority means being African American, Hispanic American, Native American, or Asian American.

mixed truckload rate A rate applied to a truckload shipment made up of two or more different materials.

multiple consignee A container car, truck, or ship loaded with materials and equipment for two or more consignees.

multiple-source buying A container car, truck, or ship loaded with materials and equipment for two or more consignees.

Nash equilibrium Involves two or more players in which each player is assumed to know the strategies such that all players reach a point of maximum benefit.

negligence Under the law, failure to exercise the care and consideration a prudent person would exercise; lack of care and attention.

negotiation The process by which a buyer and seller reach an agreement on the terms and conditions regarding the purchase of materials, equipment, or goods.

net margin Profit.

net price The price reached after all allowable discounts, rebates, and the like are deducted from the original selling price.

net ton 2,000 pounds.

net weight The weight of the materials and equipment without the shipping container and dunnage.

noncompetitive purchase award A purchase from the only available supplier of a product or service. Therefore, no bids or proposals can be obtained. Formerly known as sole source.

OBL Ocean bill of lading.

obligation A duty that is the result of a promise or contract; an agreement that an individual or organization is responsible to fulfill.

obsolete Outmoded, worn out, discarded, or no longer in use.

offer A proposal or bid made by an individual or organization to another individual to perform a service or action; the acceptance of such an offer results in a contract. The individual or organization that makes the offer is called an offeror, and the individual or organization that receives the offer is called an offeree. A bid or proposal is an example of an offer.

open-end order Purchases made against the buyer's purchase order or contract. The purchase order or contract contains price, conditions, and terms. The purchase order or contract may not specify the final quantity to be purchased.

operating resource management (ORM) A category of indirect purchasing used for the basic operating needs of a business (e.g., office equipment, travel services, and janitorial supplies).

opportunism Taking advantage of situations and people without evaluating the consequences.

opportunistic behavior The behavior of relationship motivated by the maximization of economic self-interest and occasioned loss of the other partners.

opportunistic renegotiation Occurs in the presence of high switching costs, economic lock-in, and strategic dependence on a single supplier.

option contract An agreement between a buyer and seller that gives the purchaser of the option the right to buy or sell a particular asset at a later date at an agreed-on price.

order cycle (1) The flow of information and materials. (2) A set of activities.

order lead time Period of time required to obtain an item from a vendor or supplier once the purchase order requirements are known.

outsourcing Delegation of function or production capabilities.

overhead A cost inherent in the operating of a business. A cost that cannot be charged to a specific part of the work, materials, or equipment.

packing list A document or log prepared by the shipper to indicate in detail the particular package contents.

pareto optimal An economic situation when the circumstances of one individual cannot be made better without making the situation worse for another individual.

partial payment A stage payment made upon delivery of one or more completed units.

patent A government grant to an inventor by which he or she is the only person allowed to make or sell the new invention for a certain number of years.

p-card Master card used for quick transactions that cost $5,000 or less and for hosting functions, dues, memberships, conference registration, subscriptions, and travel expenses.

penalty clause A clause in a contract that stipulates the sum of money to be forfeited in the case of nonperformance of the terms and conditions of the contract.

performance The ability to execute intentions and goals.

performance-based evaluation An assessment of the supplier's actual performance on a variety of criteria, such as delivery reliability, cost, and quality defect rate.

performance bond A bond obtained in connection with a contract; ensures the performance and completion of all the scope, terms, conditions, and agreements contained within the contract.

personal selling The sales personnel promote the product through their attitude, appearance, and specialist product knowledge; especially important when interviewing for a job.

physical distribution (warehousing) A range of materials management activities that involve taking care of shipping, receiving, internal movement, and storage of raw materials and finished goods.

piggyback The carrying of anything that usually moves alone by a large vehicle, such as the transportation of highway trailers or containers on specially equipped railroad flat cars.

pipeline The means by which various resources flow.

pledge To bind by a promise.

poaching The extent to which the service provider is inclined to use information gained through its relationship with the customer for its own, perhaps unauthorized, benefit should the customer be unable to detect such action.

point of origin (1) The location at which a shipment is received by a transportation company. (2) The actual location of origin of an article.

port of entry A port designated by a government as the entry point for materials, equipment, and services from an overseas country.

power The ability of one party (buyer or seller) to influence or control the environment around them, including the behavior of others.

power asymmetry The relationship between two individuals in which the most powerful individual has control over the actions of the other individual.

prebid conference A meeting with interested suppliers prior to the submission of bids. Its main purpose is to clarify specifications and answer questions from suppliers in an open and equitable manner.

prefabrication A manufacturing or fabrication technique, generally taking place at a location other than the construction site, in which various materials and equipment are combined to form a larger component element for final installation at the construction location.

preferred suppliers Those that are important to the buying firm, but alternative suppliers could be found with some effort.

present value factor A formula used to estimate the current worth of a sum of money that is to be received at some future date.

price break Quantity at which a price changes.

price markup The difference between the selling price of a good or service and the cost; can be expressed as a percentage or fixed amount.

price/cost analysis A powerful approach to pricing that allows the buying organization to determine what prices should be based on industry norms for direct cost, indirect cost, and a reasonable profit margin.

process-based evaluation An assessment of the supplier's production or service process.

procurement All of the processes involved in requesting, ordering, auditing, and paying for goods and services.

procurement lead time The time required by a buyer to select and negotiate with a vendor or supplier and place a purchase order.

profit center A business unit that uses resources to generate revenues.

promissory estoppels The legal principle that a promise is enforceable by law, even if made without formal consideration when a promisor has made a promise to a promisee who then relies on that promise to his subsequent detriment.

promissory note A written pledge or promise by one individual or organization to pay another unconditionally a certain sum of money (principal and interest) at a specified time.

protectionism The practice of taxing imports as a means of shielding a country's domestic industries from foreign competition.

pull system A system in which an end item (or a fixed lot of end items) is removed, triggering the order release by which the flow of materials or components is initiated.

purchase Obtaining an article for money; something acquired for a specific amount of money or its equivalent.

purchase order Authorizing document for provision of goods or services from a supplier; becomes a legally binding contract on acceptance by the supplier.

purchase risk perception (PRP) The potential for failures of a purchasing process designed to purchase goods and services.

purchasing The act of buying materials, equipment, and services that conform to the correct quality, in the correct quantity, and at the market price, and are delivered in accordance with the promised delivery date.

purchasing agents (1) An individual who implements the purchasing process by forwarding the orders to suppliers and monitoring the documentation for their business organization. (2) From a legal viewpoint, the individual responsible for acting on behalf of the principal when dealing with third parties.

purchasing criteria Price, quality, and delivery speed.

purchasing cycle The activities in the acquisition of materials, equipment, and services.

purchasing managers An individual buying goods and services for use by their business organization.

purchasing manual An operating guide that explains the policies and procedures for purchasing personnel to follow in the performance of their work activities.

purchasing process Buying goods and services for use by the buying organization.

pure inventory systems Distribution stocking points, such as warehouses or distributors.

push system A system that allows for the production or material flow in anticipation of future demand.

quality The essential attributes that permit materials and equipment to function in the desired manner.

quality assurance A formal procedure that ensures that the materials and equipment will perform satisfactorily when installed.

quality control The procedure and activities that ensure adequate quality is maintained in the materials and equipment used in the manufacturing process.

quality function deployment (QFD) The process of understanding customer expectations and how well providers of products address these expectations.

quantity The amount of equipment or material units required.

quantity discount The reduction in unit price cost established by a predetermined minimum number.

quasi-contract An obligation under which an individual or organization that received a benefit must pay the individual or organization that gave the benefit, despite the absence of a contract.

quotation A summary of price, terms of sale, and general description of materials, equipment, or services offered for sale by a contractor or vendor to a potential buyer. When issued in response to a purchase inquiry, it is considered an offer to sell.

quotation expiration date The date after which a quotation is no longer valid.

quote To state a price for securities, goods, and services.

radio frequency technology (RFID) A universal term given to any technology that uses radio waves to identify and track items.

rate of exchange The rate at which the currency of a country is exchanged for the currency of another country.

rebate The amount refunded to a purchaser for the purchase of an agreed quantity or value within a stipulated period of time.

receipt inspection An audit and examination of materials and equipment prior to acceptance; to review the completeness of the delivery and to note any obvious damage.

receipt of bids The action of an owner in receiving sealed bids that have been invited or advertised in accordance with the owner's intention to award a contract.

receiving and storage The action of processing materials and equipment from vendors and suppliers, including maintaining and controlling all elements in storage and the eventual distribution of the materials and equipment.

receiving report A form or log used by an organization's receiving department for recording the materials and equipment received and the differences, if any, from the quantities indicated on the purchase order.

request for information (RFI) Vendors give information on a particular commodity or service. RFIs are often used as "brainstorming" tools to meet a particular situation (e.g., "provide audio/visual system for auditorium") and rely more on the expertise of the vendors to meet a need.

request for proposal (RFP) Vendors are asked to meet a need or set of needs. Unlike the request for information, criteria are more developed and specifications are given that the proposed commodity or service must meet or exceed. Most, but not all, of the proposals will spell out the equipment/labor/services needed to complete the project.

request for quotation (RFQ) Specific pricing and delivery information on listed products or services. Quotations are requested for exact quantities, and products may be specified by make/model number, batch number, industry specification, and so forth.

requisition An internal form that an individual or department sends to the purchasing department requesting materials, equipment, or other services.

resource-based view A model view of the company as the primary approach for achieving a competitive advantage in a competitive environment.

reverse auction An online, declining-price auction between one buying organization and a group of prequalified suppliers. The bidding process is in real time. In most cases, the supplier with the lowest total cost bid is awarded the contract.

reversibility clauses A reversible decision in an agreement.

reward criteria Determine how closely the objectives are met.

risk management The identification and evaluation of risks followed by the control of the probability or impact of unfortunate events.

risk mitigation Involves a detailed analysis of what can be done to reduce or eliminate the probability and severity of adverse events while also considering the trade-offs involved.

safety stock Extra inventory held to protect against randomness in demand or lead time.

sales price The value received for items sold. Gross sales price is the total value paid. Net sales is the gross value less discounts, rebates, and freight costs.

salvage The material or equipment that is saved after damage or demolition has been completed.

salvage value The value recovered or realized when an article or facility is demolished, scrapped, or sold.

samples Examples of completed materials, products, equipment, or workmanship that establish standards by which the installed work will be evaluated.

satisfaction The extent of contentment with the relationship.

scope of work The division of work to be performed under a contract or subcontract in the completion of a project, typically broken out into specific tasks with deadlines.

seller's lien The seller's right to withhold or to lay claim on materials or equipment sold, giving up these rights upon receipt of payment.

shirking The extent to which the service provider is inclined to deliberately underperform or withhold resources should the customer be unable to detect such action.

short ton 2,000 pounds.

single source A purchase from a supplier who is the only respondent to a competitive bid, for example, request for quote.

social capital The sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit.

sole source A purchase from the only available supplier of a product or service. Therefore, no bids or proposals can be obtained. Also referred to as a noncompetitive purchase award.

sourcing The process of researching and determining qualified sources of materials and equipment.

special influence transaction A type of interaction that goes beyond the length of time it takes for one discrete transaction.

specifications A precise, detailed description and presentation of a component part or purchased item.

standard The requirements of a specific standardization method approved by a recognized and approved authority.

standardization The process of agreeing on a common specification. This process can take place at different levels: (1) across an organization, (2) throughout an industry, (3) across a nation, and (4) around the world.

statement of work/scope of work (SOW) The area in an agreement where the work to be performed is described.

statistical process control (SPC) The use of statistical techniques to control a process or production method.

strategic match A win-win relationship resulting in positive benefits for both the buying and selling organization.

strategic supplier The strategic supplier program is a unit within purchasing, stores, and auxiliary services. Its primary responsibility is negotiating high-valued contracts with key suppliers.

subsystem A group or set of assemblies, components, or elements that when combined perform a single function.

supplier Vendor, seller, or manufacturer.

supplier evaluation The procedure of evaluating a supplier's ability to perform the required quantity, quality, and scheduled requirements.

supplier performance review A set of expectations and measurements for controlling long-term relationships with existing strategic suppliers.

supplier relationship management (SRM) The management of strategic collaborative relationships between buying and selling organizations.

supplier relationship quality indexing (SRQ) A methodology that may provide the manufacturer with the information needed to make the hard decisions about balancing the needs of the buying organization and the needs of the supply chain itself.

supply chain management The design and management of seamless, value-added processes across organizational boundaries to meet the real needs of the end customer. The development and integration of people and technological resources are critical to successful supply chain integration.

supply management A strategic approach to planning and acquiring organizational needs through effectively managing suppliers.

surface transportation Freight movements by truck, rail, pipeline, mail, foreign trade zones, and other modes of transport other than water and air.

surplus The usable materials, equipment, components, or parts that are in excess of the requirements.

systems contracting A stockless inventory method for ordering and stocking MRO and related items.

target pricing The maximum price the buyer is able to pay without compromising the integrity of the product or the profitability of the supplier.

tariff, freight A listing of duties or taxes on imports or exports.

tax exempt Not subject to taxes.

tax-exemptin certificate A document given by the purchaser to the seller with the purchase order to indicate that the transportation is not subject to sales tax.

technical bid evaluation The ranking of vendor or supplier bids based on the quantity, cost, compliance with specifications, and delivery requirements.

technological assessment A method of evaluating current and requested capital equipment by considering the results of published clinical investigations and of physical assessment of the equipment in the decision-making process.

terms and conditions (Ts and Cs) Specific requirements a buyer makes upon a supplier in the performance of work.

terms of payments The method of payment for materials, equipment, and services stipulated in a contract.

testing Confirming an article's ability to meet preestablished requirements by subjecting the article to a set of physical, chemical, or operating evaluations.

Thomas Register A buying source that categorizes potential suppliers as manufacturers, distributors, manufacturer representatives, or services.

throughput time (TPT) The delay between receipt of raw materials and the availability of the finished goods produced; also known as velocity.

time-phased requirements Delays release of orders for components until they are needed and offsets the requirements by item lead time (lead time offset).

title The legal right to the possession of property.

total cost of ownership (TCO) The purchase price of a product and its transportation cost, plus indirect handling, inspection, quality, rework, maintenance, and all other "follow-on" costs associated with the purchase, including costs of disposal.

total quality management (TQM) Based on the principle that every employee must be committed to maintaining high standards of work in every aspect of a company's operations.

tracing Locating the current position of a shipment after it has entered the delivery and transportation phase.

trade discount The reduction in price a manufacturer or wholesaler gives a wholesaler or retailer when it buys a product or group of products.

trademark A mark, picture, name, or letters owned and used by a manufacturer or merchant to distinguish his or her goods from the goods of another.

traffic The action of transporting materials and equipment by a freight carrier.

transaction cost theory Asserts that complexity enhances the risk of opportunism and the need for costlier formal control mechanisms.

transactional suppliers Those that provide the buying firm with items that are not critical to its core business and that can be easily replaced in a short time.

transfer of value downstream Sharing the benefits of an efficient supply chain with supply chain members' lower tiers.

transit charges Costs of services rendered while a shipment is being transported.

transit rate A rate applying to traffic stopped en route for milling, painting, packing, treating, storage, and so on.

transload Shipment stopped while being transported in order to be partially unloaded.

transmittal A form or letter indicating the action to be taken on an article being transmitted from one party to another.

transportation Facilitating the movements of raw materials and component parts from suppliers through the firm's manufacturing process to the ultimate customers.

truckload (TL) shipment Shipments are defined as loads in excess of 10,000 pounds.

unavoidable costs Ordering costs, stock-out costs, and holding costs.

uncertainty in demand Occurs during times when a business is unable to accurately predict consumer demand for its products or services.

Uniform Commercial Code (UCC) A codification of law that clarifies and regulates the rights and obligations of buyers and sellers engaging in commercial transactions. It has been adopted by all states except Louisiana.

unit cost contract A contract in which reimbursement is based on a preestablished cost per unit of measured quantities produced or installed.

unit load Several articles loaded on one pallet, or placed in a crate, enabling transportation of the items at one time as one unit.

unit of issue A unit of measurement in which an item is issued from stock.

unit of measure Used to specify the number of units or items to be purchased.

unit train Freight trains that move large quantities of bulk materials between two or more locations.

usage The number of units or articles of an inventory item consumed over a period of time.

use tax A tax imposed on the user of materials and equipment.

valuation The appraisal of the value of exported or imported materials and equipment.

value The real worth of an article; marketable price; the intrinsic worth of an item. The value of an article is determined by the lowest cost at which a satisfactory supply of materials and equipment or services can be obtained.

value analysis The application of techniques that establish a value for a necessary action at the lowest evaluated cost.

value engineering A discipline that reviews the real value of various life cycle costs, materials, equipment, and manufacturing techniques. Value engineering reviews the initial cost of design, coupled with the costs associated with maintenance, energy use, and life cycle.

variable costs The costs associated with raw materials and all manufacturing operating costs, which vary with manufacturing output.

varying sum The profits (and/or losses) of the respective bargainers, when added together, need not always equal the same fixed amount.

VAT Value added tax.

vendor An individual or organization that sells something to a purchaser.

vendor diversity program The purchasing staff that expend the effort to identify minority- and women-owned businesses and those classified under the Americans with Disabilities Act, who deal at the appropriate level of distribution to foster and develop these sources within policies and procedures of the company.

vendor maintenance Vendor specialists maintain the vendor database by adding to and updating current vendor information (e.g., 1099 tax information, remitting address, government reporting date). They gather this information through the vendor certification process. The vendor database is the foundation of the procurement system; no transaction can be processed unless a vendor has been correctly entered into the database.

vendor performance evaluation A ranking and evaluation of vendors' and suppliers' performance based on quality of work, compliance with specifications, delivery, and cost.

vendor's lien A seller's right to retain possession of materials or equipment until he or she has received payment.

verification Witnessing of certain steps in the fabrication and manufacturing process, such as metallurgical analysis, hydrostatic performance, or operational tests; review and audit of nondestructive testing, x-rays, and bench tests.

vertical integration The assimilation in one company of multiple stages of production normally operated by separate companies.

vessel-ton One hundred cubic feet of volume.

visual inspection Manual inspection of materials and equipment.

volume discount A reduction in unit cost predicted on the size of a particular purchase.

voucher A document that serves as proof that the terms of a transaction have been met.

waive To give up a right or claim; to refrain from claiming or pressing.

warehouse receipt A document given by the warehouseman as a receipt for materials and equipment placed in the warehouse.

warranty A promise or pledge that something is what it is claimed to be. The seller makes a specific assurance concerning the nature, quality, and character of the goods.

waste The refuse from the fabrication and manufacturing process that cannot be reclaimed or reused.

weight, gross The actual combined weight of the item, container, or any dunnage materials.

weight, net The actual weight of the item; does not include the container or any dunnage materials.

weight, tare The difference between the gross weight and the net weight of an item being shipped; weight of the empty container, including dunnage packing material used in transport.

wholesaler An individual or organization that acquires products, materials, and equipment for resale to retailers or other users.

zero-sum bargaining The profits (and/or losses) of the respective bargainers always sum to the same fixed amount.

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