



# OPERATIONS MANAGEMENT

AN INTEGRATED APPROACH

6<sup>th</sup>  
EDITION

R. DAN REID • NADA R. SANDERS

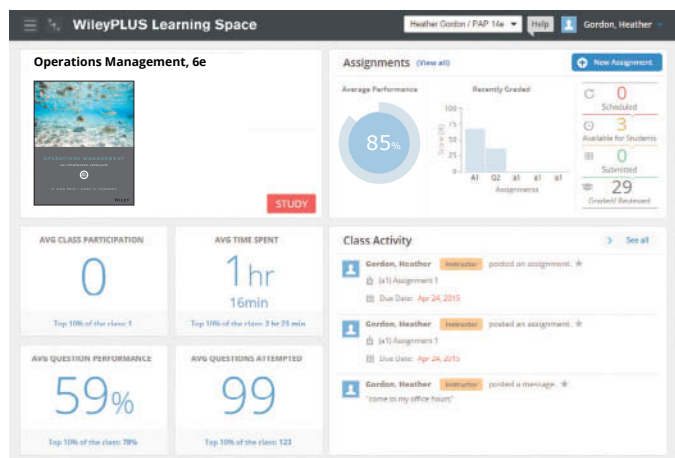
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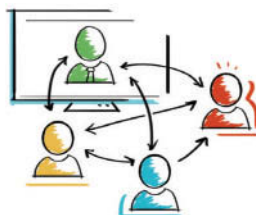
# WileyPLUS Learning Space

An easy way to help your students **learn, collaborate,** and **grow.**



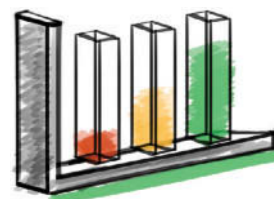
## Diagnose Early

Educators assess the real-time proficiency of each student to inform teaching decisions. Students always know what they need to work on.



## Facilitate Engagement

Educators can quickly organize learning activities, manage student collaboration, and customize their course. Students can collaborate and have meaningful discussions on concepts they are learning.



## Measure Outcomes

With visual reports, it's easy for both educators and students to gauge problem areas and act on what's most important.

## Instructor Benefits

- Assign activities and add your own materials
- Guide students through what's important in the interactive e-textbook by easily assigning specific content
- Set up and monitor collaborative learning groups
- Assess learner engagement
- Gain immediate insights to help inform teaching

## Student Benefits

- Instantly know what you need to work on
- Create a personal study plan
- Assess progress along the way
- Participate in class discussions
- Remember what you have learned because you have made deeper connections to the content



# Operations Management

**An Integrated Approach**

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WILEY

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# Preface

Today, companies are competing in a very different environment than they were only a few years ago. Rapid changes such as global competition, e-business, the Internet, and advances in technology have required businesses to adapt their standard practices. Operations management (OM) is the critical function through which companies can succeed in this competitive landscape.

Operations management concepts are not confined to one department. Rather, they are far-reaching, affecting every functional aspect of the organization. Whether studying accounting, finance, human resources, information technology, management, marketing, or purchasing, students need to understand the critical impact operations management has on any business.

We each have more than 25 years of teaching experience and understand the challenges inherent in teaching and taking the introductory OM course. The vast majority of students taking this course are not majoring in operations management. Rather, classes are typically composed of students from various business disciplines or students who are undecided about their major and have little knowledge of operations management. The challenge is not only to teach the foundation of the field, but also to help students understand the impact operations management has on the business as a whole and the close relationship of operations management with other business functions.

We were motivated to write this book to help students understand operations management and to make it easier for faculty to teach the introductory operations management course. We continue to have three major goals for this book.

## **Goals of the Book**

### **1. Provide a Solid Foundation of Operations Management**

Our book provides a solid foundation of OM concepts and techniques, but also covers the latest on emerging topics such as e-business, supply chain management, enterprise resource planning (ERP), and information technology. We give equal time to strategic and tactical decisions and provide coverage of both service and manufacturing organizations. We look closely at some of the unique challenges faced by service operations.

### **2. Provide an Integrated Approach to Operations Management**

While several excellent textbooks provide appropriate foundation coverage, we believe that few provide sufficient motivation for students. We are aware that a major teaching challenge in OM is that students aren't motivated to study OM because they don't understand its relevance to their majors. We think the course textbook can greatly support the professor in this area; therefore, a chief goal of this book is to integrate coverage of why and

how OM is integral to all organizations. Interfunctional coordination and decision making have become the norm in today's business environment. Throughout each chapter we discuss information flow between business functions and the role of each function in the organization.

The text also illustrates the linkages and integration between the various OM topics. Our end-of-chapter feature entitled "Within OM: How It All Fits Together" describes how the chapter topic is related to other OM decisions. It addresses the issue that OM topics are linked and interdependent, not independent of one another.

As supply chain management (SCM) has taken on an increasingly important role, the end-of-chapter section titled "The Supply Chain Link" explains the relationships between the specific chapter topic covered and supply chain management.

### 3. Help Students to Understand the Concepts

This course remains challenging for students to take and professors to teach. Students often have no prior exposure to operations concepts and little real business experience. They have a broad spectrum of quantitative sophistication and often find the math in the course extremely challenging. Therefore, a chief goal of the text and supplement package is to help students with these concepts. We begin each chapter with an example from everyday life, often a consumer or personal example, to help students intuitively understand what the chapter will be about. Then we explain each concept clearly and carefully, with *enough* depth for non-majors. Sustainability in operations is highlighted at the end of each chapter.

The new edition is focused on helping students by offering problem-solving hints and tips as part of the solution to most examples and solved problems throughout the entire text. Two unique supplements support student comprehension. A "Quantitative Survival Guide," available as an optional supplement packaged with the text, provides "help with the math" for all chapters. *WileyPLUS Learning Space* (available on-line via a password in an optional package with the book) provides plenty of homework practice, feedback for students, an e-book, and much more. In addition, algorithmic homework problems have been designed for each chapter in order to provide unlimited practice opportunity.

## Organization and Content of the Book

We have arranged the topics in the book in progressive order from strategic to tactical. Early in the book we cover operations topics that require a strategic perspective and a cultural change within the organization, such as supply chain management, total quality management, and just-in-time systems. Progressively we move to more tactical issues, such as work management, inventory management, and scheduling concerns. We recognize that most faculty will select the chapters relevant to their needs. To make it easier for students and faculty, each chapter can stand alone. Any specific knowledge needed for a chapter is summarized at the beginning of each chapter, with specific topic and page references for easy review.

### Balanced Coverage of Quantitative and Qualitative Topics

We have tried to find a balance between the quantitative and qualitative treatment and coverage of OM topics. To meet students' needs, this text presents the application of OM concepts through the extensive use of practical and relevant business examples. We eliminated from the printed book coverage of topics less frequently covered at the introductory level.



However, complete supplementary chapters on spreadsheet modeling, optimization, master production scheduling, rough-cut capacity planning, and waiting line models are available on the book's Web site ([www.wiley.com/college/reid](http://www.wiley.com/college/reid)).

## Integrated Technology Perspective

Advances in e-commerce and the Internet are transforming the business environment, and we integrate these concepts in every chapter. We discuss a range of topics from enterprise resource planning (ERP) and electronic data interchange (EDI) to quality issues of buying goods on-line.

## Changes to this Edition

We have made a number of changes to this edition in order to make the text as current, user-friendly, and relevant as possible. In particular we have updated company examples, technology, big data analytics, and added some supply chain management issues.

**Company Examples:** Since our last edition we have observed many changes in organizations that we had used as examples. Some companies have gone out of business while others, such as Amazon.com and Dell Computer Corporation, have changed their strategies. In order to offer the most current text we have made updates in company examples across all chapters.

**Technology:** One of the biggest changes we are witnessing relates to changes in technology. We have updated discussions with regard to the latest technologies that impact operations management. This includes discussions of 3D Printing, new generation robotics and automation, and advancements in radio frequency identification (RFID) in Chapter 3.

**Big Data Analytics:** Big data analytics is having a tremendous impact on digitizing operations. We have incorporated the latest on big data analytics in Chapters 1 and 3. In Chapter 8 we have added an entire section on predictive analytics and forecasting.

**Supply Chain Management Issues:** Since our last edition the proposed new shipping facility in Mexico has been canceled, while the Panama Canal is currently being widened. We discuss the ramifications on materials being shipped from Asia to the United States in Chapter 4.

In addition, several chapters have been reorganized to facilitate a better flow. During the past five editions, we have added many new topics. This sixth edition better integrates those topics into the chapters. We continue to emphasize inter-functional coordination and decision making, and have updated a number of features as shown below.

**Before You Begin.** In order to help students when solving quantitative problems, the feature called “Before You Begin,” placed immediately prior to the solution of most in-chapter example problems and end-of-chapter solved problems. Emphasizing our focus on strong pedagogy, this feature provides problem-solving tips and hints that the student should consider before proceeding to solve the problem.

**Supply Chain Link.** To emphasize the increasingly important role of supply chain management, there is a section on supply chain management and expanded coverage of supply chain and services in every chapter.

**Sustainability Link.** In order to address the latest challenges facing business, we have included “The Sustainability Link” feature. This feature discusses how the subject of the chapter directly ties to today's sustainability concerns and challenges, providing specific business examples that illustrate the issues.

**Problem Solving.** While our goal is to provide balanced coverage of quantitative and qualitative topics, the new edition further emphasizes and integrates problem solving to help students experience the course more successfully. We provide algorithmic homework problems for every chapter of the text (via *WileyPLUS Learning Space*) for unlimited practice opportunities, include problem-solving help in the book (“Before You Begin”) and on-line via *WileyPLUS Learning Space*, and provide step-by-step solved problems in the book and on-line. We also provide “help with math” as needed via *WileyPLUS Learning Space*. We believe that these changes to the new edition greatly enhance student learning.

## ● Features of the Book

We have developed our pedagogical features to implement and reinforce the goals discussed previously and address the many challenges in this course.

### Pedagogy that Provides an Integrated Approach

**E**veryone has had experiences of poor quality when dealing with business organizations. These experiences might involve an airline that has lost a passenger’s luggage, a dry cleaner that has left clothes wrinkled or stained, poor course offerings and scheduling at your college, a purchased product that is damaged or broken, or a pizza delivery service that is often late or delivers the wrong order. The experience of poor quality is exacerbated when employees of the company either are not empowered to correct quality inadequacies or do not seem willing to do so. We have all encountered service employees who do not seem to care. The consequences of such an attitude are lost customers and opportunities for competitors to take advantage of the market need.

Successful companies understand the powerful impact customer-defined quality can have on business. For this reason, many competitive firms continually increase their quality standards. For example, Ford Motor Company’s focus on qual-

quality problems. Open discussion is promoted, and criticism is not allowed. Although the functioning of quality circles is friendly and casual, it is serious business. Quality circles are not mere “gab sessions.” Rather, they do important work for the company and have been very successful in many firms.

**LINKS TO PRACTICE**  
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The importance of exceptional quality is demonstrated by The Walt Disney Company in the operation of its theme parks. The focus of the parks is customer satisfaction. This is accomplished through meticulous attention to every detail, with particular focus on the role of employees in service delivery. Employees are viewed as the most important organizational resource, and great

#### Chapter Opening Vignettes and Within OM: How It All Fits Together

To help students intuitively understand the topic, each chapter begins with a description of a personal problem that can be solved using the concepts discussed in the chapter. Our objective is to attract the attention of students by starting with a personal example to which they can relate. We demonstrate that OM is not just about operating a plant or a business, but that it is relevant in everything that we do. An end-of-chapter section titled “Within OM: How It All Fits Together” describes how the chapter topic is related to other OM decisions. It emphasizes the point that OM decisions are not made independently of one another, but that they are linked together and are dependent on one another.

**Links to Practice** Other OM texts have many boxes and sidebars, which make it difficult for students to understand what they need to know. Furthermore, the many examples frequently interrupt the flow of the text and make a chapter difficult to read and assimilate. We recognize the importance of including “real-world” examples, but believe they should be integrated into the stream of the text instead of interrupting the text. Therefore, we have developed embedded boxes titled

“Links to Practice,” which provide brief examples from actual companies in every chapter. Embedded by both content and design into the general text discussion, each provides a concise and relevant example without interrupting the flow of the text.

Current textbooks typically do not use business examples to which students can relate. The typical examples provided are from large corporations such as General Motors, IBM, or Xerox. Primarily using these types of examples creates the impression for students that this is a field that is either beyond their reach or irrelevant to their needs. We have found that students understand the concepts better when these concepts are also presented in a context that is smaller in scale. The examples chosen range from large multinational organizations to small local businesses.

## OM across the Organization and Cross-Functional Icons

Unique to this book is an end-of-chapter summary titled “OM across the Organization” that highlights the relationship between OM and key business functions, such as accounting, finance, human resources, information technology, management, marketing, and purchasing. This section is designed to help students understand the close relationship of operations management with other business functions and appreciate the critical impact OM has on other business functions. In addition, a cross-functional icon is used throughout the text to highlight sections in the text where the relationships between OM and other key business functions are discussed.

**Cases** Each chapter ends with four cases that reinforce the issues and topics discussed in the chapter. The first two cases are within the text, while the other two are on-line cases. The cases can provide the basis for group discussion or can be assigned as individual exercises for students. Many cases conclude with a list of questions for students to answer.

In addition, each chapter offers a unique interactive learning exercise titled “Internet Challenge” where students are provided with a short case and given specific Internet assignments.

**Interactive Cases** There are two Web-based cases for this edition. The first case features an Internet site for a simulated cruise company that has hired a student intern to help solve operations problems. The second case features an Internet site for a simulated consulting company that works in the medical industry that has hired a student to help solve operations problems. In both cases, the students are given assignments that require them to use information provided at the book Web site to develop solutions. These exercises offer students hands-on experience in the areas of supply chain management, statistical quality control, forecasting, just-in-time, aggregate planning, inventory management, scheduling, and project management, and help tie all the topics in the book together in a service environment.

## Pedagogy to Help Students Master the Course

**Learning Objectives** At the beginning of each chapter, students are provided with a short statement of what they need to either know or review from previous chapters, referring students to specific topic information. This enables students to review previous material necessary to understand the topic being covered.

**Before You Go On** Sections strategically placed within every chapter summarize key material the student should know before continuing. Often the material in chapters can be overwhelming. We felt that breaking up the chapter with a brief summary of key material is highly beneficial in aiding learning and comprehension.

**Key Terms and Definitions** Key terms and concepts are highlighted in boldface when they are first explained in the text, are defined in the margin next to their discussion in the text, and are listed at the end of the chapter with page references.

rate or the marketing department is not working closely with customers. TQM requires the close cooperation of different functions in order to be successful. In this section we look at the involvement of these other functions in TQM.

**MKT** **Marketing** plays a critical role in the TQM process by providing key inputs that make TQM a success. Recall that the goal of TQM is to satisfy customer needs by producing the exact product that customers want. Marketing's role is to understand the changing needs and wants of customers by working closely with them. This requires a solid identification of target markets and an understanding of whom the product is intended for. Sometimes, apparently small differences in product features can result in large differences in customer appeal. Marketing needs to accurately pass customer information along to operations, and operations needs to include marketing in any planned product changes.

**FIN** **Finance** is another major participant in the TQM process because of the great cost consequences of poor quality. General definitions of quality need to be translated into specific dollar terms. This serves as a baseline for monitoring the financial impact of quality efforts and can be a great motivator. Recall the four costs of quality discussed earlier. The first two costs, prevention and appraisal, are preventive costs; they are intended to prevent inter-

### Interactive Case: Virtual Company

[www.wiley.com/college/reid](http://www.wiley.com/college/reid)

#### On-line Case: Cruise International, Inc.

**Assignment:** *Total Quality Management (TQM) at Cruising International, Inc.* For this assignment, you will work again with Meghan Willoughby, Chief Purser aboard the *Friendly Seas I*. You know the assignment has something to do with quality, but you aren't quite sure what. You meet Meghan aboard the ship. She greets you and says, “Let me tell you a bit about what you'll be doing for us. We've been working on quality measures for several years, and now must focus on quality even more as our industry becomes more competitive. We need to make sure that our guests receive quality service from

beginning to end. We need your help in bringing ideas together on how to measure quality in a service organization.” This assignment will enhance your knowledge of the material in Chapter 5 of your textbook while preparing you for your future assignments.

#### To access the Web site:

- Go to [www.wiley.com/college/reid](http://www.wiley.com/college/reid)
- Click **Student Companion Site**
- Click **Virtual Company/Cruise International, Inc.**
- Click **Consulting Assignments**
- Click **Service Package and Processes at CII**

### Learning Objectives

**After studying this chapter you should be able to:**

- 1 Explain the meaning of total quality management (TQM).

### BEFORE YOU GO ON

Today's concept of quality, called total quality management (TQM), focuses on building quality into the process, as opposed to simply inspecting for poor quality after production. TQM is customer driven and encompasses the entire company. Before you go on, you should know the four categories of quality costs. These are prevention and appraisal costs, which are costs that are incurred to prevent poor quality, and internal

and external failure costs, which are costs that the company hopes to prevent. You should understand the evolution of TQM and the notable individuals who have shaped our knowledge of quality. Last, you should know the seven concepts of the TQM philosophy: customer focus, continuous improvement, employee empowerment, use of quality tools, product design, process management, and managing supplier quality.

**Before You Begin** Most example problems within the chapters, and end-of-chapter solved problems, have a feature called “Before You Begin.” The feature provides students with problem-solving tips and hints they need to consider before solving the problem. The purpose is to help students with their problem-solving ability.

**Solved Problems** (See student companion site for Excel template.)

**PROBLEM 1**  
 An office security system at Delco, Inc. has two component parts, both of which must work for the system to function. Part 1 has a reliability of 80 percent, and part 2 has a reliability of 98 percent. Compute the reliability of the system.  
**Before You Begin:** Before you begin solving reliability problems, it is best to first draw a diagram of the compo-

**Solution:**

The reliability of the system is  
 $R_8 = R_1 \times R_2$

**Solved Problems** Numerous solved problems are provided, complete with step-by-step explanations to ensure students understand the process and why the problem is solved in a particular way. Where appropriate, we provide a series of steps for problem solving and offer problem-solving tips.

## ● Teaching and Learning Resources

Our supporting material has been designed to make learning OM easier for students and teaching OM easier for faculty.

### Book Companion Site [www.wiley.com/college/reid](http://www.wiley.com/college/reid)

An extensive Web site has been developed in support of *Operations Management*. The site is available at [www.wiley.com/college/reid](http://www.wiley.com/college/reid), and offers a range of information for instructors and students.

#### For Instructors

- **Instructor’s Manual:** Includes a suggested course outline, teaching tips and strategies, war stories, answers to all end-of-chapter material, brief description of the additional resources referenced in the Interactive Learning box, additional in-class exercises, and tips on integrating the theory of constraints.
- **Solutions Manual:** A complete set of detailed solutions is provided for all problems.
- **Virtual Company Cases Instructor’s Materials:** Include accompanying Instructor’s Manual with answers to exercises and Excel solutions.
- **Test Bank:** A comprehensive Test Bank comprised of approximately 1700 questions that consist of multiple choice, true-false, essay questions, and open-ended problems for each chapter. The Test Bank is also available in a computerized version that allows instructors to customize their exams.
- **PowerPoint Lecture Slides:** PowerPoint Slides are available for use in class. Full-color slides highlight key figures from the text as well as many additional lecture outlines, concepts, and diagrams. Together, these provide a versatile opportunity to add high-quality visual support to lectures.
- **Operations Management Video Series:** The video package, including Wiley’s own Student OM Videos, offers video selections that tie directly to the theme of operations management and bring to life many of the examples used in the text. Videos can be viewed within *WileyPLUS Learning Space*.

## For Students

- **Supplemental Chapters:** The supplement chapters include Supplement A: Spreadsheet Modeling; An Introduction; Supplement B: Introduction to Optimization; Supplement C: Waiting Line Models; Supplement D: Master Scheduling and Rough-Cut Capacity Planning.
- **Excel Spreadsheets:** Templates are provided so that students can model and solve problems presented in the textbook. A spreadsheet icon appears next to those examples and problems in the textbook that have an accompanying Excel template available on the student Web site. Step-by-step directions are provided. Directions prompt students as they work through each spreadsheet. Expected outcomes and questions are also given.

## WileyPlus Learning Space

What is *WileyPLUS Learning Space*? It is a place where students can learn, collaborate, and grow. Through a personalized experience, students create their own study guide while they interact with course content and work on learning activities.

*WileyPLUS Learning Space* combines adaptive learning functionality with a dynamic new e-textbook for your course—giving you tools to quickly organize learning activities, manage student collaboration, and customize your course so that you have full control over content as well as the amount of interactivity between students.

You can:

- Assign activities and add your own materials
- Guide students through what is important in the e-textbook by easily assigning specific content
- Set up and monitor collaborative learning groups
- Assess student engagement
- Benefit from a sophisticated set of reporting and diagnostic tools that give greater insight into class activity

Learn more at [www.wileypluslearningspace.com](http://www.wileypluslearningspace.com). If you have questions, please contact your Wiley representative.

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# Contents

## Preface v

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## About the Authors xv

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## CHAPTER 1

### Introduction to Operations Management 1

---

#### What is Operations Management? 2

#### Differences between Manufacturing and Service Organizations 5

#### Operations Management Decisions 6

#### Historical Development 10

Why OM? 10

Historical Milestones 10

The Industrial Revolution 10

Scientific Management 12

The Human Relations Movement 12

Management Science 13

The Computer Age 13

Just-in-Time 14

Total Quality Management 14

Business Process Reengineering 14

Flexibility 14

Time-Based Competition 15

Supply Chain Management 15

Global Marketplace 16

Sustainability and Green Operations 17

Electronic Commerce 17

Outsourcing and Flattening of the World 17

Big Data Analytics 18

#### Today's OM Environment 18

#### Operations Management in Practice 19

#### Within OM: How It All Fits

#### Together 20

#### OM Across the Organization 20

 THE SUPPLY CHAIN LINK 22

 THE SUSTAINABILITY LINK 22

Chapter Highlights 23

Key Terms 23

Discussion Questions 24

**CASE:** Hightone Electronics, Inc. 24

**CASE:** Creature Care Animal Clinic  
(A) 25

**INTERACTIVE CASE:** Virtual Company 26

**INTERNET CHALLENGE:** Demonstrating Your  
Knowledge of OM 26

Selected Bibliography 26

## CHAPTER 2

### Operations Strategy and Competitiveness 28

---

#### The Role of Operations Strategy 29

The Importance of Operations  
Strategy 30

#### Developing a Business Strategy 30

Mission 30

Environmental Scanning 31

Core Competencies 32

Putting It Together 33

#### Developing an Operations Strategy 34

Competitive Priorities 35

The Need for Trade-Offs 38

Order Winners and Qualifiers 38

Translating Competitive Priorities into Production  
Requirements 39

#### Strategic Role of Technology 40

Types of Technologies 40

Technology as a Tool for Competitive  
Advantage 41

#### Productivity 41

Measuring Productivity 41


Interpreting Productivity Measures 44

Productivity and Competitiveness 44

Productivity and the Service Sector 45

#### Operations Strategy Within OM: How it All Fits Together 45

#### Operations Strategy Across the Organization 46

 THE SUPPLY CHAIN LINK 46

 THE SUSTAINABILITY LINK 47

Chapter Highlights 47

Key Terms 47

Formula Review 48

Solved Problems 48

Discussion Questions 49

Problems 49

**CASE:** Prime Bank of Massachusetts 50

**CASE:** Boseman Oil and Petroleum  
(BOP) 51

**INTERACTIVE CASE:** Virtual Company 52

**INTERNET CHALLENGE:** Understanding Strategic  
Differences 52

Selected Bibliography 53

**CHAPTER 3****Product Design and Process Selection 54****Product Design 55**

Design of Services versus Goods 55

**The Product Design Process 56**

Idea Development 56

Product Screening 58

Preliminary Design and Testing 59

Final Design 60

**Factors Impacting Product Design 60**

Design for Manufacture 60

Product Life Cycle 61

Concurrent Engineering 62

Remanufacturing 64

**Process Selection 64**

Types of Processes 64

**Designing Processes 67****Process Performance Metrics 69****Linking Product Design and Process Selection 72**

Product Design Decisions 72

Competitive Priorities 74

Facility Layout 74

Product and Service Strategy 76

Degree of Vertical Integration 76

**Technology Decisions 77**

Information Technology 77

Automation 78

E-manufacturing 80

**Designing Services 82**

How Are Services Different from Manufacturing? 82

How Are Services Classified? 83

The Service Package 84

Differing Service Designs 84

**Product Design and Process Selection Within OM: How It All Fits Together 86****Product Design and Process Selection Across the Organization 87** **THE SUPPLY CHAIN LINK 88** **THE SUSTAINABILITY LINK 88**

Chapter Highlights 88

Key Terms 89

Formula Review 89

Solved Problems 90

Discussion Questions 91

Problems 92

**CASE:** Biddy's Bakery (BB) 94**CASE:** Creature Care Animal Clinic (B) 95**INTERACTIVE CASE:** Virtual Company 96**INTERNET CHALLENGE:** Country Comfort Furniture 96

Selected Bibliography 96

**CHAPTER 4****Supply Chain Management 98****Basic Supply Chains 99**

Components of a Supply Chain for a Manufacturer 100

A Supply Chain for a Service Organization 102

The Bullwhip Effect 104

**Issues Affecting Supply Chain Management 106**

E-commerce and Supply Chains 106

Consumer Expectations and Competition Resulting from E-commerce 108

Globalization 110

Infrastructure Issues 111

Government Regulation and E-commerce 113

Green Supply Chain Management 113

**The Role of Purchasing 116**

Traditional Purchasing and E-purchasing 116

**Sourcing Decisions 120**

Insourcing versus Outsourcing Decisions 121

Developing Supplier Relationships 123

How Many Suppliers? 124

Developing Partnerships 125

Supplier Management Ethics 129

**The Role of Warehouses 130**

Crossdocking 132


Radio Frequency Identification Technology (RFID) 134

Third-Party Service Providers 135

**Implementing Supply Chain Management 135**

Strategies for Leveraging Supply Chain Management 136

Supply Chain Performance Metrics 137

**Supply Chain Management Within OM: How It All Fits Together 139****SCM Across the Organization 140** **THE SUPPLY CHAIN LINK 140** **THE SUSTAINABILITY LINK 140**

Chapter Highlights 141

Key Terms 142

Formula Review 142

Solved Problems 142

Discussion Questions 144

Problems 144

**CASE:** Electronic Personal Heart Rate Monitors Supply Chain Management Game 145**CASE:** Supply Chain Management At Durham International Manufacturing Company (DIMCO) 148**INTERACTIVE CASE:** Virtual Company 148**INTERNET CHALLENGE:** Global

Shopping 149

Selected Bibliography 149

## CHAPTER 5

### Total Quality Management 151

---

#### Defining Quality 152

Differences between Manufacturing and Service Organizations 153

#### Cost of Quality 154

#### The Evolution of Total Quality Management (TQM) 156

Quality Gurus 156

#### The Philosophy of TQM 160

Customer Focus 160  
 Continuous Improvement 160  
 Employee Empowerment 162  
 Use of Quality Tools 163  
 Product Design 166  
 Process Management 170  
 Managing Supplier Quality 171


#### Quality Awards and Standards 171


The Malcolm Baldrige National Quality Award (MBNQA) 171  
 The Deming Prize 172  
 ISO 9000 Standards 173  
 ISO Standards for Sustainability Reporting 174

#### Why TQM Efforts Fail 174

#### Total Quality Management (TQM) Within OM: How It All Fits Together 175

#### Total Quality Management (TQM) Across the Organization 175

 THE SUPPLY CHAIN LINK 176

 THE SUSTAINABILITY LINK 176

Chapter Highlights 177

Key Terms 177

Formula Review 178

Solved Problems 178

Discussion Questions 179

Problems 179

**CASE:** Gold Coast Advertising (GCA) 180

**CASE:** Delta Plastics, Inc. (A) 181

**INTERACTIVE CASE:** Virtual Company 182

**INTERNET CHALLENGE:** Snyder Bakeries 183

Selected Bibliography 183

#### Descriptive Statistics 187

The Mean 188

The Range and Standard Deviation 188

Distribution of Data 188

#### Statistical Process Control Methods 189

Developing Control Charts 189

Types of Control Charts 190

#### Control Charts for Variables 191

Mean ( $\bar{x}$ -Bar) Charts 191

Range ( $R$ ) Charts 194

Using Mean and Range Charts Together 196

#### Control Charts for Attributes 197

$p$ -Charts 198

$c$ -Charts 201

#### Process Capability 203

Measuring Process Capability 203

#### Six Sigma Quality 208

#### Acceptance Sampling 210

Sampling Plans 210

Operating Characteristic (OC) Curves 211

Developing OC Curves 213

Average Outgoing Quality 214

#### Implications for Managers 216

How Much and How Often to Inspect 216


Where to Inspect 217

Which Tools to Use 217

#### Statistical Quality Control in Services 217

#### Statistical Quality Control (SQC) Within OM: How It All Fits Together 219

#### Statistical Quality Control (SQC) Across the Organization 219

 THE SUPPLY CHAIN LINK 220

 THE SUSTAINABILITY LINK 220

Chapter Highlights 221

Key Terms 221

Formula Review 222

Solved Problems 222

Discussion Questions 227

Problems 227

**CASE:** Scharadin Hotels 230

**CASE:** Delta Plastics, Inc. (B) 231

**INTERACTIVE CASE:** Virtual Company 232

**INTERNET CHALLENGE:** Safe-Air 232

Selected Bibliography 233

## CHAPTER 7

### Just-in-Time and Lean Systems 234

---

#### The Philosophy of JIT 235

Eliminate Waste 235

A Broad View of Operations 236

Simplicity 236

## CHAPTER 6



### Statistical Quality Control 185

---

#### What Is Statistical Quality Control? 186

#### Sources of Variation: Common and Assignable Causes 187



Continuous Improvement	236
Visibility	237
Flexibility	237
<b>Elements of JIT</b>	<b>237</b>
Just-in-Time Manufacturing	237
Total Quality Management (TQM)	239
Respect for People	240
<b>Just-in-Time Manufacturing</b>	<b>241</b>
The Pull System	241
Kanban Production	241
Variations of Kanban Production	243
Small Lot Sizes and Quick Setups	245
Uniform Plant Loading	246
Flexible Resources	246
Facility Layout	247
<b>Total Quality Management</b>	<b>249</b>
Product versus Process	249
Quality at the Source	250
Preventive Maintenance	250
Work Environment	251
<b>Respect for People</b>	<b>251</b>
The Role of Production	
Employees	251
Lifetime Employment	252
The Role of Management	253
Supplier Relationships	254
<b>Benefits of JIT</b>	<b>255</b>
<b>Implementing JIT</b>	<b>256</b>
<b>JIT in Services</b>	<b>258</b>
Improved Quality	258
Uniform Facility Loading	258
Use of Multifunction Workers	258
Reductions in Cycle Time	258
Minimizing Setup Times and Parallel Processing	258
Workplace Organization	259
<b>JIT and Lean Systems Within OM: How It All Fits Together</b>	<b>259</b>
<b>JIT and Lean Systems Across the Organization</b>	<b>259</b>
 <b>THE SUPPLY CHAIN LINK</b>	<b>260</b>
 <b>THE SUSTAINABILITY LINK</b>	<b>260</b>
Chapter Highlights	261
Key Terms	261
Formula Review	262
Solved Problems	262
Discussion Questions	262
Problems	263
<b>CASE:</b> Katz Carpeting	263
<b>CASE:</b> Dixon Audio Systems	265
<b>INTERACTIVE CASE:</b> Virtual Company	265
<b>INTERNET CHALLENGE:</b> Truck-Fleet, Inc.	266
Selected Bibliography	266

## CHAPTER 8

### Forecasting 267

---

<b>Principles of Forecasting</b>	<b>268</b>
<b>Steps in the Forecasting Process</b>	<b>268</b>
<b>Types of Forecasting Methods</b>	<b>269</b>
Qualitative Methods	271
Quantitative Methods	272
<b>Time Series Models</b>	<b>272</b>
Forecasting Level or Horizontal Pattern	275
Forecasting Trend	283
Forecasting Seasonality	286
<b>Causal Models</b>	<b>289</b>
Linear Regression	289
Multiple Regression	293
<b>Measuring Forecast Accuracy</b>	<b>293</b>
Forecast Accuracy Measures	293
Tracking Signal	295
<b>Selecting the Right Forecasting Model</b>	<b>296</b>
Forecasting Software	297
Predictive Analytics and Forecasting	298
Combining Forecasting	299
<b>Collaborative Planning, Forecasting, and Replenishment (CPFR)</b>	<b>299</b>
<b>Forecasting Within OM: How It All Fits Together</b>	<b>300</b>
<b>Forecasting Across the Organization</b>	<b>301</b>
 <b>THE SUPPLY CHAIN LINK</b>	<b>301</b>
 <b>THE SUSTAINABILITY LINK</b>	<b>302</b>
Chapter Highlights	302
Key Terms	303
Formula Review	303
Solved Problems	304
Discussion Questions	308
Problems	308
<b>CASE:</b> Bram-Wear	312
<b>CASE:</b> The Emergency Room (Er) At Northwest General (A)	313
<b>INTERACTIVE CASE:</b> Virtual Company	314
<b>INTERNET CHALLENGE:</b> On-line Data Access	315
Selected Bibliography	315

## CHAPTER 9

### Capacity Planning and Facility Location 316

---

<b>Capacity Planning</b>	<b>317</b>
Why Is Capacity Planning Important?	317
Measuring Capacity	318
Capacity Considerations	320

**Making Capacity Planning Decisions 323**

- Identify Capacity Requirements 324
- Develop Capacity Alternatives 325
- Evaluate Capacity Alternatives 325

**Decision Trees 325**

**Location Analysis 328**

- What Is Facility Location? 328
- Factors Affecting Location Decisions 329
- Globalization 331

**Making Location Decisions 332**

- Procedure for Making Location Decisions 332
- Procedures for Evaluating Location Alternatives 333

**Capacity Planning and Facility Location Within OM: How It All Fits Together 343**

**Capacity Planning and Facility Location Across the Organization 343**

- THE SUPPLY CHAIN LINK 344
- THE SUSTAINABILITY LINK 344

- Chapter Highlights 344
- Key Terms 345
- Formula Review 345
- Solved Problems 345
- Discussion Questions 348
- Problems 348

**CASE:** Data Tech, Inc. 351

**CASE:** The Emergency Room (ER) At Northwest General (B) 352

**INTERACTIVE CASE:** Virtual Company 353

**INTERNET CHALLENGE:** EDS Office Supplies, Inc. 354

Selected Bibliography 354

**CHAPTER 10**

**Facility Layout 355**

---

**What Is Layout Planning? 356**

**Types of Layouts 356**

- Process Layouts 356
- Product Layouts 358
- Hybrid Layouts 359
- Fixed-Position Layouts 359

**Designing Process Layouts 360**

- Step 1: Gather Information 360
- Step 2: Develop a Block Plan 363
- Step 3: Develop a Detailed Layout 366

**Special Cases of Process Layout 366**

- Warehouse Layouts 366
- Office Layouts 369

**Designing Product Layouts 370**

- Step 1: Identify Tasks and Their Immediate Predecessors 370
- Step 2: Determine Output Rate 372
- Step 3: Determine Cycle Time 372
- Step 4: Compute the Theoretical Minimum Number of Stations 374

- Step 5: Assign Tasks to Workstations (Balance the Line) 374
- Step 6: Compute Efficiency, Idle Time, and Balance Delay 375
- Other Considerations 376

**Group Technology (Cell) Layouts 377**

**Facility Layout Within OM: How It All Fits Together 378**

**Facility Layout Across the Organization 378**

- THE SUPPLY CHAIN LINK 379
- THE SUSTAINABILITY LINK 379

Chapter Highlights 380

Key Terms 380

Formula Review 380

Solved Problems 381

Discussion Questions 383

Problems 384

**CASE:** Sawhill Athletic Club (A) 388

**CASE:** Sawhill Athletic Club (B) 389

**INTERACTIVE CASE:** Virtual

Company 390

**INTERNET CHALLENGE:** DJ and Associates, Inc. 391

Selected Bibliography 391

**CHAPTER 11**

**Work System Design 392**

---

**Work System Design 393**

**Job Design 393**

- Job Design 393
- Machines or People? 395
- Level of Labor Specialization 395
- Eliminating Employee Boredom 396
- Team Approaches to Job Design 397
- The Alternative Workplace 398
- The Work Environment 400
- Methods Analysis 400

**Work Measurement 402**

- Developing Standards 404
- Developing a Standard Work Sampling 411
- Learning Curve Theory 414

**Compensation 415**

- Group Incentive Plans 417
- Incentive Plan Trends 417

**Work System Design Within OM: How It All Fits Together 418**

**Work System Design Across the Organization 418**

- THE SUPPLY CHAIN LINK 419
- THE SUSTAINABILITY LINK 419

Chapter Highlights 420

Key Terms 421  
 Formula Review 421  
 Solved Problems 421  
 Discussion Questions 424  
 Problems 425  
**CASE:** The Navigator III 428  
**CASE:** Northeast State University 428  
**INTERACTIVE CASE:** Virtual Company 429  
**INTERNET CHALLENGE:** E-commerce Job Design 430  
 Selected Bibliography 430

## CHAPTER 12

### Inventory Management 432

#### Basic Inventory Principles 433

How Manufacturers Use Inventory 433  
 Inventory in Service Organizations 435

#### Inventory Management Objectives 436

Customer Service 436  
 Cost-Efficient Operations 437  
 Minimum Inventory Investment 438

#### Relevant Inventory Costs 440

#### ABC Inventory Classification 442

#### Inventory Record Accuracy 445

#### Determining Order Quantities 446

Non-mathematical Techniques for Determining Order Quantity 447  
 Mathematical Models for Determining Order Quantity 448  
 The Single-Period Inventory Model 459  
 Why Companies Don't Always Use the Optimal Order Quantity 461  
 How a Company Justifies Smaller Order Quantities 462



#### Determining Safety Stock Levels 463

#### The Periodic Review System 466

Comparing Continuous Review Systems and Periodic Review Systems 468

#### Inventory Management within OM: How It All Fits Together 468

#### Inventory Management across the Organization 469

 THE SUPPLY CHAIN LINK 469  
 THE SUSTAINABILITY LINK 470

Chapter Highlights 470  
 Key Terms 471  
 Formula Review 471  
 Solved Problems 472  
 Discussion Questions 476  
 Problems 476

**CASE:** Fabqual Ltd. 480

**CASE:** Kayaks! Incorporated 480

**INTERACTIVE CASE:** Virtual Company 481

**INTERNET CHALLENGE:** Community Fund-Raiser (A) 482

Selected Bibliography 482

## CHAPTER 13

### Aggregate Planning 483

#### Business Planning 484

#### Aggregate Planning Options 486

Demand-Based Options 487  
 Capacity-Based Options 488  
 Evaluating the Current Situation 489

#### Aggregate Plan Strategies 490


Level Aggregate Plan 490  
 Chase Aggregate Plan 491  
 Hybrid Aggregate Plan 492

#### Developing the Aggregate Plan 492

Aggregate Plans for Companies with Tangible Products 494  
 Aggregate Plans for Companies with Nontangible Products 497

#### Aggregate Planning Within OM: How It All Fits Together 502

#### Aggregate Planning Across the Organization 502

 THE SUPPLY CHAIN LINK 503

 THE SUSTAINABILITY LINK 503

Chapter Highlights 503

Key Terms 504

Solved Problems 504

Discussion Questions 510

Problems 511

**CASE:** Newmarket International Manufacturing Company (A) 513

**CASE:** JPC, Inc.: Kitchen Countertops Manufacturer 514

**INTERACTIVE CASE:** Virtual Company 515

**INTERNET CHALLENGE:** Cruising 515

Selected Bibliography 516

## CHAPTER 14

### Resource Planning 517

#### Enterprise Resource Planning 518

The Evolution of ERP Systems 520

#### The Benefits and Costs of ERP 522

The Benefits of ERP Systems 522

The Costs of ERP Systems 523

#### Material Planning Systems 524

An Overview of Material Planning Systems 524

Objectives of MRP 525

Types of Demand 525

The Operating Logic of MRP 527

#### How MRP Works 532



Action Notices 536

Comparing Different Lot Size Rules 536

#### Capacity Requirements Planning (CRP) 538

#### Resource Planning Within OM: How It All Fits Together 540

**Resource Planning Across the Organization 540**

-  **THE SUPPLY CHAIN LINK 541**
-  **THE SUSTAINABILITY LINK 541**

- Chapter Highlights 542
- Key Terms 542
- Formula Review 543
- Solved Problems 543
- Discussion Questions 546
- Problems 547

**CASE:** Newmarket International Manufacturing Company (B) 549

**CASE:** Desserts By J.B. 551

**INTERACTIVE CASE:** Virtual Company 551

**INTERNET CHALLENGE:** The Gourmet Dinner 552

Selected Bibliography 552

**CHAPTER 15  
Scheduling 553**

---

**Basic Scheduling Concepts 554**

- Scheduling High-Volume Operations 554
- Scheduling Low-Volume Operations 555
- Shop Loading Methods 556

**Developing a Schedule of Operations 560**

- Scheduling Performance Measures 561
- Using Different Priority Rules 564
- Sequencing Jobs through Two Work Centers 567

**Optimized Production Technology 569**



- Scheduling Bottlenecks 569
- Theory of Constraints 571

**Scheduling Issues for Service Organizations 572**

- Scheduling Techniques for Service Organizations 572
- Scheduling Employees 573
- Developing a Workforce Schedule 574

**Scheduling Within OM: Putting It All Together 576**

**Scheduling Across the Organization 576**

-  **THE SUPPLY CHAIN LINK 577**
-  **THE SUSTAINABILITY LINK 577**

- Chapter Highlights 577
- Key Terms 578
- Formula Review 578
- Solved Problems 578
- Discussion Questions 582
- Problems 583

**CASE:** Air Traffic Controller School (ATCS) 586

**CASE:** Scheduling At Red, White, And Blue Fireworks Company 586

**INTERACTIVE CASE:** Virtual Company 587

**INTERNET CHALLENGE:** Batter Up 587

Selected Bibliography 588

**CHAPTER 16  
Project Management 589**

---

**The Project Life Cycle 590**

**Project Management Concepts 591**

- Step 1: Describe the Project 592
- Step 2: Diagram the Network 593
- Step 3: Estimate the Project's Completion Time 595
- Step 3 (a): Deterministic Time Estimates 595
- Step 3 (b): Probabilistic Time Estimates 598
- Step 4: Monitor the Project's Progression 603

**Estimating the Probability of Completion Dates 604**

**Reducing Project Completion Time 606**



Crashing Projects 606

**The Critical Chain Approach 609**

- Adding Safety Time 609
- Wasting Safety Time 609

**Project Management Within OM: How It All Fits Together 611**

**Project Management OM Across the Organization 611**

-  **THE SUPPLY CHAIN LINK 612**
-  **THE SUSTAINABILITY LINK 612**

- Chapter Highlights 612
- Key Terms 613
- Formula Review 613
- Solved Problems 614
- Discussion Questions 618
- Problems 618

**CASE:** The Research Office Moves 621

**CASE:** Writing A Textbook 622

**INTERACTIVE CASE:** Virtual Company 623

**INTERNET CHALLENGE:** Creating Memories 623

Selected Bibliography 624

**Appendix A**

**Solutions to Odd-Numbered Problems 625**

**Appendix B**

**The Standard Normal Distribution 647**

**Appendix C**

**p-Chart 648**

**NAME INDEX 651**

**SUBJECT INDEX 654**

To view Supplemental Chapters A-D, please visit [www.wiley.com/college/reid](http://www.wiley.com/college/reid) or your WileyPLUS Learning Space course.

## **SUPPLEMENT A**

### **Spreadsheet Modeling: An Introduction A1**

#### **What Are Models? A2**

#### **The Spreadsheet Modeling Process A3**

- Evaluating the Spreadsheet Model A4
- Constructing the Model A6
- Assessing Our Model A8
- Using the Model for Analysis A10
- Using Data Tables A13
- Graphing the Model Results A16

#### **Multiple-Criteria Decision Making A17**

- Relative and Absolute Cell Referencing A19
- Entering Formulas in the Model A20

#### **Useful Spreadsheet Tips A25**

#### **Important Excel Formulas A25**

#### **Spreadsheet Modeling Within OM:**

#### **How It All Fits Together A27**

- Supplement Highlights A27
- Key Terms A28
- Discussion Questions A28
- Problems A28
- CASE: Diet Planning A30**
- Selected Bibliography A31

## **SUPPLEMENT B**

### **Introduction to Optimization B1**

#### **Optimization B2**

#### **Algebraic Formulation B3**

- Examining the Formulation B6

#### **Spreadsheet Model Development B7**

- Testing the Model B8
- Solver Basics B8
- Setting Up and Running Solver B9
- Solving the Problem B12

#### **Interpreting the Solution B13**

- Solver Solution Reports B14
- Outcomes of Linear Programming Problems B16

#### **Optimization Within OM: How It All Fits Together B17**

- Supplement Highlights B18
- Key Terms B18
- Solved Problems B18
- Discussion Questions B23
- Problems B24

#### **CASE: Exeter Enterprises B25**

- Selected Bibliography B26

## **SUPPLEMENT C**

### **Waiting Line Models C1**

#### **Elements of Waiting Lines C2**

- Links to Practice: Waiting for Fast Food C2
- The Customer Population C3
- The Service System C3
- Arrival and Service Patterns C5
- Waiting Line Priority Rules C5

#### **Waiting Line Performance Measures C6**

- Single-Server Waiting Line Model C6
- Multiserver Waiting Line Model C9

#### **Changing Operational Characteristics C12**

- Larger-Scale Waiting Line Systems C13

#### **Waiting Line Models Within OM: How It All Fits Together C14**

- Supplement Highlights C14
- Key Terms C15
- Formula Review C15
- Solved Problems C15
- Discussion Questions C18
- Problems C18
- CASE: The Copy Center Holdup C19**
- Selected Bibliography C19

## **SUPPLEMENT D**

### **Master Scheduling and Rough-Cut Capacity Planning D1**

#### **Master Production Scheduling D2**

- MPS as a Basis of Communication D2
- Objectives of Master Scheduling D3

#### **Developing an MPS D4**

- Rough-Cut Capacity Planning D5
- Evaluating and Accepting the MPS D8

#### **Using the MPS D9**

#### **Stabilizing the MPS D12**

#### **Master Production Scheduling and Rough-Cut Capacity Planning within OM: How It All Fits Together D14**

- Supplement Highlights D14
- Key Terms D15
- Formula Review D15
- Solved Problems D15
- Discussion Questions D20
- Problems D20

- CASE: Newmarket International Manufacturing Company (C) D22**





# Introduction to Operations Management

# 1

**M**any of you reading this book may think that you don't know what operations management (OM) is or that it is not something you are interested in. However, after reading this chapter you will realize that you already know quite a bit about operations management. You may even be working in an operations management capacity and have used certain operations management techniques. You will also realize that operations management is probably the most critical business function today. If you want to be on the frontier of business competition, you want to be in operations management.

Today companies are competing in a very different environment than they were only a few years ago. To survive, they must focus on quality, time-based competition, efficiency, international perspectives, and customer relationships. Global competition, e-business, the Internet, and advances in technology require flexibility and responsiveness. Increased financial pressures require lean and agile organizations that are free of waste. This new focus has placed operations management in the business limelight because it is the function through which companies can achieve this type of competitiveness.

Consider some of today's most successful companies, such as Wal-Mart, Southwest Airlines, General Electric, Starbucks, Apple Computer, Toyota, FedEx, and Procter & Gamble. These companies have achieved world-class status in large part

## Learning Objectives

**After studying this chapter you should be able to**

- 1 Define operations management.
- 2 Describe difference between manufacturing and service organizations.
- 3 Describe decisions that operations managers make.
- 4 Identify major historical developments in operations management.
- 5 Identify current trends in operations management.
- 6 Describe the flow of information between operations management and other business functions.



due to a strong focus on operations management. In this book you will learn specific tools and techniques of operations management that have helped these and other companies achieve their success.

The purpose of this book is to help prepare you to be successful in this new business environment. Operations management will give you an understanding of how to help your organization gain a competitive advantage in the marketplace. Regardless of whether your area of expertise is marketing, finance, MIS, or operations, the techniques and concepts in this book will help you in your business career. The material will teach you how your company can offer goods and services cheaper, better, and faster. You will also learn that operations management concepts are far-reaching, affecting every aspect of the organization and even everyday life. ●

## ● What is Operations Management?

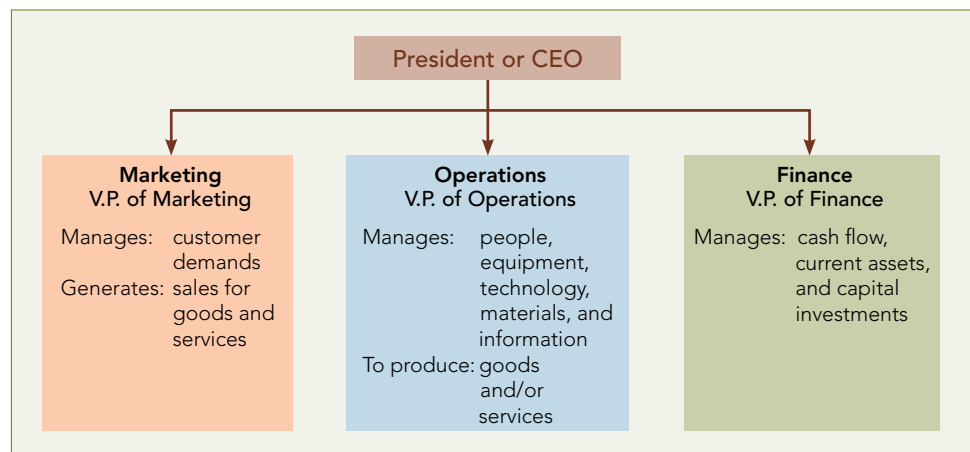


Every business is managed through three major functions: finance, marketing, and operations management. Figure 1.1 illustrates this by showing that the vice presidents of each of these functions report directly to the president or CEO of the company. Other business functions—such as accounting, purchasing, human resources, and engineering—support these three major functions. Finance is the function responsible for managing cash flow, current assets, and capital investments. Marketing is responsible for sales, generating customer demand, and understanding customer wants and needs. Most of us have some idea of what finance and marketing are about, but what does operations management do?

**Operations management (OM)** The business function responsible for planning, coordinating, and controlling the resources needed to produce a company's goods and services.

**Operations management (OM)** is the business function that plans, organizes, coordinates, and controls the resources needed to produce a company's goods and services. Operations management is a *management* function. It involves managing people, equipment, technology, information, and many other resources. Operations management is the central core function of every company. This is true whether the company is large or small, provides a physical good or a service, is for-profit or not-for-profit. Every company has an operations management function. Actually, all the other organizational functions are there primarily to support the operations function. Without operations, there

● **FIGURE 1.1** Organizational chart showing the three major business functions



would be no goods or services to sell. Consider a retailer such as The Gap, which sells casual apparel. The marketing function provides promotions for the merchandise, and the finance function provides the needed capital. It is the operations function, however, that plans and coordinates all the resources needed to design, produce, and deliver the merchandise to the various retail locations. Without operations, there would be no goods or services to sell to customers.

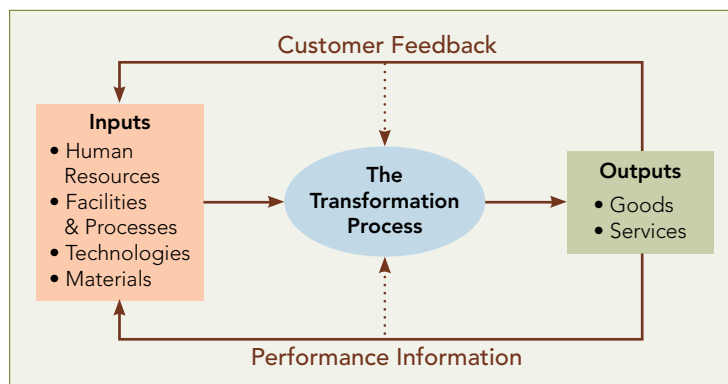
The **role of operations management** is to transform a company's inputs into the finished goods or services. Inputs include human resources (such as workers and managers), facilities and processes (such as buildings and equipment), as well as materials, technology, and information. Outputs are the goods and services a company produces. Figure 1.2 shows this *transformation process*. At a factory the transformation is the physical change of raw materials into products, such as transforming leather and rubber into sneakers, denim into jeans, or plastic into toys. At an airline it is the efficient movement of passengers and their luggage from one location to another. At a hospital it is organizing resources such as doctors, medical procedures, and medications to transform sick people into healthy ones.

Operations management is responsible for orchestrating all the resources needed to produce the final product. This includes designing the product; deciding what resources are needed; arranging schedules, equipment, and facilities; managing inventory; controlling quality; designing the jobs to make the product; and designing work methods. Basically, operations management is responsible for all aspects of the process of transforming inputs into outputs. Customer feedback and performance information are used to continually adjust the inputs, the transformation process, and the characteristics of the outputs. As shown in Figure 1.2, this transformation process is dynamic in order to adapt to changes in the environment.

Proper management of the operations function has led to success for many companies. For example, in 1994 Dell Computer Corporation was a second-rate computer maker that managed its operations similarly to others in the industry. Then Dell implemented a new business model that completely changed the role of its operations function. Dell developed new and innovative ways of managing the operations function that have become one of today's best practices. These changes enabled Dell to provide rapid product delivery of customized products to customers at a lower cost. The company has since expanded this model to use an analytics driven system. This has enabled Dell to identify certain models so common they could be stocked in preconfigured inventory. Ordered today the customer can have them tomorrow. Dell's model is one many have tried to emulate and is the key to its being an industry leader.

**Role of operations management** To transform organizational inputs into outputs.

● **FIGURE 1.2** | The transformation process



Just as proper management of operations can lead to company success, improper management of operations can lead to failure. This is illustrated by Kozmo.com, a Web-based home delivery company founded in 1997. Kozmo's mission was to deliver products to customers—everything from the latest video to ice cream—in less than an hour. Kozmo was technology enabled and rapidly became a huge success. However, the initial success gave rise to overly fast expansion. The company found it difficult to manage the operations needed in order to deliver the promises made on its Web site. The consequences were too much inventory, poor deliveries, and losses in profits. The company rapidly tried to change its operations, but it was too late. It had to cease operations in April 2001.

## LINKSTO PRACTICE

THE E-TAILERS

[www.Amazon.com](http://www.Amazon.com)

[www.Barnesandnoble.com](http://www.Barnesandnoble.com)

[www.alibaba.com](http://www.alibaba.com)



Getty Images, Inc.

The Web-based age has created a highly competitive world of on-line shopping that poses special challenges for operations management. The Web can be used for on-line purchasing of everything from CDs, books, and groceries to prescription medications and automobiles. The Internet has given consumers flexibility; it has also created one of the biggest challenges for companies: delivering exactly what the customer

ordered at the time promised. As we saw with the example of Kozmo.com, making promises on a Web site is one thing; delivering on those promises is yet another. Ensuring that orders are delivered from “mouse to house” is the job of operations and is much more complicated than it might seem. In the 1990s many dot-com companies discovered just how difficult this is. They were not able to generate a profit and went out of business. To ensure meeting promises, companies must forecast what customers want and maintain adequate inventories of goods, manage distribution centers and warehouses, operate fleets of trucks, and schedule deliveries while keeping costs low and customers satisfied. Many companies like Amazon.com manage almost all aspects of their operation. In fact, Amazon.com has been moving toward having its own delivery service. Other companies hire outside firms for certain functions, such as outsourcing the management of inventories and deliveries to UPS. Competition among e-tailers has become intense as customers demand increasingly shorter delivery times and highly customized products. Same-day service has become common in metropolitan areas. For example, Barnesandnoble.com provides same-day delivery in Manhattan, Los Angeles, and San Francisco. Amazon.com has significantly expanded same-day delivery locations. Understanding and managing the operations function of an on-line business has become essential in order to remain competitive.

For operations management to be successful, it must add value during the transformation process. We use the term **value added** to describe the net increase between the final value of a product and the value of all the inputs. The greater the value added, the more productive a business is. An obvious way to add value is to reduce the cost of activities in the transformation process. Activities that do not add value are considered a waste; these include certain jobs, equipment, and processes. In addition to value added, operations must be efficient. **Efficiency** means being able to perform activities well and at the lowest possible cost. An important role of operations is to analyze all activities, eliminate those that do not add value, and restructure processes and jobs to achieve greater efficiency. Because today's business environment is more competitive than ever, the role of operations management has become the focal point of efforts to increase competitiveness by improving value added and efficiency.

**Value added** The net increase created during the transformation of inputs into final outputs.

**Efficiency** Performing activities well and at the lowest possible cost.

## ● Differences between Manufacturing and Service Organizations

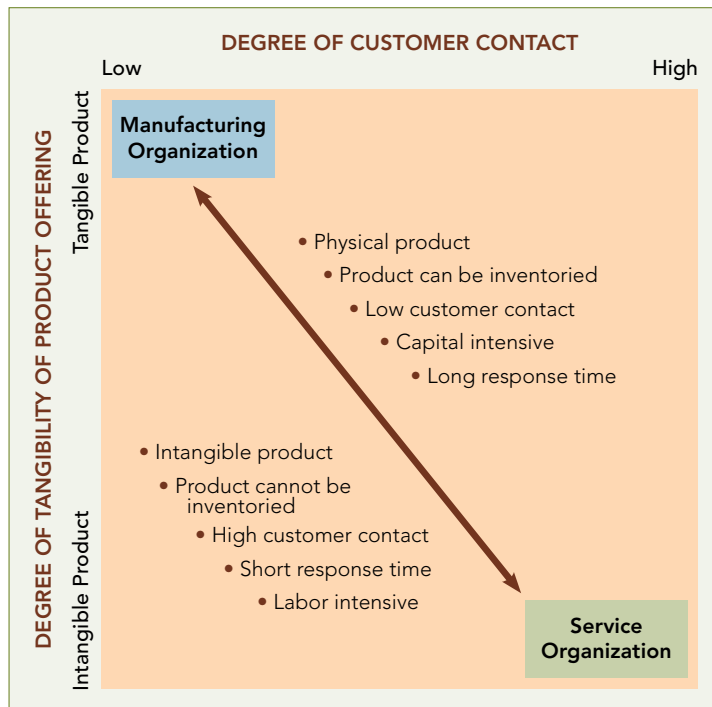
Organizations can be divided into two broad categories: **manufacturing organizations** and **service organizations**, each posing unique challenges for the operations function. There are two primary distinctions between these categories. First, manufacturing organizations produce physical, tangible goods that can be stored in inventory before they are needed. By contrast, service organizations produce intangible products that cannot be produced ahead of time. Second, in manufacturing organizations most customers have no direct contact with the operation. Customer contact occurs through distributors and retailers. For example, a customer buying a car at a car dealership never comes into contact with the automobile factory. However, in service organizations the customers are typically present during the creation of the service. Hospitals, colleges, theaters, and barber shops are examples of service organizations in which the customer is present during the creation of the service.

The differences between manufacturing and service organizations are not as clear-cut as they might appear, and there is much overlap between them. Most manufacturers provide services as part of their business, and many service firms manufacture physical goods that they deliver to their customers or consume during service delivery. For example, a manufacturer of furniture may also provide shipment of goods and assembly of furniture. A barber shop may sell its own line of hair care products. You might not know that General Motors' greatest return on capital does not come from selling cars, but rather from postsales parts and service. Figure 1.3 shows the differences between manufacturing

**Manufacturing organizations**  
Organizations that primarily produce a tangible product and typically have low customer contact.

**Service organizations**  
Organizations that primarily produce an intangible product, such as ideas, assistance, or information, and typically have high customer contact.

● **FIGURE 1.3** Characteristics of manufacturing and service organizations





and services, focusing on the dimensions of product tangibility and the degree of customer contact. It shows the extremes of pure manufacturing and pure service, as well as the overlap between them.

Even in pure service companies some segments of the operation may have low customer contact while others have high customer contact. The former can be thought of as “back room” or “behind the scenes” segments. Think of a fast-food operation such as Wendy’s, for which customer service and customer contact are important parts of the business. However, the kitchen segment of Wendy’s operation has no direct customer contact and can be managed like a manufacturing operation. Similarly, a hospital is a high-contact service operation, but the patient is not present in certain segments, such as the lab where specimen analysis is done.

In addition to pure manufacturing and pure service, there are companies that have some characteristics of each type of organization. It is difficult to tell whether these companies are actually manufacturing or service organizations. Think of a post office, an automated warehouse, or a mail-order catalog business. They have low customer contact and are capital intensive, yet they provide a service. We call these companies *quasi-manufacturing organizations*.



The U.S. Postal Service is an example of a quasi-manufacturing type of company. It provides a service: speedy, reliable delivery of letters, documents, and packages. Its output is intangible and cannot be stored in inventory. Yet most operations management decisions made at the Postal Service are similar to those that occur in manufacturing. Customer contact is low, and at any one time there is a large amount of inventory. The Postal Service is capital intensive, having its own facilities and fleet of trucks and relying on scanners to sort packages and track customer orders. Scheduling enough workers at peak processing times is a major concern, as is planning delivery schedules. Note that although the output of the U.S. Postal Service is a service, inputs include labor, technology, and equipment. The responsibility of OM is to manage the conversion of these inputs into the desired outputs. Proper management of the OM function is critical to the success of the U.S. Postal Service.

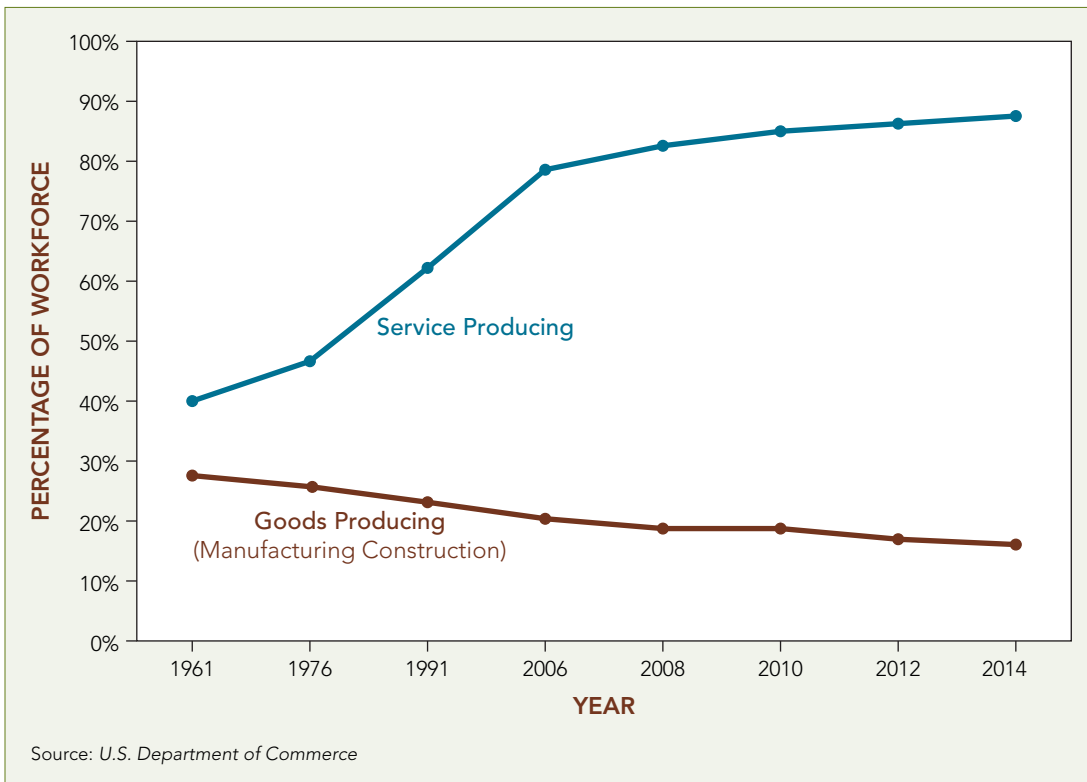
It is important to understand how to manage both service and manufacturing operations. However, managing service operations is of especially high importance. The reason is that the service sector constitutes a dominant segment of our economy. Since the 1960s, the percentage of jobs in the service-producing industries of the U.S. economy has increased from less than 50 to over 80 percent of total nonfarm jobs. The remaining 20 percent are in the manufacturing and goods-producing industries. Figure 1.4 illustrates this large growth of the service sector.

## ● Operations Management Decisions

In this section we look at some of the specific decisions that operations managers have to make. The best way to do this is to think about decisions we would need to make if we started our own company—say, a company called Gourmet Wafers that produces praline-pecan cookies from an old family recipe. Think about the decisions that would have to be made to go from the initial idea to actual production of the product: that is operations management. Table 1.1 breaks these down into the generic decisions that would be appropriate for almost



● **FIGURE 1.4** U.S. employment by economic sector



any good or service, the specific decisions required for our example, and the formal terms for these decisions that are used in operations management.

Note in the Gourmet Wafers example that the first decisions made were very broad in scope (e.g., the unique features of our product). We needed to do this before we could focus on more specific decisions (e.g., worker schedules). Although our example is simple, this decision-making process is followed by every company, including IBM, General Motors, Lands' End, and your local floral shop. Also note in our example that before we can think about specific day-to-day decisions, we need to make decisions for the whole company that are long-term in nature. Long-term decisions that set the direction for the entire organization are called **strategic decisions**. They are broad in scope and set the tone for other, more specific decisions. They address questions such as: What are the unique features of our product? What market do we plan to compete in? What do we believe will be the demand for our product?

Short-term decisions that focus on specific departments and tasks are called **tactical decisions**. Tactical decisions focus on more specific day-to-day issues, such as the quantities and timing of specific resources. Strategic decisions are made first and determine the direction of tactical decisions, which are made more frequently and routinely. Therefore, we have to start with strategic decisions and then move on to tactical decisions. This relationship is shown in Figure 1.5. Tactical decisions must be aligned with strategic decisions because they are the key to the company's effectiveness in the long run. Tactical decisions provide feedback to strategic decisions, which can be modified accordingly.

#### Strategic decisions

Decisions that set the direction for the entire company; they are broad in scope and long-term in nature.

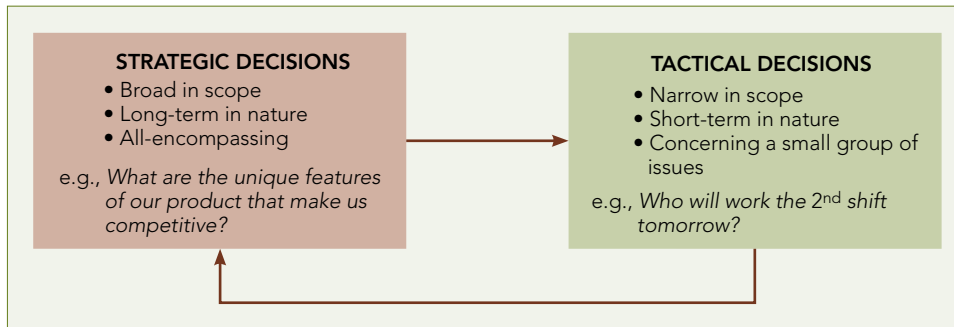
#### Tactical decisions

Decisions that are specific and short-term in nature and are bound by strategic decisions.

**TABLE 1.1** | Operations Management Decisions for Gourmet Wafers

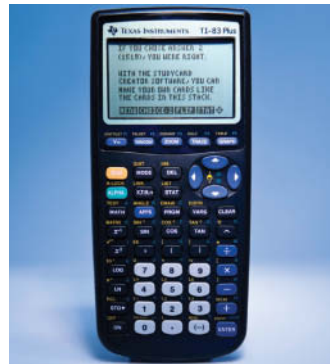
General Decisions to Be Made	Decision Specific for Cookie Production	Operations Management Term
What are the unique features of the business that will make it competitive?	The business offers freshly baked cookies “homemade” style, in a fast-food format.	Operations strategy
What are the unique features of the product?	The unique feature of the cookies is that they are loaded with extra-large and crunchy pecans and are fresh and moist.	Product design
What are the unique features of the process that give the product its unique characteristics?	A special convection oven is used to make the cookies in order to keep them fresh and moist. The dough is allowed to rise longer than usual to make the cookies extra light.	Process selection
What sources of supply should we use to ensure regular and timely receipt of the extract materials we need? How do we manage these sources of supply?	The key ingredients, pecans and syrup, will be purchased from only one supplier located in South Carolina because it offers the best products. A relationship is worked out in which the supplier sends the ingredients on the exact schedule that they are needed.	Supply chain management
How will managers ensure the quality of the product, measure quality, and identify quality problems?	A quality check is made at each stage of cookie production. The dough is checked for texture; the pecans are checked for size and freshness; the syrup is checked for consistency.	Quality management
What is the expected demand for the product?	Expected sales for each day of the week have been determined; for example, it is expected that more cookies will be sold on weekdays and most during the lunch hours. Expected cookie sales for each month and for the year have also been determined.	Forecasting
Where will the facility be located?	After looking at locations of customers and location costs, it is decided that the facility will be located in a shopping mall.	Location analysis
How large should the facility be?	The business needs to be able to produce 200 cookies per hour, or up to 2000 cookies per day.	Capacity planning
How should the facility be laid out? Where should the kitchen and ovens be located? Should there be seating for customers?	Decisions are made about where the kitchen will be located and how the working area will be arranged for maximum efficiency. The business is competing on the basis of <i>speed</i> and <i>quality</i> ; therefore, the facility should be arranged to promote these features. There will be a small seating area for customers and a large counter and display case for buying.	Facility layout
What jobs will be needed in the facility, who should do what task, and how will their performance be measured?	Two people will be needed in the kitchen during busy periods and one during slow periods. Their job duties are determined. One person will be needed for order taking at all times.	Job design and work measurement
How will the inventory of raw materials be monitored? When will orders be placed, and how much will be kept in stock?	A different policy is developed for common ingredients, such as flour and sugar. These ingredients will be ordered every two weeks for a two-week supply. A special purchasing arrangement is worked out with the supplier of specialty ingredients.	Inventory management
Who will work on what schedule?	Two people will work the counter in split shifts. One kitchen employee will work a full shift, with a second employee working part-time.	Scheduling

● **FIGURE 1.5** The relationship between strategic and tactical decisions



You can see in the example of Gourmet Wafers how important OM decisions are. They are critical to all types of companies, large and small. In large companies these decisions are more complex because of the size and scope of the organization. Large companies typically produce a greater variety of products, have multiple location sites, and often use domestic and international suppliers. Managing OM decisions and coordinating efforts can be a complicated task, and the OM function is critical to the company's success.

We can illustrate this point by looking at operations management decisions made by Texas Instruments (TI) in order to position itself for global collaboration with customers, distributors, and suppliers. TI realized its business was growing exponentially, with more than 120,000 monthly orders received and processed electronically. The coordination effort encompassed 56 factories, including subcontractors, and the management of over 45,000 products. To succeed, the company needed to develop a system to generate better forecasts, coordinate manufacturing of products, manage orders, and track deliveries. Managing and coordinating global operations management functions was considered paramount to the company's success. TI adopted a comprehensive software package called enterprise resource planning (ERP) that integrates information throughout the organization, manages forecasts, and coordinates factory operations. Designing and implementing the ERP system at TI required an understanding of all the strategic and tactical operations decisions; otherwise, it would not be effective. The system has proven to be a success and a major achievement, enabling TI to consistently manage factory operations across the globe.



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## BEFORE YOU GO ON

You should understand that operations management (OM) is the business function responsible for planning, coordinating, and controlling the resources needed to produce a company's goods and services. OM is directly responsible for managing the transformation of a company's inputs (e.g., materials, technology, and information) into finished products and services. OM requires a wide range of strategic and tactical decisions. Strategic decisions are long-range and very broad in scope

(e.g., unique features of the company's product and process). They determine the direction of tactical decisions, which are more short-term and narrow in scope (e.g., policy for ordering raw materials). All organizations can be separated into manufacturing and service operations, which differ based on product tangibility and degree of customer contact. Service and manufacturing organizations have very different operational requirements.