

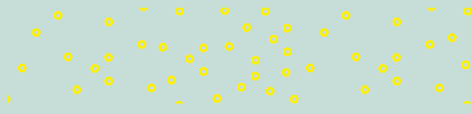
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FOURTH EDITION

Managing Operations Across the Supply Chain

SWINK | MELNYK | HARTLEY





Managing Operations

Across the Supply Chain

Fourth Edition

Morgan Swink

Texas Christian
University

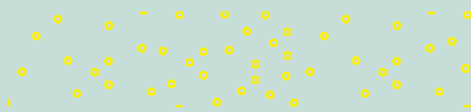
Steven A. Melnyk

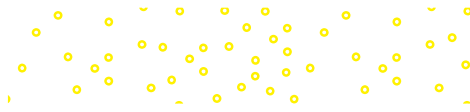
Michigan State University
University of Newcastle
(Australia)

Janet L. Hartley

Bowling Green State
University

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MANAGING OPERATIONS ACROSS THE SUPPLY CHAIN

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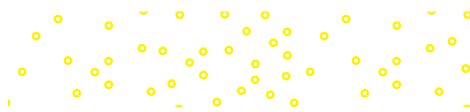
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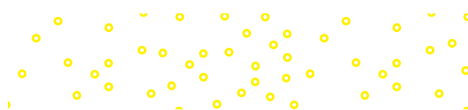
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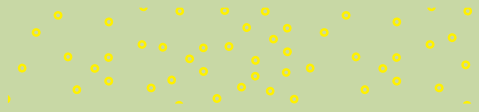
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Dedication

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 my colleagues in the United States (Dave Frayer, Randall Schaefer, Nick Little)
and in Australia (Jim Jose, Suzanne Ryan, Will Rifkin, Kevin Lyons).

To these people, this book is dedicated.

Steven A. Melnyk

To Glenn and Caleb, for their love and support.

Janet Hartley



About the Authors



Courtesy of Morgan Swink

Morgan Swink

is Professor, Eunice and James L. West Chair of Supply Chain Management, and Executive Director of the Center for Supply Chain Innovation 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 75 articles in a variety of academic and managerial journals. Dr. Swink is formerly the Co-Editor in Chief for the *Journal of Operations Management* and past president of the *Decision Sciences Institute*.



Courtesy of Steven A. Melnyk

Steven A. Melnyk

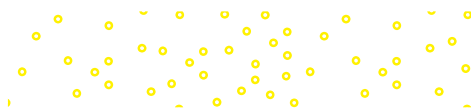
is Professor of Operations Management at Michigan State University. Dr. Melnyk obtained his undergraduate degree from the University of Windsor and his doctorate from the Ivey School of Business, the University of Western Ontario. He has co-authored 21 books focusing on operations and the supply chain and has published over 90 refereed articles in numerous international and national journals. He is Associate Editor for the *Journal of Business Logistics*. He also is a member of several editorial advisory boards, including the *International Journal of Production Research* and the *International Journal of Operations and Production Management*. Dr. Melnyk has consulted with over 60 companies. He has also served as a member of the APICS Board of Directors (2014–2016) and the APICS leadership team (2015). In 2017, Dr. Melnyk accepted a joint appointment as the Global Innovation Chair in Supply Chain Management at the University of Newcastle, New South Wales, Australia.



Courtesy of Janet L. Hartley

Janet L. Hartley

is Professor at 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 30 articles on supply management and supply chain management. She serves as an Associate Editor for the *Journal of Operations Management*, *Journal of Business Logistics*, *Journal of Supply Chain Management*, *International Journal of Operations and Production Management*, and *Journal of Purchasing and Supply Management*. Dr. Hartley is president-elect of the Decision Science Institute.



Preface

We continue to live in dynamic and exciting times. Recent years have seen many changes that have affected nearly every aspect of business, including operations management. In this fourth edition of our book, we continue 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 lipservice 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.
- **From a static to a dynamic treatment of operations and supply chain management.** We have revised each new edition to keep pace with changes taking place in the field. In recent years, very evident changes include the emergence of millennials as key

consumers and the rapid developments taking place in digital technologies. Consequently, in this edition, we introduce a new theme: digital. While the basics remain the same, the context in which operations are managed continues to change rapidly.

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 Vision 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.

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

- **Integrative Frameworks** The book introduces and develops various topics in supply chain operations management using five integrative frameworks:
 1. An *operations strategy* framework that brings together three critical elements: (1) the key customer, (2) the value proposition, and (3) capabilities, introducing students to a *broad supply chain perspective* of operations management.
 2. A *foundations* framework that covers process fundamentals, innovation, quality, inventory, and lean thinking.
 3. A *relational* framework that highlights functional, supplier, and customer management aspects of operations management.
 4. A *planning* framework that covers demand and supply planning at multiple levels.
 5. A *change management* framework that illustrates how projects and future developments can be used to drive innovation in operations management.
- **Use of Integrating Themes** Four key themes are highlighted throughout the book: digital transformation, global issues, relationships, and sustainability.
 -  *Digital technologies* such as the Internet and other communication networks, automation, and artificial intelligence are rapidly and radically changing supply chain operations management. The book highlights numerous examples of these changes, explaining how technologies are enabling faster, better, cheaper, and richer customer experiences.
 -  Because most organizations have supply chains that reach beyond a home country, we examine the dynamic *global environment* influencing supply chain operations management, taking care to represent business norms and cultures in many different parts of the world.
 -  Operations managers must collaborate with other functional personnel, with suppliers, and with customers to accomplish most operations activities. The book showcases how to build, maintain, and benefit from cross-functional and interorganizational *relationships*.
 -  To reduce costs and be competitive, organizations today must adopt *sustainable* business practices. Sustainability is increasingly becoming a key metric for operations managers, and an important expectation of customers. 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.

Managing Operations Across the Supply Chain, fourth edition, 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.

CHAPTER-BY-CHAPTER REVISIONS FOR THE FOURTH EDITION

In this major revision of *Managing Operations Across the Supply Chain*, our key objective has been to integrate and highlight the role of digital technologies throughout

all aspects of supply chain operations management. We also strove to make all of the content more concise and crisp. We have updated or replaced many of the opening vignettes and Get Real stories throughout the book, along with other changes, which are summarized below.

Chapter 1: Introduction to Managing Operations Across the Supply Chain

- Introduced digital theme with examples illustrating how technologies are changing operational processes.
- Replaced example (now a restaurant supply chain) of functional relationships across the supply chain.
- Added new Cemex Digital Transformation case.

Chapter 2: Operations and Supply Chain Strategy

- New opening vignette on Redbubble.
- Added a case on Lil' Me, a manufacturer of customized dolls that look like their owner.
- Additional discussion questions and problems.

Chapter 3 and 3S: Managing Processes and Capacity

- Included a better focus on the notion of process thinking.
- Additional discussion questions and problems.
- Expanded alternative process mapping approaches with the expanded coverage of techniques such as service blueprinting.

Chapter 4: Product/Process Innovation

- Introduced new concepts including product service platforms, servitization, and augmented/virtual reality (VR).
- Added new example for modular design.
- New **Get Real** describing Lockheed's application of VR.

Chapter 5: Manufacturing and Service Process Structures

- Revised Table 5-1 to show inputs, transformation, outputs, and examples.
- New **Get Real** explaining how Adidas uses digital technologies to customize shoes.
- Moved service blueprinting to Chapter 3S.
- Added figure to illustrate market orientation.
- Updated the section Capability Enabling Technologies to reflect advances in digital technologies.
- New **Get Real** on Amazon Go explaining how digital technologies are changing retailing.
- Updated and added a discussion question.

Chapter 6: Managing Quality

- Updated the Hyundai story to include awards and changes within the last 3 years.
- Updated **Get Real** on food safety.
- Dropped discussion of Malcolm Baldrige award.
- Additional problems.

Chapter 6 Supplement: Quality Improvement Tools

- Additional discussion questions and problems.

Chapter 7: Managing Inventories

- Added discussion of customization and customer service aspects of inventory location decisions.
- Additional problems applying square root law.
- Added discussion of Internet of Things (IoT) and inventory visibility in the supply chain.
- Added fuller discussion of choice between using P and Q inventory models.
- New Case: Dexter's Chicken.

Chapter 8: Lean Systems

- Additional discussion questions and problems.

Chapter 9: Customer Service Management

- New opening vignette on the "Amazon Effect."
- New discussion of digital enhancement of customer service including omnichannel service, product platforms, and crowdsourcing service.
- New discussion of social (millennials) and global impacts on customers' service expectations.
- New **Get Real** on service delivery failures.
- New section on service information.

Chapter 10: Sourcing and Supply Management

- Updated the opening vignette on sourcing and supply management at Chipotle to reflect challenges with food safety.
- New **Get Real** on Resilinc and supply chain risk management.
- Updated the **Get Real** box on Takata airbags.
- New **Get Real** showing how Boeing is doing more insourcing.
- Added a section on Supply Category Management.
- Revised the Examining the Sourcing Process.
- New **Get Real** showing the importance of supplier innovation in self-driving vehicles.
- Updated the discussion of information sharing to reflect new digital technologies such as blockchain.
- Additional discussion questions.
- Added new sourcing case.

Chapter 11: Logistics Management

- Updated opening vignette about Amazon's innovations in delivery.
- Moved cost management discussion to Logistics Network Design.
- Changed Warehouse Management to Distribution and Fulfillment Management.
- New **Get Real** on Walmart's delivery policy.

- Added discussion of electronic logging devices (ELDS).
- Added discussion of last mile delivery.
- New **Get Real** explaining how logistics network design caused a chicken shortage for KFC.
- Updated and added discussion questions.

Chapter 12: Demand Planning: Forecasting and Demand Management

- New opening vignette on how Walmart uses weather, social media, and other data to forecast sales.
- **Get Real** on how Lennox uses artificial intelligence to improve demand planning.
- Enhanced discussion of artificial intelligence.
- New discussions of social media and dynamic pricing in demand management.

Chapter 13: Sales and Operations Planning

- Additional discussion questions and problems.

Chapter 14: Materials and Resource Requirements Planning

- Updated opening vignette on Blue Apron, a home meal delivery service.
- Updated the Advances in Planning Systems to reflect digital technologies.
- New **Get Real** showing how MOD Pizza is using a cloud-based ERP system for planning.

Chapter 15 and 15S: Project Management

- Updated opening Pixar vignette.
- More in-depth discussion of stages in project life cycle.
- New discussion of agile project management.
- New **Get Real** on Spray-N-Wash project.
- Deeper discussion of project management software.
- New example of a business case for a proposed project.

Chapter 16: Sustainable Operations Management—Preparing for the Future

- Updated Unilever vignette with achievements of zero landfill waste.
- New **Get Real** on Patagonia’s sustainability efforts.
- Discussion of Starbucks Reserve, a new experiential coffee store in Seattle aimed at making the experience of brewing and enjoying a unique cup of coffee critical and attractive.
- Discussion of how the Internet of Things (IoT) is affecting not only the supply chain but also the business model.
- New case: “Sourcing Outside the Cage.”
- Expanded discussion of the changes in customer (specifically the advent of millennials) is changing how firms compete and how operations and supply chain management is carried out.

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*Morgan Swink
Steven A. Melynk
Janet L. Hartley*

Walkthrough

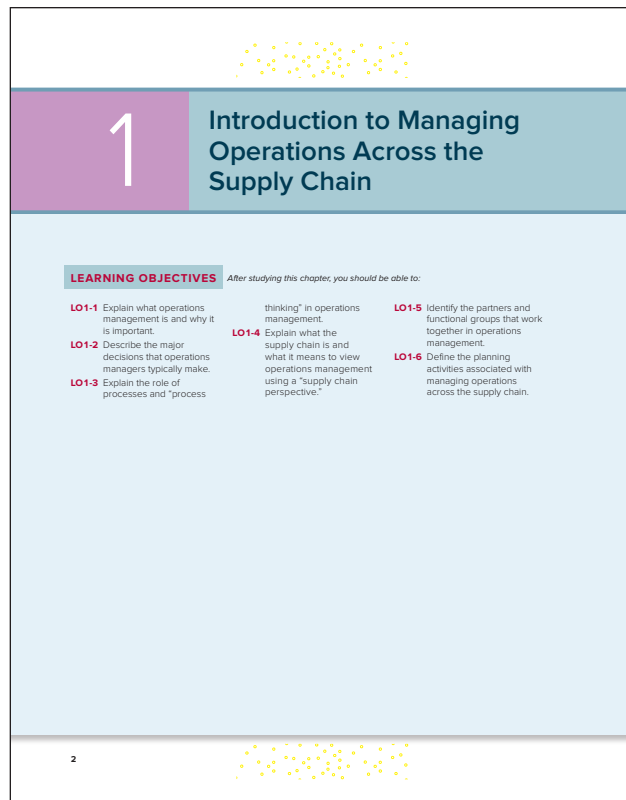
The following section highlights the key features of *Managing Operations Across the Supply Chain* and the text's accompanying resources, which have been developed to help you learn, understand, and apply operations concepts.

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.

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. Learning objectives provide a quick introduction to the important operations topics that will be covered in the chapter.



1 Introduction to Managing Operations Across the Supply Chain

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



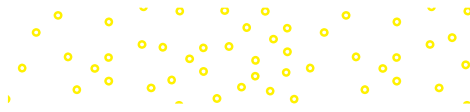
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It Takes More than Cool Products to Make Apple Great

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. This operational edge is what enables Apple to handle massive product launches without having to maintain large, profit-sapping inventories. It has 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 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 specific 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.

<p>supply chain The global network of organizations and activities involved in designing, transforming, consuming, and disposing of goods and services.</p>	<p>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.</p> <p>Think about all the different organizations located in different companies that are</p>
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Student Activity

At appropriate moments 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.

activity

student

Explore the information on restaurant supply chains provided at Supplychainscene.org. From the articles you find there, learn about ways that technologies and changing customer demands are changing restaurant operations. Which of the stages and organizations depicted in Figure 1-3 are likely to be most affected by a shift to more digital processes? How will the structure of the overall supply chain be changed?

Numbered Examples

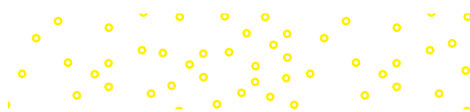
Numbered examples are integrated into chapters where analytic techniques are introduced. Students learn how to solve specific problems step-by-step and gain insight into general principles by seeing how they are applied.

EXAMPLE 2-1

Suppose that the director of marketing has approached you, as a member of the top management team, with a suggestion that appears very attractive. The proposal begins by noting that because demand is down, the firm (and its supply chain) has much unused capacity. Happily, the marketing group has identified a new potential customer segment. Unlike existing customers (who are price sensitive and who buy large quantities of fairly standard products), these new customers will likely order smaller quantities more frequently. The new customers are also likely to want to make last-minute changes to order sizes, due dates, and product mix. Your current operating system is not really set up to accommodate such changes. However, the marketing director feels that the prices these customers are willing to pay will provide gross margins (30 percent, as compared to the 10–15 percent currently being given by existing customers) that should be high enough to offset any operational problems. The chief financial officer has stated that, in order to enter any new market, it must be expected to generate at least a 25 percent return on assets (ROA).

Given the information provided below, would you recommend accepting the marketing director's proposal?

Category	Estimated First Year Impact	Comments
Sales	\$420,000	
Cost of Goods Sold	\$294,000	30% gross margin



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

Bosch CS20: Finding a New Order Winner by Changing the Way Customers Cut Straight Lines

Managers at Bosch Power Tools faced a challenging problem—how to design and deliver a better circular saw. Such saws are found in nearly every handyman's workshop, and over the years their designs had become fairly standard. Consequently, there were few features except price to differentiate competing products. Bosch managers looked at circular saws from an outcome perspective. They saw that many of the circular saws on the market did a poor job of helping users attain a simple but critical outcome—cutting straight lines. Customers were frustrated because the lines were inevitably covered up by either sawdust or by the footplate of the saw itself. Bosch's solution? First, it installed a powerful fan to vacuum dust off the cut line. Second, it replaced the steel footplate with an acrylic one that allowed users to see the line as they cut. The result: an award-winning product that customers want to buy.²



©picture alliance/Getty Images

²For more information about this innovative product, see: www.newwoodworker.com/reviews/bcs20rvu.html.

Icons

Instructive icons throughout the text point out relevant applications of our central themes of global issues, relationships, sustainability, and digital technologies.

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

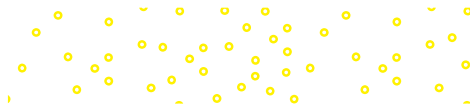


Operations managers must collaborate with other functional personnel, with customers, and with suppliers to accomplish many operations activities. The book showcases how to build, maintain, and benefit from cross-functional and interorganizational *relationships*.

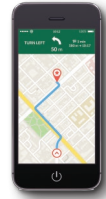


To reduce costs and be competitive, organizations today must adopt sustainable business practices. In fact, *sustainability* is a key metric for operations managers and an important expectation of customers.





Digital technologies such as the Internet and other communication networks, automation, and artificial intelligence are rapidly and radically changing supply chain operations management. The book highlights numerous examples of these changes, explaining how technologies are enabling faster, better, cheaper, and richer customer experiences.



digital

END-OF-CHAPTER RESOURCES

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

Chapter Summary Chapter summaries provide an overview of the material covered.

CHAPTER SUMMARY

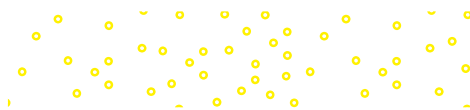
This chapter provides a broad overview and introduction to operations management. In discussing the scope and complexity of operations management, we have made the following points:

1. The goal of the modern firm is to develop and run an operations management system able to deliver superior product value to the firm’s targeted consumers.
2. Operations management deals with the effective and efficient management of transformation processes. These processes include not only the making of products but also the design of products and related processes; sourcing of required materials and services; and delivery and management of relationships among customers, suppliers, and functions within the firm. As a system, operations management involves four major functional activities and their interactions: (1) customer relationships management, (2) internal operations (manufacturing and services) management, (3) supply management, and (4) logistics management.

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

KEY TERMS

core capability 11	operational planning 19	supply chain 4
customer management 14	operations management 4	supply chain management 12
customers 12	process 8	supply management 14
dematerialization 7	stakeholders 14	tactical planning 19
echelon 16	strategic planning 18	tier 15
lean operation 9	suppliers 12	total product experience 7
logistics management 14		



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. Review *Fortune* magazine's "Most Admired" American companies for 1959, 1979, 1999, and the most current year. (The issue normally appears in August each year.) Which companies have remained on the top throughout this period? Which ones have disappeared? What do you think led to the survival or demise of these companies?
2. Select two products that you have recently purchased; one should be a service and the other a manufactured good. Think about the process that you used to make the deci-

Solved Problems Solved problems 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:

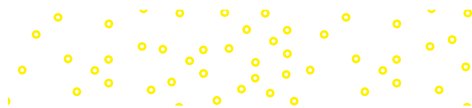
Categories	Values
Sales	\$32,000,000
Cost of goods sold	\$20,000,000
Variable expenses	\$ 4,000,000
Fixed expenses	\$ 6,000,000
Inventory	\$ 8,000,000
Accounts receivable	\$ 4,000,000
Other current assets	\$ 3,000,000
Fixed assets	\$ 6,000,000

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	\$32,000,000
Cost of goods sold	\$20,000,000
Variable expenses	\$ 4,000,000
Fixed expenses	\$ 6,000,000
Inventory	\$ 8,000,000
Accounts receivable	\$ 4,000,000
Other current assets	\$ 3,000,000
Fixed assets	\$ 6,000,000



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	
<p>Business Textbook Supply Chain</p> <p>Dave Eisenhart, senior editor for Mountain Publishing, Inc., looked out his window as he considered the operational implications of the changes he had just heard discussed in the company’s annual strategic planning meeting. The future looked to be both exciting and scary. As an editor for Mountain’s business textbook division, Dave had witnessed major changes in his primary market. First, the body of knowledge in business school curricula had exploded over the past decade. It was getting harder and harder to cover all the content that any professor might want in a single textbook, while keeping the size of the book manageable. Second, Dave had noted that</p>	
<p>cases from several different publishers into a single package for their students. While the quality of “books” (packets) did not match that of traditional bound texts, many professors and students valued the flexibility associated with this option.</p> <p>Finally, the demand for e-books was growing. While the percentage of books purchased in electronic form was currently small, the potential seemed large. In addition, e-books provided a platform for new ancillary and “interactive” learning tools. For example, students using an e-book could immediately access other, external sources of related material (including</p>	<p>cases from several different publishers into a single package for their students. While the quality of “books” (packets) did not match that of traditional bound texts, many professors and students valued the flexibility associated with this option.</p> <p>Finally, the demand for e-books was growing. While the percentage of books purchased in electronic form was currently small, the potential seemed large. In addition, e-books provided a platform for new ancillary and “interactive” learning tools. For example, students using an e-book could immediately access other, external sources of related material (including</p>

INSTRUCTOR RESOURCES

The Connect Instructor Library provides complete materials for study and review. Instructors have access to teaching supports such as electronic files of the ancillary materials: Solutions Manual, PowerPoint Lecture Slides, Digital Image Library, and Test Bank.

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. The Test Bank questions are assignable within Connect or through the TestGen online platform and are also available as Word files. Each Test Bank question is tagged with 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.

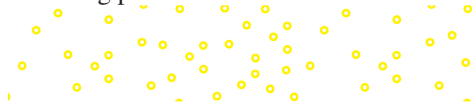
Digital Image Library All the figures in the book are included for insertion in PowerPoint slides or for class discussion.

STUDENT RESOURCES

Student resources are available within the Connect Library or as tools within the Connect assignments.

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.

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.

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.

The screenshot shows the 'assignment statistics' page in the Connect LMS. The page title is 'assignment statistics' and it includes a 'Show: Assignment Statistics' dropdown. Below the title, there is a note: 'View score statistics on submitted assignments.' and a link to 'show report options & settings'. A yellow banner states 'Scores below are averages across attempts.' The main content area shows 'assignment statistics: MGMT 3000 Integrated Ops and SCM (Spring 2016) (Eboch, Karen)' with a report creation date of '05/23/2016 10:29 AM EDT' and an assignment type of 'Homework, Practice, Quiz, Exam, LearnSmart'. Below this, there is a table of assignment statistics with columns for 'assignment', 'mean score', 'highest score', 'lowest score', '# students submitted', and '# times submitted'. The table lists five assignments: Chapter 1 Introduction to Managing Operations Across the Supply Chain, Chapter 1 quiz, Chapter 2 Operations and Supply Chain Strategy, Chapter 2 Problems, and Chapter 2 Quiz.

assignment	mean score	highest score	lowest score	# students submitted	# times submitted
▶ Chapter 1. Introduction to Managing Operations Across the Supply Chain (unlimited attempts, 100.0 points)	93.41	100	0	78	78
▶ Chapter 1 quiz (3 attempts, 100.0 points)	80.62	100	10	77	129
▶ Chapter 2. Operations and Supply Chain Strategy (unlimited attempts, 100.0 points)	96.39	100	0	78	78
▶ Chapter 2 Problems (unlimited attempts, 40.0 points)	37.94	40	0	76	78
▶ Chapter 2 Quiz (3 attempts, 100.0 points)	85.25	100	30	78	120

Tegrity Campus: Lectures 24/7

Tegrity Campus is a service that makes class time available 24/7 by automatically capturing every lecture in a searchable format for students to review when they study and complete assignments. With a simple one-click start-and-stop process, you capture all computer screens and corresponding audio. Students can replay any part of any class with easy-to-use browser-based viewing on a PC or Mac.

Educators know that the more students can see, hear, and experience class resources, the better they learn. In fact, studies prove it. With *Tegrity Campus*, students quickly recall key moments by using *Tegrity Campus*'s unique search feature. This search helps students efficiently find what they need, when they need it, across an entire semester of class recordings. Help turn all your students' study time into learning moments immediately supported by your lecture. To learn more about *Tegrity*, watch a two-minute Flash demo at <http://tegritycampus.mhhe.com>.



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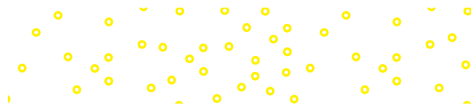
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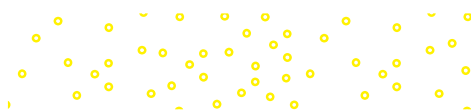
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1

PART

SUPPLY CHAIN: A PERSPECTIVE FOR OPERATIONS MANAGEMENT

What is operations management? Have you ever stopped to consider all of the specifics 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 and service concepts, identify sources for raw materials, determine resources and skills for service tasks, decide how products will be made and delivered, and establish how to serve customers. Operations management includes all of these types of decisions:

Operations management 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 in businesses. 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 how to measure the effectiveness of operations activities.



1

Introduction to Managing Operations Across the Supply Chain

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.



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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.

This operational edge is what enables Apple to handle massive product launches without having to maintain large, profit-sapping inventories. It has 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 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 specific 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.

**It Takes More
than Cool
Products to
Make Apple
Great**

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.

A BROAD DEFINITION OF SUPPLY CHAIN OPERATIONS MANAGEMENT

operations management

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



digital

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

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. An operations manager interacts with managers in other business functions, both inside and outside the operations manager’s 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. Increasingly, digital sensors, systems, devices, and software are connecting, enhancing, and automating operational processes. Operations located around the globe are becoming more tightly interconnected all the time. 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.

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.

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.

LO1-1

Explain what operations management is and why it is important.

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

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. Operations management also directly impacts sustainability issues, including the environment, the fair treatment of people, and safety. In doing so, operations management affects social systems and cultural norms, as well as the 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 will 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 study² 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.

²M. 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.

- 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.

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 above 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 fundamentals of how to manage 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 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,



relationships

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 processes running effectively and efficiently.

LO1-2

Describe the major decisions that operations managers typically make.

Important Decisions in Supply Chain Operations Management

What?

- What goods and services should be delivered by the system?
- 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 (what capacity) should our 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?



relationships

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, cross-functional activity.

Differences in Goods and Services Operations

Operational activities exist in order to produce both 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.

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

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

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 co-designer 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.

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.

In addition, advancing technologies are driving the **dematerialization** of many products, essentially converting them from goods to services. For example, many of you are probably reading this book on a computer or mobile device! Imagine the changes in operations needed to develop, produce, and deliver digital ebooks in place of traditional physical textbooks.

Because most firms deliver products that involve both goods and services, operations managers recognize the importance of delivering a **total product experience**.



digital

dematerialization The process of transforming a tangible good into an intangible product or service, through digitization or direct service replacement.

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

student activity

student

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

Name some products that were formerly delivered in tangible forms, yet through digitization or other means are now delivered intangibly. Media-based products such as music (CDs, now files), news (newspapers, now on-line pages), and event tickets (paper stubs, now bar codes delivered to your phone) probably come to mind. Can you think of other physical goods that have been dematerialized into services?

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.

LO1-3

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

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

Processes and Process Thinking

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

An airport operation contains dozens of interrelated processes.

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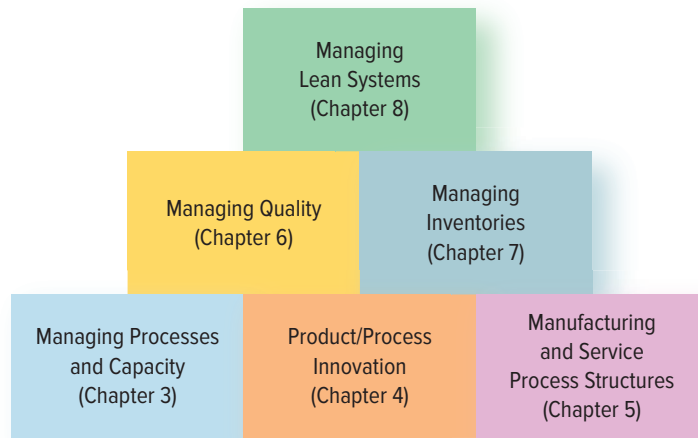


FIGURE 1-1
Foundational
Concepts in Supply
Chain Operations
Management

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.

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

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