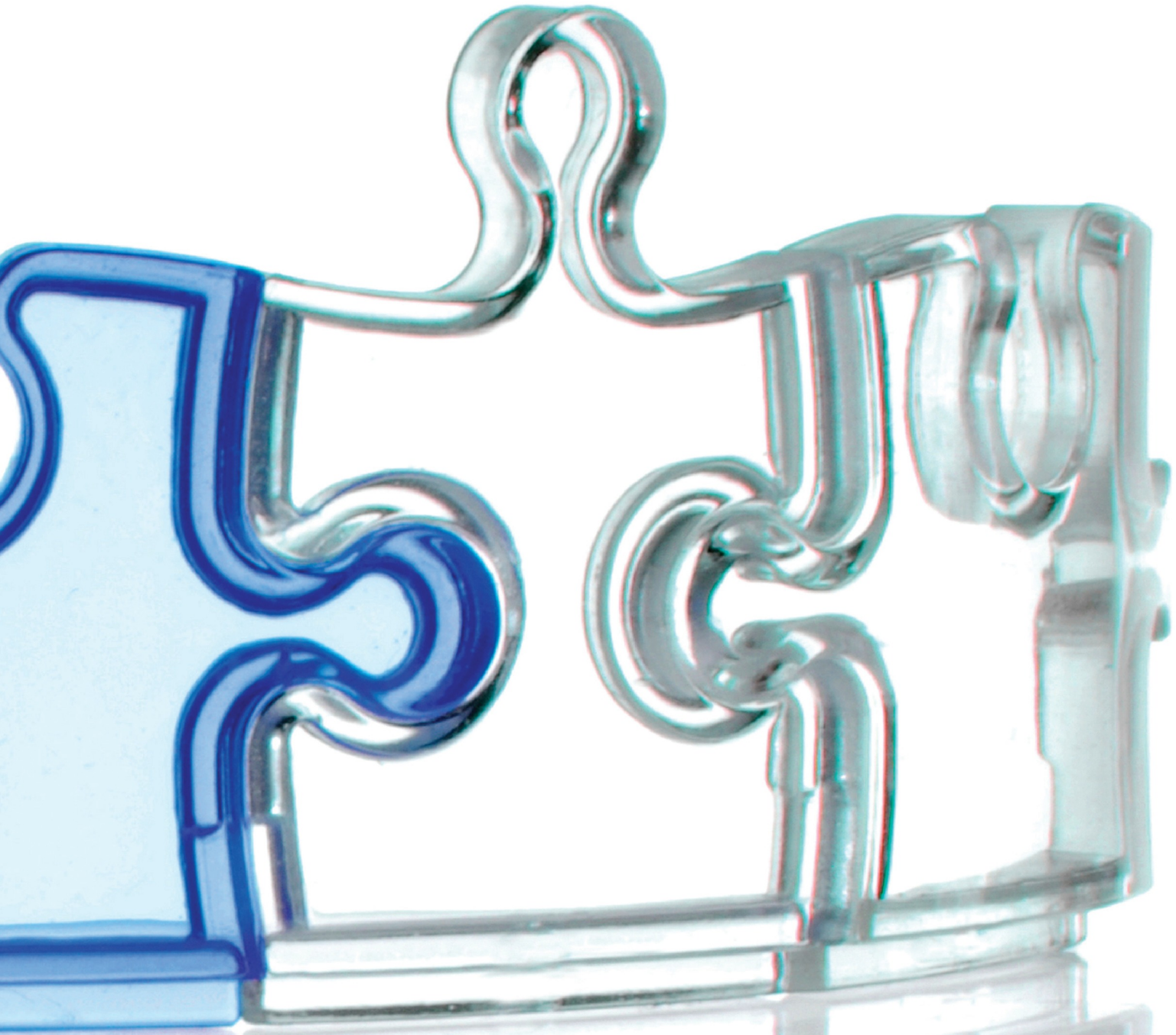
MANAGING OPERATIONS

Across the Supply Chain

second edition



Swink Melnyk Cooper Hartley

Managing Operations

Across the Supply Chain

Second Edition

Morgan Swink
Texas Christian University

Steven A. Melnyk
Michigan State University

M. Bixby Cooper
Michigan State University

Janet L. Hartley
Bowling Green State University

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Dedication

To Jenni, Derek, Rachel, and Sarah, who make my life so full!
Morgan Swink

To my wife and children–Christine, Charles and Beth–for their support and patience.
To five great friends who have been "teachers" to me in my continual quest for more knowledge–Randall Schaefer, Joe Sandor, Ed Davis (Darden School, University of Virginia) Dave Frayer, and Nick Little (Michigan State University).
To these people, this book is dedicated.
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To my children who make my life complete.
Bix Cooper

To Glenn and Caleb, for their love and support.
Janet Hartley

About the Authors

Morgan Swink

is Professor, Eunice and James L. West Chair of Supply Chain Management, and Executive Director of the Supply and Value Chain Center at the Neeley School of Business, Texas Christian University. He holds a BS in Mechanical Engineering from Southern Methodist University, an MBA from the University of Dallas, and a PhD in Operations Management from Indiana University. Before becoming a professor, Dr. Swink worked for 10 years in a variety of manufacturing and product development positions at Texas Instruments Incorporated. He has co-authored three books and published over 50 articles in a variety of academic and managerial journals. Dr. Swink is formerly the Co-Editor in Chief for the *Journal of Operations Management.*

Steven A. Melnyk

is Professor of Operations Management at Michigan State University. Dr. Melnyk obtained his undergraduate degree from the University of Windsor and his doctorate from the Ivey School of Business, the University of Western Ontario. He has co-authored 15 books focusing on operations and the supply chain and has published 80 refereed articles in numerous international and national journals. He is Associate Editor for the *Journal of Business Logistics.* He also is a member of the editorial advisory board for the *Production and Inventory Management Journal,* the *Journal of Supply Chain Management,* and the *International Journal of Production Research.* Dr. Melnyk is co-editor (North America) for the *Journal of Humanitarian Logistics and Supply Chain Management.* Dr. Melnyk has consulted with over 60 companies.

M. Bixby Cooper

is Associate Professor in the Department of Supply Chain Management at Michigan State University. He received his BS in Business Administration from the University of North Carolina, MBA from the University of Virginia, and PhD from the University of Alabama. Prior to joining Michigan State, he served on the faculty of Winthrop University and Louisiana State University. He is an active researcher and co-author of several books on distribution and logistics. Dr. Cooper has consulted with numerous organizations including Kellogg, Johnson and Johnson, Mead Johnson, Westinghouse, Novartis, Dayton Hudson (Target), Kerr-McGee, VF Industries, and Siemens.

Janet L. Hartley

is Professor and Director of the Supply Chain Management Institute of the Department of Management at Bowling Green State University. She received her BS in Chemical Engineering from the University of Missouri-Rolla, and the MBA and PhD degrees in Business Administration from the University of Cincinnati. Prior to graduate school, she developed new products and designed new manufacturing processes for the Clorox Company. She has published over 28 articles on supply management and supply chain management. She serves as an associate editor for the *Journal of Operations Management, Journal of Business Logistics,* and *Journal of Supply Chain Management.*

Preface

We continue to live in dynamic and exciting times. The recent 20 years have seen many changes that have affected nearly every aspect of business—including operations management. We have enhanced this second edition of our book to reflect key shifts in operations management, including transitions:

- ***From a focus on the internal system to a focus on the supply chain*** In today's highly competitive business environment, organizations must leverage the capabilities of their suppliers and customers. Operations managers must look beyond the "four walls" of the firm and take an integrated supply chain perspective of operations.
- ***From a local focus to a global focus*** As Thomas L. Friedman pointed out,[1] the world is indeed flat. Business solutions generated in Argentina are used to meet needs in the United States, and parts built by suppliers located in China are used to assemble cars in Canada. Commercial needs have overcome, to a large part, national borders, presenting new opportunities and challenges for operations managers.
- ***From an emphasis on tools and techniques to an emphasis on systems, people, and processes*** To be successful, operations managers must think more broadly than just the application of analytical tools and techniques. They must take a systems view to address important managerial issues such as designing processes, working with people, managing information flows, and building interorganizational relationships.
- ***From myopic pursuit of profit to a holistic pursuit of sustainability.*** Pressures on businesses have risen to the point that they can no longer ignore or give only lip-service to social and environmental issues. Operations managers have to balance the profit motive with the need to protect and even strengthen both people and the planet.

Managing Operations Across the Supply Chain provides a global, supply chain perspective of operations management for students in introductory courses in operations management and in supply chain management courses that do not require an operations management prerequisite. While the book is primarily written for undergraduates, it also can be used effectively in MBA courses. There are several features that help to differentiate this book in its view of operations management:

- ***Broader Treatment of Operations Management*** While many operations management textbooks have revised or added a chapter to address supply chain issues, we developed our book from the ground up to effectively integrate operations management and the supply chain. The primary focus of the book is operations management, but we provide a "supply chain" perspective. Operations management cuts across a firm's boundaries, bringing together its internal activities with the operations of customers, suppliers, and other partners around the world. We clarify the functional roles of operations, supply management, and logistics while examining the integrative processes that make up the supply chain. One unique aspect of the book is that we examine both the upstream (supply-side) and downstream (demand-side) aspects of the supply chain, including a discussion of marketing and customer relationships.
- ***Balanced Treatment*** The book balances the quantitative and qualitative coverage needed to equip operations and supply chain managers for the challenges and opportunities they face. It describes and applies analytical tools that operations managers use to support decision making. However, we also address the important managerial issues such as systems, people, and processes that are critical in a supply chain context.
- ***Use of Integrative Frameworks*** The various elements of operations management are introduced and developed using an operations strategy framework that brings together three critical elements: (1) the critical customer, (2) the value proposition, and (3) capabilities. Furthermore, the students are introduced to operations management in a structured way that begins with the "big" picture of operations strategy, proceeds to the foundations of operations management, integrating relationships, planning for integrated supply chain operations, and then ending with a discussion of how to manage the system looking to the future.
- ***Use of Three Integrating Themes*** Three key themes are highlighted throughout the book: global issues, relationships, and sustainability. Because most

[1]Thomas L. Friedman, *The World Is Flat: A Brief History of the Twenty-First Century* (New York: Farrar, Straus, and Giroux, 2006).

organizations have supply chains that reach beyond a single country, we examine global issues associated with operations and supply chain management. Organizations must collaborate with customers and suppliers to accomplish many operations activities. Thus, the book showcases how to build, maintain, and benefit from cross-functional and interorganizational relationships. To reduce costs and be competitive, organizations today must adapt sustainable business practices. We expect sustainability to increasingly become a key metric for operations and supply chain management performance. Accordingly, we have dedicated an entire chapter to sustainability, while also incorporating it throughout the book.

- ***Real, Integrated Examples*** The book brings operations and supply chain management to life through opening vignettes, Get Real highlights, and rich examples throughout the book. Companies such as Disney/Pixar®, HP, Boeing, IKEA, American Apparel, Starbucks, and Procter & Gamble, to name a few, are used to illustrate how to address real operations and supply chain challenges.

Managing Operations Across the Supply Chain offers a new, global, supply chain perspective of operations management—a treatment that embraces the foundations of operations management but includes new frameworks, concepts, and tools to address the demands of today and changing needs of the future. The book is organized into five major sections:

- **Part 1 Supply Chain: A Perspective for Operations Management** provides an overview of operations management as a field, and describes the strategic role operations has in business from the perspective of supply chain management.
- **Part 2 Foundations of Operations Management** discusses foundational process concepts and principles that govern all operational activities. This section examines concepts such as product/process innovation, quality, lean, and inventory fundamentals.
- **Part 3 Integrating Relationships Across the Supply Chain** deals with the primary functional relationships between internal operations management activities and other operational functions both inside and outside the firm. This section describes customer relationship management, supply management, and logistics management.
- **Part 4 Planning for Integrated Operations Across the Supply Chain** discusses planning approaches and technologies used at different levels of operations decision making. Key topics such as demand planning, forecasting, sales and operations planning, inventory management, and materials requirements planning are examined.
- **Part 5 Managing Change in Supply Chain Operations** discusses how operations managers use projects, change programs, and technologies to shape a sustainable future for operations and supply chain management.

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Morgan Swink
Steven A. Melynk
M. Bixby Cooper
Janet L. Hartley

Walkthrough

The following section highlights the key features of the text and accompanying resources, which have been developed to help you learn, understand, and apply operations concepts.

CHAPTER ELEMENTS

Within each chapter, of the text, you will find the following elements. All of these have been developed to facilitate study and learning.

Chapter Opener

Each chapter begins with an outline of the chapter and a chapter vignette to help set the tone for the material that follows. Learning objectives provide a quick introduction to the material students will learn and should understand before moving to the next chapter.

Opening Vignette

Each chapter opens with an introduction to the important operations topics covered in the chapter. Students need to see the relevance of operations management in order to actively engage in learning the material.

1

Introduction to Managing Operations Across the Supply Chain

CHAPTER OUTLINE

LEARNING OBJECTIVES *After studying this chapter, you should be able to:*

- **LO1-1** Explain what operations management is and why it is important.
- **LO1-2** Describe the major decisions that operations managers typically make.
- **LO1-3** Explain the role of processes and "process thinking" in operations management.
- **LO1-4** Explain what the supply chain is and what it means to view operations management using a "supply chain perspective."
- **LO1-5** Identify the partners and functional groups that work together in operations management.
- **LO1-6** Define the planning activities associated with managing operations across the supply chain.

2

It Takes More than Cool Products to Make Apple Great

Apple often receives praise for its user-friendly and aesthetically pleasing product designs. But a less well-known contributor to Apple's success is its prowess in managing operations across its supply chain. This is the world of manufacturing, procurement, and logistics in which the chief executive officer, Tim Cook, excelled, earning him the trust of Steve Jobs. Apple has built a closed ecosystem where it exerts control over nearly every piece of the supply chain, from design to retail store. "Operations expertise is as big an asset for Apple as product innovation or marketing," says Mike Fawkes, the former supply-chain chief at Hewlett-Packard. "They've taken operational excellence to a level never seen before."

This operational edge is what enables Apple to handle massive product launches without having to maintain large, profit-sapping inventories. It's allowed a company often criticized for high prices to sell its iPad at a price that very few rivals can beat, while still earning a 25 percent margin on the device. Some of the basic elements of Apple's operational strategy include:

- Capitalize on volume. Because of its buying power, Apple gets big discounts on parts, manufacturing capacity, and air freight.
- Work closely with suppliers. Apple design guru Jony Ive and his engineers sometimes spend months living out of hotel rooms in order to be close to suppliers and manufacturers, helping to tweak the industrial processes and tools that translate prototypes into mass-produced devices.
- Focus on a few product lines, with little customization. Apple's unified strategy allows it to eliminate complexity and cost, while maximizing volume-based economies in its supply chain.
- Ensure supply availability and low prices. Apple makes big upfront payments to suppliers to lock in their capacity and to limit options for competitors.
- Keep a close eye on demand. By selling through its own retail stores, Apple can track demand by the store and by the hour; then it adjusts sales forecasts and production plans daily to respond quickly to demand changes.

Apple designs cool products. But its enormous profit margins—two to four times the profit margins of most other hardware companies—come in large part from its priority and focus on operations management.

Key Terms

Key terms are presented in bold and defined in the margin as they are introduced. A list of chapter key terms is also available at the end of the chapter.

Because most firms deliver products that involve both goods and services, operations managers recognize the importance of delivering a **total product experience**. This term refers to all of the outputs of an operation, both goods and services, that are combined to define a customer's complete consumption experience. The experience includes all aspects of purchasing, consuming, and disposing of the product.

total product experience All the goods and services that are combined to define a customer's complete consumption experience.

Prepare/Organize

A systematic approach to new material provides a learning framework. Every main topic in the chapter includes a Prepare section that asks a question designed to orient students to what will be covered in that section, followed by an Organize section that provides an outline of the material. Together they offer a framework and brief preview of the material that follows in the reading. These are also intended to be helpful as a quick reference and pointer to students as they review for quizzes or exams.

VIEWING OPERATIONS MANAGEMENT FROM A SUPPLY CHAIN MANAGEMENT PERSPECTIVE

We began this chapter by noting that operations managers must coordinate a system of activities both inside and outside their firm's boundaries. The network of organizations that contains this system of activities is often referred to as a *supply chain.* So how then is "supply chain management" different from "operations management"?

Supply chain management is the design and execution of relationships and flows that connect the parties and processes across a supply chain. Recall that our definition of *operations management* is the management of processes used to design, supply, produce, and deliver valuable goods and services to customers.

As you can see, there is a substantial degree of overlap between the two definitions. Operations management focuses on managing *processes* (design, supply, production, delivery); supply chain management focuses on managing *relationships* and *flows* (flows of information, materials, energy, money, and people). Think of supply chain management as a way of viewing operations management. You can also think of the supply chain as a network of organizations in which operations activities are conducted.

Prepare

What does it mean to view operations management from a supply chain perspective?

Organize

Viewing Operations Management from a Supply Chain Management Perspective

- Operations Management Partners Across the Supply Chain
- Cross-Functional Relationships in Operations Management
- The Changing Nature of Supply Chains
- Levels of Operational Planning Across the Supply Chain

Student Activity

Students are asked to do a personal activity that illustrates the concept being presented or covered, thereby helping them learn to apply the concepts and understand them more deeply.

student activity

Think of the last time you visited an amusement park (like Disney World). How many different goods and services did you consume as a part of your overall experience? How many of these products were "pure" goods and "pure" services? Which of these products was prepared before you ordered it, versus being prepared at the very time that you ordered it?

Numbered Examples

Numbered examples are integrated into chapters where analytic techniques are introduced. Students learn how to solve specific problems step-by-step and gain insight into general principles by seeing how they are applied.

EXAMPLE 3-1

A distribution center for an Internet bookseller can handle a peak demand of 200,000 orders in a single day, under ideal conditions. However, the facility was designed to handle up to 120,000 orders per day during normal operating conditions. Orders processed for the first two weeks of December averaged 150,000 per day. Calculate the utilization of the distribution center relative to both maximum capacity and effective capacity.

SOLUTION

Maximum capacity = 200,000 orders per day

Effective capacity = 120,000 orders per day

Actual orders = 150,000 orders per day

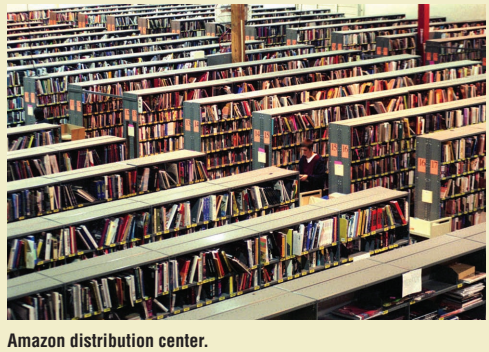
Utilization of maximum capacity = (150,000/200,000) × 100% = 75%

Utilization of effective capacity = (150,000/120,000) × 100% = 125%

This example illustrates that the Internet bookseller can accommodate high periods of demand by utilizing maximum capacity (e.g., by using overtime work) in the short run. However, if this high demand continued for more than a few weeks, it should consider increasing its effective capacity by expanding its distribution center and/or hiring more workers.

Figures and Photos

The text includes photographs and graphic illustrations to support student study and provide interest and motivation.



Amazon distribution center.

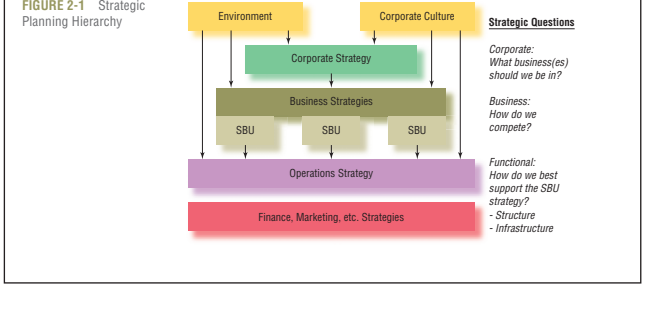


FIGURE 2-1 Strategic Planning Hierarchy

Get Real Boxes

Throughout the chapters, readings highlight important real-world applications. They provide examples of operations issues and offer a picture of the concepts in practice. These also provide a basis for classroom discussion and generate interest in the subject matter.

GET REAL

Storyboarding: The Key to Success at Pixar

Few people can deny the success of Pixar. This company has the enviable record of a string of hit movies, including *Toy Story, A Bug's Life, Finding Nemo, The Incredibles, Cars, Toy Story 2, WALL-E, Up,*—and Pixar's latest hit—*Brave.* Critical to this success is the practice of storyboarding. Storyboarding was first developed at the Walt Disney studio during the early 1930s. It involves developing a series of illustrations displayed in sequence for the purposes of previsualizing a motion graphic or media sequence. It allows users to experiment with changes in storylines to evoke stronger reactions or interest. It also facilitates brainstorming. Pixar has adapted this process to fit with computer animation. A storyboard is the blueprint of the movie, beginning with the concept and ending with the finished product. One of the reasons that Pixar has been so successful is that they focus intensely on this practice. About three-quarters of the film's development at Pixar is spent in the story and in the storyboard. To better understand this process, see www.pixar.com/howwedoit/index.html.

Logos

Logos are included throughout the text to point out relevant applications of relationships, sustainability, and global issues.

Since most organizations have supply chains that reach beyond a single country, we examine global issues associated with operations and supply chain management.

global

Organizations must collaborate with customers and suppliers to accomplish many operations activities. Thus, the book showcases how to build, maintain, and benefit from cross-functional and interorganizational relationships.

relationships

To reduce costs and be competitive, organizations today must adopt sustainable business practices. In fact, we expect sustainability to become a key metric for operations and supply chain management performance.

sustainability

END-OF-CHAPTER RESOURCES

For student study and review, the following items are provided at the end of each chapter:

Chapter Summary Chapters contain summaries that provide an overview of the material covered.

CHAPTER SUMMARY

Processes are the critical building blocks of operations across the supply chain. The importance of processes is emphasized in the following critical lessons:

1. Every business is defined by its various processes. These processes determine capabilities including what the organization can and cannot do regarding the types of product value delivered to customers.
2. A process is a collection of activities that uses resources to convert various inputs into outputs that customers value. Inputs used by processes include materials, energy, information, management, technology, and labor. Outputs consist of products, information, and experiences.
3. Processes are characterized by activities (i.e., operations, decisions, storage, transportation, delays, and inspections), flows (inputs and outputs), structures (organization schemes of activities), resources, and metrics.

Key Terms Key terms are highlighted in the text, and then repeated at the end of the chapter with page references.

KEY TERMS

bottlenecks 67
capacity 62
cycle time 69
Juran's Law 59
learning curve 66
Little's Law 68
serial/sequential structure 67
storage (inventory/store) 60

Discussion Questions Each chapter has a list of discussion questions. These are intended to serve as a student self-review or as class discussion starters.

DISCUSSION QUESTIONS

1. Describe the various operations within an amusement park that are most likely to become a bottleneck. How might an amusement park influence demand to better fit available capacity?
2. What are the primary resources that determine the capacity of each of the following?
   a. A grocery store.
   b. A hospital emergency room.
   c. A company that assembles appliances.
3. How can a university attain economies of scale? What impact might this have on quality and flexibility?
4. How would you define the maximum capacity for the front desk of a hotel? What is meant by the effective capacity? Define the difference in these two terms relative to

Solved Problems Solved problems are provided to illustrate problem solving and the main concepts in the chapter. These have been carefully prepared to enhance student understanding as well as to provide additional examples of problem solving.

SOLVED PROBLEM

Suppose you have been asked to determine the return on net worth for Great Northwest Canoe and Kayak, a small manufacturer of kayaks and canoes, located near Seattle, Washington. For this task, you have been given the following information:

Categories	Values
Sales	$32,000,000
Cost of goods sold	$20,000,000
Variable expenses	$ 4,000,000
Fixed expenses	$ 6,000,000
Inventory	$ 8,000,000

Problems Each chapter includes a set of problems for assignment. The problems are intended to be challenging but doable for students.

PROBLEMS

1. Given the following information:

Categories	Values
Sales	$48,000,000
Cost of goods sold	$24,000,000
Variable expenses	$ 8,000,000
Fixed expenses	$ 8,000,000
Inventory	$ 6,000,000
Accounts receivable	$ 3,000,000
Other current assets	$ 4,000,000
Fixed assets	$10,000,000

   a. What is the net profit margin for this firm?
   b. What is the asset turnover?
   c. What is the return on assets?

Cases The text includes short cases for most chapters. The cases were selected to provide a broader, more integrated thinking opportunity for students without taking a full "case" approach.

CASE

Otis Toy Trains Explores the Supply Chain

Otis Toy Trains of Minneapolis, Minnesota, was a landmark company in the toy business. Since the 1900s, it had been responsible for building electrical and steam-driven toy trains. Since the 1950s, Otis trains had developed a major presence on children's television shows. Every person (especially boys) knew about Otis toy trains and nearly everyone wanted one. For many kids growing up in the 1960s to the 1980s, waking up on Christmas day and finding an Otis toy train set under the tree was a dream come true. However, the 1990s had not been good to Otis Toy Trains. The preferences of many children had changed. (a train model based on the train coaches that were used to transport the body of the recently assassinated President Lincoln from Washington, DC, to Springfield, IL, for final burial), the Zephyr (the famous streamlined train that ran between Chicago and Denver during the 1930s), and the Orange Blossom Special. Launched in limited numbers, this first series was an unqualified success. Subsequent launches were almost as successful. Over this time, the designers at Otis Toy Trains developed and refined the skill of identifying attractive train series and of designing products that were detailed, attractive, accurate, and highly

INSTRUCTOR RESOURCES

Online Learning Center (OLC) www.mhhe.com/swink2e

The Online Learning Center provides complete materials for study and review. At this book's Web site, instructors have access to teaching supports such as electronic files of the ancillary materials: Solutions Manual, Instructor's Manual, PowerPoint Lecture Slides, Digital Image Library, and Test Bank.

Instructor's Manual. Prepared by Laura Meade, Texas Christian University, this manual includes teaching notes, chapter overview, and an outline for each chapter.

Solutions Manual. Prepared by the authors, this manual contains solutions to all the end-of-chapter problems and cases.

Test Bank. Prepared by the authors, the Test Bank includes true/false, multiple-choice, and discussion questions/problems at varying levels of difficulty.

EZ Test Online. All test bank questions are available in EZ Test Online, a flexible electronic testing program. The answers to all questions are given, along with a rating of the level of difficulty, chapter learning objective met, Bloom's taxonomy question type, and the AACSB knowledge category.

PowerPoint Lecture Slides. The PowerPoint slides draw on the highlights of each chapter and provide an opportunity for the instructor to emphasize the key concepts in class discussions.

Digital Image Library. All the figures in the book are included for insertion in PowerPoint slides or for class discussion.

Operations Management Video Series

The operations management video series, free to text adopters, includes professionally developed videos showing students real applications of key manufacturing and service topics in real companies. Each segment includes on-site or plant footage, interviews with company managers, and focused presentations of OM applications in use to help the companies gain competitive advantage. Companies such as Zappos, FedEx, Subaru, Disney, BP, Chase Bank, DHL, Louisville Slugger, McDonald's, Noodles, and Honda are featured.

STUDENT RESOURCES

Online Learning Center (OLC) www.mhhe.com/swink2e

Students have access to study materials created specifically for the text.

- Quizzes—self-grading to assess knowledge of the material.
- PowerPoint Slides—give an overview of the chapter content.
- Excel Data Files—import into Excel for quick calculation and analysis.
- Study Outlines—provide a framework for taking notes.

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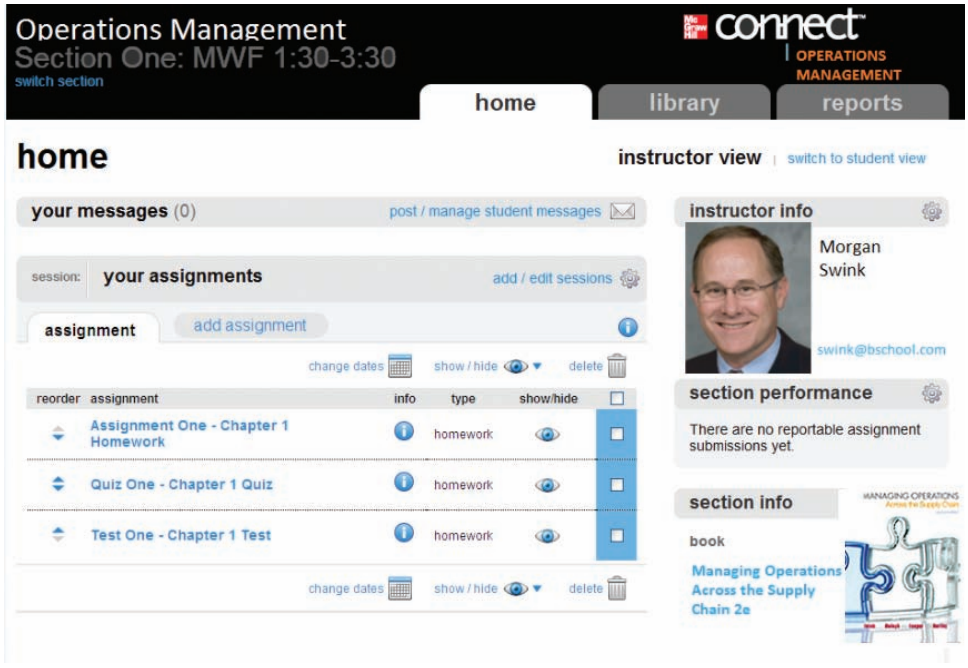
TECHNOLOGY

McGraw-Hill *Connect*® *Operations Management*

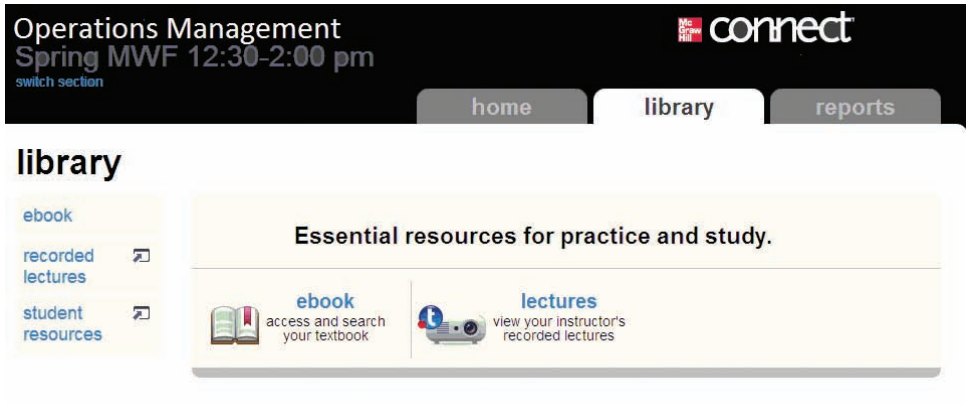
McGraw-Hill *Connect*® *Operations Management* is an online assignment and assessment solution that connects students with the tools and resources they'll need to achieve success through faster learning, higher retention, and more efficient studying. It provides instructors with tools to quickly pick content and assignments according to the topics they want to emphasize.

Online Assignments. *Connect Operations Management* helps students learn more efficiently by providing practice material and feedback when they are needed. *Connect* grades homework automatically and provides feedback on any questions that students may have missed.



Integration of Excel Data Sets. A convenient feature is the inclusion of an Excel data file link in many problems using data files in their calculation. The link allows students to easily launch into Excel, work the problem, and return to *Connect* to key in the answer.

Student Resource Library. The *Connect Business Statistics* Student Library is the place for students to access additional resources. The Student Library provides quick access to recorded lectures, practice materials, eBooks, and more.



Guided Examples. These narrated video walkthroughs provide students with step-by-step guidelines for solving problems similar to those contained in the text. The student is given personalized instruction on how to solve a problem by applying the concepts presented in the chapter. The narrated voiceover shows the steps to take to work through an exercise. Students can go through each example multiple times if needed.

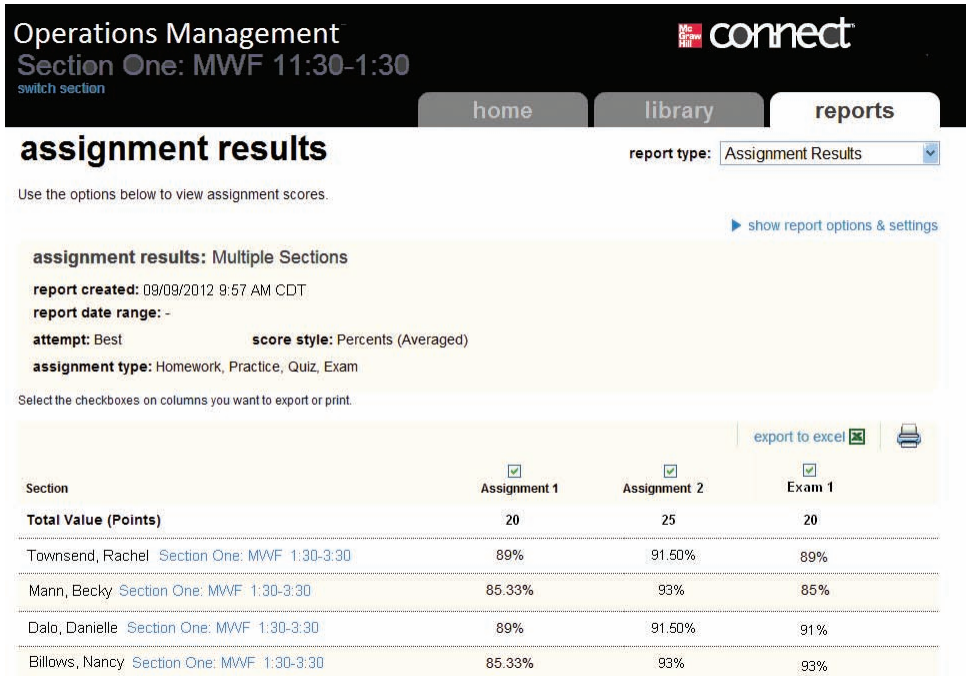
LearnSmart. LearnSmart adaptive self-study technology with *Connect Operations Management* helps students make the best use of their study time. LearnSmart provides a seamless combination of practice, assessment, and remediation for every concept in the textbook. LearnSmart's intelligent software adapts to students by supplying questions on a new concept when students are ready to learn it. With LearnSmart students will spend less time on topics they understand and instead focus on the topics they need to master.

Simple Assignment Management and Smart Grading. When it comes to studying, time is precious. *Connect Operations Management* helps students learn more efficiently by providing feedback and practice material when they need it, where they need it. When it comes to teaching, your time also is precious. The grading function enables you to:

- Have assignments scored automatically, giving students immediate feedback on their work and side-by-side comparisons with correct answers.
- Access and review each response; manually change grades or leave comments for students to review.

Student Reporting. *Connect Operations Management* keeps instructors informed about how each student, section, and class is performing, allowing for more productive use of lecture and office hours. The progress-tracking function enables you to:

- View scored work immediately (Add Assignment Results Screen) and track individual or group performance with assignment and grade reports.
- Access an instant view of student or class performance relative to learning objectives.
- Collect data and generate reports required by many accreditation organizations, such as AACSB.



Instructor Library. The *Connect Operations Management* Instructor Library is your repository for additional resources to improve student engagement in and out of class. You can select and use any asset that enhances your lecture. The *Connect Business Statistics* Instructor Library includes:

- eBook
- PowerPoint presentations
- Test Bank
- Instructor's Solutions Manual
- Digital Image Library

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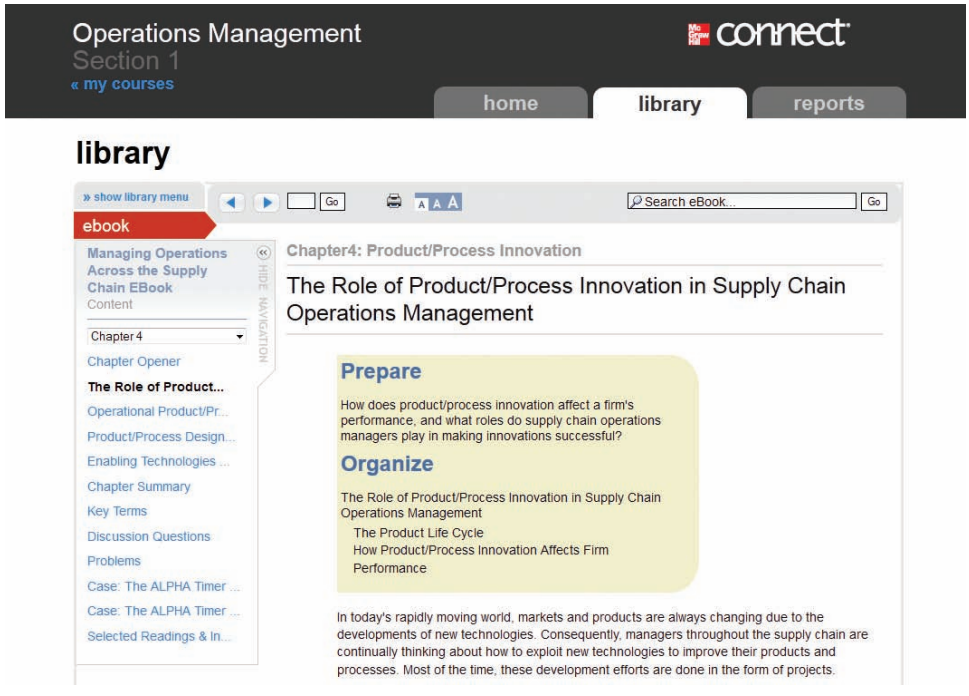

Dynamic Links. Dynamic links between the problems or questions you assign to your students and the location in the eBook where that problem or question is covered.

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Chapter-by-Chapter Revisions for Second Edition

In this major revision to the book, we made many specific changes to the chapters; the larger changes are highlighted for each chapter below. Overall, we enhanced the discussion of sustainability issues throughout the book, including a new chapter focused on this topic (Chapter 16). We updated or replaced most of the opening vignettes and Get Real stories throughout the book. We added about 30 percent more practice problems, as well as more solved problems and examples. And we added at least one new case to almost every chapter.

Chapter 1: Introduction to Managing Operations Across the Supply Chain

- New opening vignette on Apple supply chain.
- Made stronger linkages of operations to other functions, economies, and business success.
- Incorporated deeper discussion of sustainability issues.

Chapter 2: Operations and Supply Chain Strategy

- New opening vignette on HBO and content.
- Greater integration of the business model.
- More extensive discussion of sustainability, including the triple bottom line.

Chapter 3 and 3S: Managing Processes and Capacity

- New opening vignette–Changes in the dry cleaning industry and the role of Tide.
- Updated the stories.
- More extensive discussion of metrics and performance measurement.
- Introduction of new material such as swim lanes into the process analysis section.
- Closer integration of capacity into the process discussion.

Chapter 4: Product/Process Innovation

- New opening vignette on the design and rollout of Coke "Freestyle" machines.
- Deeper explanations of product life cycle and innovation funnel.
- New **Get Real** describing Clorox and P&G codevelopment efforts.
- Added new case on QFD implementation.

Chapter 5: Manufacturing and Service Process Structures

- Moved capacity planning section to Chapter 3.
- Expanded the discussion of the use of technology in operations and the supply chain.
- Added a case to allow students to apply line balancing and service blueprinting.

Chapter 6: Managing Quality

- New **Get Real** box on food safety in the supply chain.
- Updated **Get Real** box comparing cost of quality in manufacturing and services.
- New section on industry interpretations of ISO 9000.
- New "Aqua-Fun" case emphasizing cost of quality.

Chapter 6 Supplement: Quality Improvement Tools

- Improved discussion of C_p and C_{pk}.
- Inclusion of p attribute control charts.
- Revised cause-and-effect analysis.

Chapter 7: Managing Inventories

- Formerly titled "Understanding Inventory Fundamentals," the material from the first edition's Chapter 14 (titled "Independent Demand Inventory Planning") has been incorporated into this chapter to provide comprehensive coverage in a single chapter.
- New opening vignette describing inventory management's impact at PolyOne Corp.
- Added discussion on causes of the bullwhip effect.
- Added new case requiring analysis of alternative safety stock policies.

Chapter 8: Lean Systems

- Expanded discussion of waste and the categories of waste.
- Expanded discussion of the various techniques (e.g., kanban scheduling).

- Expansion of the application of lean systems to include the service environment (i.e., lean services).
- Examples updated.

Chapter 9: Customer Service Management

- Title changed from "Customer Management."
- Expanded discussion of basic service to differentiate more clearly the differences in fill rate measurements.
- New **Get Real** stories describing Procter & Gamble's changes in measuring service performance and Tesco's "virtual store."
- Added new case to allow students to analyze customer service policies for different segments.

Chapter 10: Sourcing and Supply Management

- Increased the focus on sustainability.
- Updated the content to include contemporary topics such as low-cost country sourcing and nearshoring.
- Added an insourcing/outsourcing solved problem and additional homework problems.

Chapter 11: Logistics Management

- New opening vignette about Starbucks and its logistical challenges.
- Updated data on logistics cost.
- Revised table on freight modes and market share.
- Added discussion of transportation's impact on the environment, including a table showing greenhouse emissions by transportation mode.
- Replaced **Get Real** stories about True Value and Urban Outfitters with more up-to-date examples of Tuesday Morning and Dots.com.
- New case allowing students to analyze proposals from transportation carriers in terms of both cost and service.

Chapter 12: Demand Planning: Forecasting and Demand Management

- Reordered and clarified discussion of various forecasting methods.
- Incorporated material from Chapter 12 supplement directly into the chapter.

Chapter 13: Sales and Operations Planning

- New **Get Real** story (Whirlpool and Lowe's integrated planning process).
- Added content in comparing alternative production strategies, including ethical considerations and differences in make-to-stock vs. make-to-order.
- Added a case on aggregate planning in a professional law practice.

Old Chapter 14: Independent Demand Inventory Planning

- Merged material into Chapter 7.

Chapter 14 (was Chapter 15): Materials and Resource Requirements Planning

- Reorganized so that Master Production Scheduling (MPS) precedes Bill of Materials (BOM).
- Added a solved problem and problems.
- Added a case on ERP implementation.

Chapter 15 and 15S (was Chapter 16): Project Management

- Extended discussion of project execution, metrics, and termination.
- New case on planning a European tour.
- Enhanced discussion of probabilistic methods.

Chapter 16: Sustainable Operations Management—Preparing for the Future

- New chapter focused on the triune concerns of sustainability.
  - Business sustainability
  - Environmental sustainability
  - Social responsibility
- A more comprehensive discussion of environmental sustainability (what it involves, why it is emphasized now) and its implications for operations management.
- A broader discussion of social responsibility and how social pressures affect operations management decisions.
- A discussion of how change requires that business models must be continuously renewed.

Brief Contents

Contents

PART 1

SUPPLY CHAIN: A PERSPECTIVE FOR OPERATIONS MANAGEMENT

		relationships	sustainability	global
1	Introduction to Managing Operations Across the Supply Chain	X	X	X
2	Operations and Supply Chain Strategy	X	X	X

What is operations management? Have you ever stopped to consider all of the "nuts and bolts" of how organizations (business and not-for-profit) deliver goods and services to their customers? Think of all the details that must be managed to develop product concepts, to identify sources for raw materials, to decide how products will be made and delivered, and to establish how to serve customers. Operations management includes all of these types of decisions:

> Operations mangement is the management of processes used to design, supply, produce, and deliver valuable goods and services to customers.

In Part 1, *Supply Chain: A Perspective for Operations Management,* we define the scope of operations management as well as its strategic role. **Chapter 1** explains what operations management is and why it is important for all managers (accounting, marketing, finance, and other managers) to understand the basics of this management discipline. **Chapter 1** also introduces an important perspective, the *supply chain,* as a way to think about how to coordinate operational activities across different organizations. **Chapter 2** describes how strategic choices in operations management relate to an organization's overall objectives and to choices made in marketing, finance, and other functional areas. In addition, **Chapter 2** explains how to increase competitiveness through effective operations, and finally how to measure the effectiveness of operations activities.

1 Introduction to Managing Operations Across the Supply Chain

CHAPTER OUTLINE

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

LO1-1 Explain what operations management is and why it is important.

LO1-2 Describe the major decisions that operations managers typically make.

LO1-3 Explain the role of processes and "process thinking" in operations management.

LO1-4 Explain what the supply chain is and what it means to view operations management using a "supply chain perspective."

LO1-5 Identify the partners and functional groups that work together in operations management.

LO1-6 Define the planning activities associated with managing operations across the supply chain.

It Takes More than Cool Products to Make Apple Great

Apple often receives praise for its user-friendly and aesthetically pleasing product designs. But a less well-known contributor to Apple's success is its prowess in managing operations across its supply chain. This is the world of manufacturing, procurement, and logistics in which the chief executive officer, Tim Cook, excelled, earning him the trust of Steve Jobs. Apple has built a closed ecosystem where it exerts control over nearly every piece of the supply chain, from design to retail store. "Operations expertise is as big an asset for Apple as product innovation or marketing," says Mike Fawkes, the former supply-chain chief at Hewlett-Packard. "They've taken operational excellence to a level never seen before."

This operational edge is what enables Apple to handle massive product launches without having to maintain large, profit-sapping inventories. It's allowed a company often criticized for high prices to sell its iPad at a price that very few rivals can beat, while still earning a 25 percent margin on the device. Some of the basic elements of Apple's operational strategy include:

- Capitalize on volume. Because of its buying power, Apple gets big discounts on parts, manufacturing capacity, and air freight.
- Work closely with suppliers. Apple design guru Jony Ive and his engineers sometimes spend months living out of hotel rooms in order to be close to suppliers and manufacturers, helping to tweak the industrial processes and tools that translate prototypes into mass-produced devices.
- Focus on a few product lines, with little customization. Apple's unified strategy allows it to eliminate complexity and cost, while maximizing volume-based economies in its supply chain.
- Ensure supply availability and low prices. Apple makes big upfront payments to suppliers to lock in their capacity and to limit options for competitors.
- Keep a close eye on demand. By selling through its own retail stores, Apple can track demand by the store and by the hour; then it adjusts sales forecasts and production plans daily to respond quickly to demand changes.

Apple designs cool products. But its enormous profit margins—two to four times the profit margins of most other hardware companies—come in large part from its priority and focus on operations management.

This book, *Managing Operations Across the Supply Chain,* will help you to study "operations management" using a "supply chain" perspective. This perspective means that we will examine operational activities that take place *within firms* as well those *that cross firms' boundaries,* involving suppliers and customers of all types. This larger network of organizations makes up a firm's *supply chain.*

The Apple story illustrates the value of this broad perspective of operations management. The combination of excellence in both internal product design operations and external supply chain operations management makes Apple a dominant player in its industry. Operations management by definition spans a large number of activities that take place both inside and outside the business firm.

Prepare

What is operations management, and what is the supply chain?

Organize

A Broad Definition of Supply Chain Operations Management

- Important Decisions in Supply Chain Operations Management
- Differences in Goods and Services Operations
- Processes and Process Thinking

A BROAD DEFINITION OF SUPPLY CHAIN OPERATIONS MANAGEMENT

Operations management is the management of processes used to design, supply, produce, and deliver valuable goods and services to customers.

Operations management includes the planning and execution of tasks that may be long-term (yearly) or short-term (daily) in nature. Operations managers interact with managers in other business functions, both inside and outside the operations managers' own company. Operations management thus spans the boundaries of any single firm, bringing together the activities of internal operations (i.e., internal to a given company) with the operations of customers, suppliers, and other partners around the world. In the future, operations located around the globe will be even more tightly interconnected than they are today. The supply chain concept can be used to describe connections among business partners.

A **supply chain** is the global network of organizations and activities involved in (1) designing a set of goods and services and their related processes, (2) transforming inputs into goods and services, (3) consuming these goods and services, and (4) disposing of these goods and services.

operations management The management of processes used to design, supply, produce, and deliver valuable goods and services to customers.

supply chain The global network of organizations and activities involved in designing, transforming, consuming, and disposing of goods and services.

Think about all the different organizations located in different companies that are involved in converting raw materials into a delivered finished product. Dozens of organizations are involved in producing and delivering even a simple product like bottled water. Together, supply chain organizations perform all the value-creating activities required to innovate, plan, source, make, deliver, and return or dispose of a given set of products and services.[1] Other terms sometimes substituted for *supply chain* include *demand chain, extended enterprise, supply network,* or *supply web.* All of these terms reflect the idea that a supply chain involves connections and relationships among organizations that play various roles for a given set of products.

LO1-1 Explain what operations management is and why it is important.

Operations management activities located throughout a supply chain create and enhance the value of goods and services by increasing their economic value (e.g., lowering delivered cost), functional value (e.g., improving product quality or convenience), and psychosocial value (e.g., improving product aesthetics and desirability). The following statements help define and describe operations management:

- Operations management is mainly concerned with how resources will be developed and used to accomplish business goals.
- Operations management is about designing, executing, and improving business processes.
- Operations management deals with processes that transform inputs including materials, information, energy, money, and even people into goods and services.
- Within a supply chain context, operations management brings together four major sets of players: the firm, customers, suppliers, and stakeholders.

[1]Supply Chain Council, *Integrated Supply Chain Performance Measurement: A Multi-Industry Consortium Recommendation,* Supply Chain Council Report #5566, p. 1.

- To be effective, operations management must be consistent with the strategic goals of the firm.
- Operations management is dynamic because of changes in customers' demands, resources, competition, and technologies.

relationships

To work in this increasingly interconnected world, you will need to understand the foundational concepts, functional groups, and integrated activities involved in managing operations located across a supply chain. The Get Real box below describes why operations management is important to all of us.

Even if you do not pursue a career in operations management, it will be important for you to understand and appreciate the fundamental challenges associated with managing operations well. First, the decisions you make as a worker in marketing, finance, accounting, human resources, or other areas will have an impact on, and be impacted by, operations. For example, suppose that you work in a hotel where managers want to buy new kiosks that will allow guests to check themselves into the hotel. The effects of this decision extend beyond operational issues such as labor costs and efficiency. The decision will also have implications for the use of capital (a finance concern), the type of

Automated check-in kiosks at a hotel.

GET REAL

Why You Need to Study Operations Management

Because it matters to people:

Operations management plays an important role in determining the quality of life for people around the world. New operational practices and technologies continue to radically improve the effectiveness of governments, not-for-profit institutions, and businesses in providing goods and services. Operations management also directly impacts sustainability issues including the environment, fair treatment of people, and safety. In doing so, operations management affects social systems and cultural norms, as well as the basic economic prosperity of people everywhere. Consider how your own life is affected. The speed with which organizations provide services to you determines the amount of leisure time you have. In an emergency, the speed and efficiency of a relief organization might even save your life. The cost and quality of products you consume affects your disposable income, your health, even your outlook on life. You can probably think of a good service experience that put a smile on your face, or a bad one that ruined your day! As an operations manager, you may someday have the opportunity and responsibility to positively affect your organization's success. In doing so, you may also be improving the quality of life of the firm's employees, its customers, and even society as a whole.

Because it matters to organizations:

Every product or service offering is a promise of some kind of benefit for someone. Organizations are successful only when they can consistently deliver upon the promises that they make. Operations management determines how well such promises are fulfilled. Research shows that operationally excellent organizations consistently outperform their rivals in financial and other terms. For example, a recent study[1] showed that companies possessing excellent supply chain operations outperformed their nearest competitors in the following ways:

- 50 percent higher net profit margins
- 20 percent lower sales, general & administration (SG&A) expenses
- 12 percent lower average inventories
- 30 percent less working capital expenses
- Twice the return on assets (ROA)
- Twice the return on equity (ROE)
- 44 percent higher economic value added
- Twice the returns on stock prices
- 2.4 times the risk-weighted stock returns
- 46 percent greater market-value-to-assets ratio

These differences in performance are truly stunning, and highlight the important contributions that operations management makes to the financial well-being of a firm.

[1]M. L. Swink, R. Golecha, and T. Richardson, "Does Becoming a Top Supply Chain Company Really Pay Off? An Analysis of Top SCM Companies and Their Rivals," *Supply Chain Management Review,* March 2010, pp. 14–21.

service provided to customers (a marketing concern), and the training of employees (a human resource management concern). Managers of various functions cannot work in isolation if they hope to make decisions that are good for the overall success of the firm. Second, all activities, including marketing, finance, accounting, and so on, have operational elements to them. For example, think about the operational processes required to run a sales office. Managers in all functions need to understand the principles of operations management in order to keep their functional processes running effectively and efficiently.

Important Decisions in Supply Chain Operations Management

LO1-2 Describe the major decisions that operations managers typically make.

Operations managers get involved in answering certain questions, namely:

What?

- What types of activities and what types of goods or services are to be delivered by the system?
- What product features do our intended customers care about?
- What activities and resources are needed, and how should they be developed, allocated, and controlled?

How?

- How is the good or service to be designed, made, and delivered?
- How much should our transformation process be able to deliver (and under what conditions)?
- How should we measure and assess performance?

When?

- When should products be made, activities be carried out, services be delivered, or capacities/facilities come on line?

Where and Who?

- Where should certain activities be done, and who should do them: suppliers, partners, or the firm?

Operations managers answer these questions by defining both the structural and infrastructural aspects of the operations management system. Structural decisions affect physical resources such as capacity, facilities, technology, and the supply chain network. Once made, decisions in these areas determine what the operations management system can and cannot do well. Altering these decisions often requires significant investments and lots of time—often years. Infrastructural decisions affect the workforce, production planning and control, process innovation, and organization. Decisions in these areas determine what is done, when it is done, and who does it. Decisions in all of these areas are interrelated, making operations management a complex and cross-functional activity.

relationships

Differences in Goods and Services Operations

Operational activities exist in order to produce tangible goods and intangible services. Books, cars, and televisions are all tangible goods. In contrast, services like health care, banking, and entertainment are largely experiential or informational. For example, at a hair salon, you *consume* the expertise and labor of the hair stylist as part of the experience of getting a haircut. The experiences and information you receive at school form a service called *education.* Table 1-1 summarizes some of the important differences between goods and services.

Some businesses are mostly about producing goods (e.g., production of gasoline), and some are mostly about delivering services (e.g., financial consulting). However, most businesses integrate a mix of goods-producing and service-producing operations activities.

TABLE 1-1 Characteristics of Goods and Services

Goods	Services
Tangible	Intangible
Can be inventoried	Cannot be inventoried
Little customer contact (consumption is often separate from production)	Extensive customer contact (simultaneous production and consumption)
Long lead times	Short lead times
Often capital-intensive	Often labor-intensive
Quality easily assessed	Quality more difficult to assess (more perceptual)
Material is transformed	Information or the customer is transformed

There are key structural differences in operational processes designed to provide mostly goods versus mostly services. Chapter 5 discusses these differences in depth, but we will highlight a few important ones here. First, goods can be produced in advance and stored in inventory until a customer buys or consumes them. Since services are intangible, they cannot be stored. The production and consumption of a service usually occur at the same time. While goods-manufacturing operations can use inventory to smooth out imbalances between production capacity and customer demand, a producer of services must maintain enough capacity to meet demand during peak periods; otherwise, it must postpone (backlog) the demand. For example, when you go into a restaurant during its busy time and the greeter asks you to wait in the lounge, you become part of a backlog of demand. Service operations managers often use reservation and appointment systems to help customers avoid long wait times.

In services, customers frequently can observe the operational processes directly. In fact, the customer may take part in producing and consuming the service at the same time (think of your roles as codesigner and quality inspector in getting a haircut). On the other hand, the production of goods may require little contact with the customer.

Finally, operations managers can easily establish measurable quality standards for tangible goods to evaluate whether they work adequately, how they appear, and so on. Quality control is more difficult for services, as it is not always easy to objectively measure a service product's attributes. Service operations managers often evaluate both methods of delivery and customer perceptions. For example, a quality control inspector for a movie theater might study how workers interact with customers as they sell tickets or food to customers. In addition, they may periodically survey customers to gauge their levels of satisfaction.

student activity

Think of the last time you visited an amusement park (like Disney World). How many different goods and services did you consume as a part of your overall experience? How many of these products were "pure" goods and "pure" services? Which of these products was prepared before you ordered it, versus being prepared at the very time that you ordered it?

In reality, there are very few pure goods and pure services. Most manufactured products also include services. When you buy a new car, for example, you may also buy financing, maintenance, and repair services. Many service products also include tangible items. A hospital, for example, provides medicines and bandages along with intangible diagnostic and treatment services.

Because most firms deliver products that involve both goods and services, operations managers recognize the importance of delivering a **total product experience**. This term refers to all of the outputs of an operation, both goods and services, that are combined to define a customer's complete consumption experience. The experience includes all aspects of purchasing, consuming, and disposing of the product.

total product experience All the goods and services that are combined to define a customer's complete consumption experience.

Processes and Process Thinking

process A system of activities that transforms inputs into valuable outputs.

LO1-3 Explain the role of processes and "process thinking" in operations management.

Operations management is a *process*-oriented discipline. What, then, is a **process**? It is a system of activities that *transforms* inputs into valuable outputs. Processes use resources (workers, machines, money, and knowledge) to transform inputs (such as materials, energy, money, people, and data) into outputs (goods and services). For example, one uses a grill (a resource) and heat (an input) to convert a raw hamburger patty (an input) into a cooked hamburger (an output).

Processes can also transform information, or even people (customers), from one condition into another. In decision making, for example, managers transform data into actionable information and decisions. Think about how you are "transformed" by going to a movie—this is a process in which you are both an input and an output! Other processes transform things by transporting them from one location to another, or by storing them (e.g., a warehouse stores finished goods). Finally, some activities check or inspect work to make sure that it meets standards for quality, quantity, or timeliness.

Every organization can be described as a bundle of processes that connect different organizational groups. For example, companies use *design processes* to develop new goods and services and *strategic planning processes* to determine how the firm should compete. They use *production processes* to plan and execute the supply, manufacture, and delivery of goods and services to customers. Finally, companies use *evaluation processes* to measure and report how well they are meeting their goals or using their resources.

It is valuable to think about operations as *sets of processes and subprocesses* with many interrelationships and linkages. Consider the operations of an airport. There are flight-scheduling processes, ticketing processes, facilities-management processes, security processes, vendor-management processes, and on and on. The structure governing how these processes work together determines the ability of the airport to serve its customers.

We all have experienced organizations with complex, bureaucratic processes that seem incapable of providing a desired service in a timely manner. The design of a process should reflect what customers want. If customers want quick response, for example, then the process should be designed to be fast and flexible. In this case operations managers must identify and eliminate unnecessary or redundant steps, reduce distances between steps or activities, and diminish the time needed to complete each step. This connection between the process design and customers' desires must be maintained. If customers' desires change, then processes may also have to change.

An airport operation contains dozens of interrelated processes.

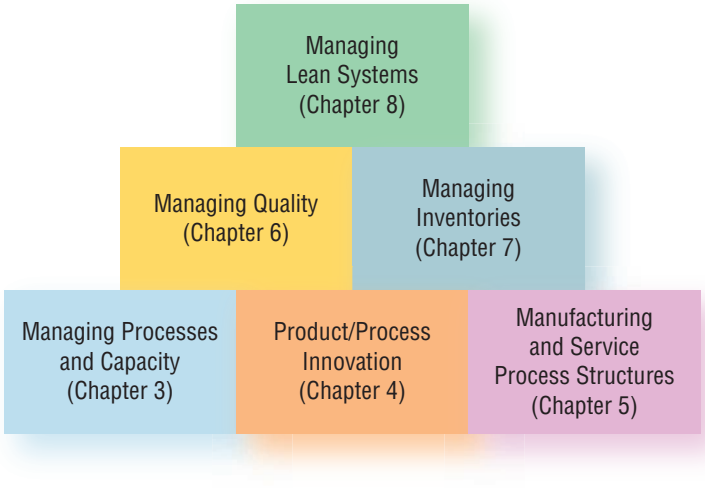

FIGURE 1-1
Foundational Concepts in Supply Chain Operations Management

Process thinking is so important that we have dedicated an entire section of this book to topics related to it. Figure 1-1 shows the conceptual building blocks of process thinking that are essential to the management of any operation. A separate chapter in this book addresses each building block. The bottom three blocks represent the foundational principles that describe how operational processes work, how product and process characteristics are intertwined, and how certain process structures are related to operational objectives. In order to make good decisions, operations managers need to understand the "physics" that govern processes, as well as understand how they relate to product design and development.

Building upon this foundational knowledge, operations managers can better understand how to make good decisions regarding product quality and the use of inventory (the second row of blocks in Figure 1-1). Product quality is a result of how people and technologies work together to execute processes. Inventory management can make processes more or less efficient, depending on whether the inventory is used wisely or unwisely.

The top block in Figure 1-1, "Managing Lean Systems," represents the application of all the aforementioned process-related concepts in ways that maximize the overall productivity of the operation. A **lean operation** produces maximum levels of efficiency and effectiveness using a minimal amount of resources.

lean operation An operation that produces maximum levels of efficiency and effectiveness using a minimal amount of resources.

OPERATIONS MANAGEMENT YESTERDAY AND TODAY: GROWTH OF THE SUPPLY CHAIN MANAGEMENT PERSPECTIVE

Prepare

Why has the supply chain perspective become important?

Organize

Operations Management Yesterday and Today: Growth of the Supply Chain Management Perspective

- Advances in Technology and Infrastructure
- Reduction in Governmental Barriers to Trade
- Focus on Core Capabilities
- Collaborative Networks

Many of the formal practices and concepts of operations management have their origins in the Industrial Revolution, which took place in the latter half of the 18th century. As an activity, however, operations management is much older. Signs of organized operations have been found in all ancient civilizations including Greece, Rome, and Egypt. Building the great pyramids was undoubtedly accomplished by means of organized operations, even if we don't know the exact nature of those operations.

Table 1-2 provides a brief history of operations management. Since the Industrial Revolution, modern operations management has evolved at different rates throughout the world. In America, the early 20th century witnessed a huge growth in demand and the rise of mass production. The latter half of the century was marked by standardization of operations practices and by fierce global competition. Today, continued globalization, the Internet, and numerous other technologies are radically transforming business operations.

The supply chain management perspective represents the latest technological shift in operations management. This now-dominant perspective is the result of certain forces in the marketplace, discussed below.

LO1-4 Explain what the supply chain is and what it means to view operations management using a "supply chain perspective."