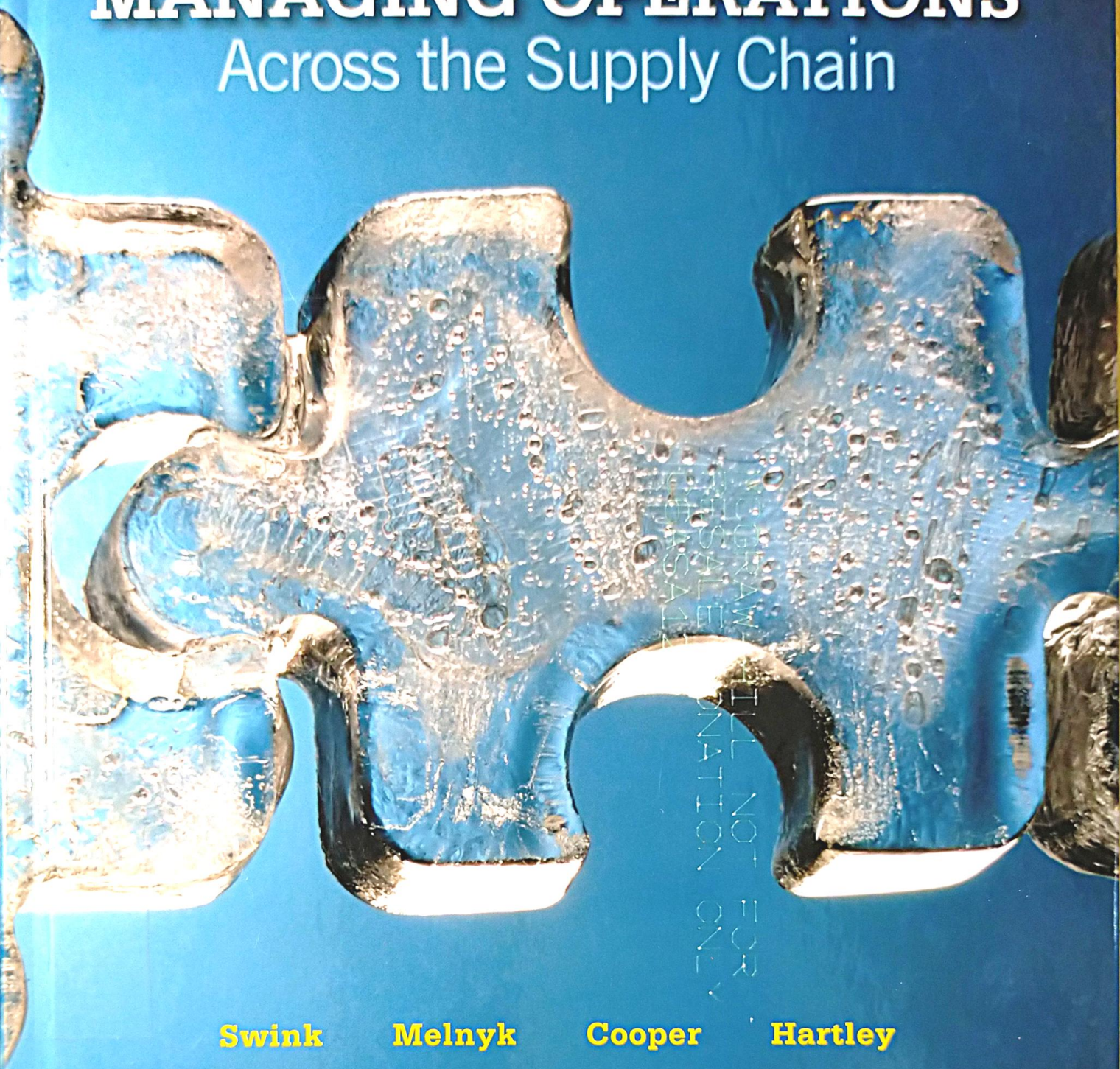


MANAGING OPERATIONS

Across the Supply Chain



Swink

Melnyk

Cooper

Hartley

Managing Operations

Across the Supply Chain

Morgan Swink

Michigan State University

Steven A. Melnyk

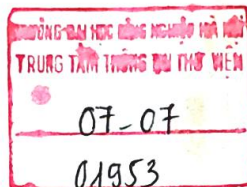
Michigan State University

M. Bixby Cooper

Michigan State University

Janet L. Hartley

Bowling Green State University



**McGraw-Hill
Irwin**



MANAGING OPERATIONS ACROSS THE SUPPLY CHAIN

Published by McGraw-Hill/Irwin, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY, 10020. Copyright © 2011 by The McGraw-Hill Companies, Inc. All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written consent of The McGraw-Hill Companies, Inc., including, but not limited to, in any network or other electronic storage or transmission, or broadcast for distance learning. Some ancillaries, including electronic and print components, may not be available to customers outside the United States.

This book is printed on acid-free paper.

2 3 4 5 6 7 8 9 0 DOW/DOW 1 0 9 8 7 6 5 4 3 2 1 0

ISBN 978-0-07-340331-1

MHID 0-07-340331-8

Vice president and editor-in-chief: *Brent Gordon*

Editorial director: *Stewart Mattson*

Publisher: *Tim Vertovec*

Executive editor: *Richard T. Hercher, Jr.*

Director of development: *Ann Torbert*

Managing development editor: *Gail Korosa*

Vice president and director of marketing: *Robin J. Zwettler*

Marketing director: *Sankha Basu*

Marketing manager: *Melissa Caughlin*

Vice president of editing, design and production: *Sesha Bolisetty*

Senior project manager: *Harvey Yep*

Lead production supervisor: *Michael R. McCormick*

Lead designer: *Matthew Baldwin*

Senior photo research coordinator: *Jeremy Cheshareck*

Photo researcher: *Ira C. Roberts*

Senior media project manager: *Greg Bates*

Cover design: *Kay Lieberherr*

Interior design: *Kay Lieberherr*

Cover image: ©Getty Images

Typeface: *10/12 Times Roman*

Compositor: *Laserwords Private Limited*

Printer: *R. R. Donnelley*

Library of Congress Cataloging-in-Publication Data

Managing operations across the supply chain / Morgan Swink . . . [et al.].—1st ed.

p. cm.—(The McGraw-Hill/Irwin series operations and decision sciences)

Includes index.

ISBN-13: 978-0-07-340331-1 (alk. paper)

ISBN-10: 0-07-340331-8 (alk. paper)

1. Business logistics. 2. Production management. 3. Industrial management.

I. Swink, Morgan, 1959-

HD38.5.M36175 2011

658.5—dc22

2009054152

Brief Contents

Part 1 SUPPLY CHAIN: A PERSPECTIVE FOR OPERATIONS MANAGEMENT 1

- 1** Introduction to Managing Operations Across the Supply Chain 2
- 2** Operations and Supply Chain Strategy 24

Part 2 FOUNDATIONS OF OPERATIONS MANAGEMENT 51

- 3** Managing Processes and Capabilities 52
- 3** Supplement: Process Mapping and Analysis 80
- 4** Product/Process Innovation 96
- 5** Manufacturing and Service Process Structures 124
- 6** Managing Quality 154
- 6** Supplement: Quality Improvement Tools 184
- 7** Understanding Inventory Fundamentals 210
- 8** Lean Systems 234

Part 3 INTEGRATING RELATIONSHIPS ACROSS THE SUPPLY CHAIN 259

- 9** Customer Management 260
- 10** Supply Management 282
- 11** Logistics Management 310

Part 4 PLANNING FOR INTEGRATED OPERATIONS ACROSS THE SUPPLY CHAIN 341

- 12** Demand Planning: Forecasting and Demand Management 342
- 12** Supplement: Advanced Forecasting and Tracking Models 370
- 13** Sales and Operations Planning 390
- 14** Independent Demand Inventory Planning 418
- 15** Materials and Resource Requirements Planning 446

Part 5 MANAGING CHANGE IN SUPPLY CHAIN OPERATIONS 479

- 16 Project Management 480
- 16 Supplement: Advanced Methods for Project Scheduling 512
- 17 Evolving Business Models and Change Drivers in the Supply Chain 526

Appendix A Table of Cumulative Probability of the Normal Distribution (One-Tail) 550

Appendix B Answers to Selected Problems 551

Photo Credits 563

Indexes 564

Contents

Part 1

SUPPLY CHAIN: A PERSPECTIVE FOR OPERATIONS MANAGEMENT 1

CHAPTER 1 Introduction to Managing Operations Across the Supply Chain 2

A Broad Definition of Supply Chain Operations Management 4

Get Real: Why You Need to Study Operations
Management 5

Important Decisions in Supply Chain Operations
Management 6

Differences in Goods and Services Operations 6
Processes and Process Thinking 7

Operations Management Yesterday and Today: Growth of the Supply Chain Management Perspective 9

Advances in Technology and Infrastructure 10

Reduction in Governmental Barriers to
Trade 10

Focus on Core Capabilities 11

Collaborative Networks 11

Viewing Operations Management from a Supply Chain Management Perspective 11

Operations Management Partners Across the Supply
Chain 12

Cross-Functional Relationships in Operations
Management 13

The Changing Nature of Supply Chains 16

Levels of Operational Planning Across the Supply
Chain 16

Get Real: Jobs in Operations Management 17

How this Book Is Structured 18

Chapter Summary 20

Key Terms 21

Discussion Questions 21

Case: Business Textbook Supply Chain 22

Selected Readings and Internet Sites 23

CHAPTER 2 Operations and Supply Chain Strategy 24

Levels of Strategic Planning 26

Corporate Strategic Planning 27

Business Unit Strategic Planning 27

Functional Strategic Planning 27

Developing Operations Strategy: Creating Value through Strategic Choices 28

Critical Customers 28

Get Real: Huffy Bikes Targets It's Critical
Customer 29

Assessing Customer Wants and Needs 29

Value Propositions and Competitive
Priorities 30

Get Real: Bosch CS20: Finding a New Order
Winner by Changing the Way Customers Cut
Straight Lines 30

Product-Related Competitive Priorities 31

Process-Related Competitive Priorities 32

Get Real: IKEA: Growth through Supply Chain
Innovation 34

Get Real: Seven Cycles: Building a Bicycle Your
Way 35

Capabilities: Strengths and Limitations of Supply Chain
Operations 35

Maintaining the Fit between Customer Outcomes, Value
Propositions, and Capabilities 37

Deploying Operations Strategy: Creating Value through Execution 37

Get Real: Apple Does Not Build a Low-Cost
Netbook 37

Feedback/Masurement: Communicating and Assessing
Operations Strategy 38

The Strategic Profit Model 39

The Supply Chain Operational Reference
Model 42

Chapter Summary 43

Key Terms 43

Discussion Questions 44

Solved Problem 45

- Problems 46
- Case: Otis Toy Trains Explores the Supply Chain 47
- Case: Steinway & Sons Piano 48
- Case: Trail Frames Chassis 49
- Selected Readings and Internet Sites 50

Part 2 FOUNDATIONS OF OPERATIONS MANAGEMENT 51

CHAPTER 3 Managing Processes and Capabilities 52

- Processes and Process Thinking 54
- Anatomy of a Process 54
 - Activities of a Process 55
 - Get Real:** States Reduce Waiting Times for Car License Renewals and Registrations 56
 - Inputs, Outputs, and Flows 56
 - Structure 56
 - Management Policies 57
- Process Capacity and Utilization 57
- Principles of Process Performance: The Theory of Constraints 59
 - Principle 1: Every Process Has a Constraint 60
 - Principle 2: Every Process Contains Variance That Consumes Capacity 62
 - Principle 3: Every Process Must be Managed as a System 64
 - Get Real:** Storyboarding: The Key to Success at Pixar 65
 - Principle 4: Performance Measures Are Crucial to the Process's Success 66
 - Principle 5: Every System Must Continuously Improve 66
 - Business Process Reengineering: Radical Process Change 67
 - Kaizen Events: Small Process Changes Made Quickly 67
 - Get Real:** Delta Faucet Uses a Kaizen Event to Improve Quality and Reduce Scrap 68
- Chapter Summary 69
- Key Terms 69
- Discussion Questions 70
- Solved Problem 71
- Problems 73
- Case: Evergreen Products 75
- Case: Midas Gold Juice Company 76
- Case: American Vinyl Products 77
- Selected Readings and Internet Sites 79

CHAPTER 3 Supplement Process Mapping and Analysis 80

The "Process" of Process Mapping and Analysis 81

American Health and Medical Products (AHMP) 81

- Step 1: Identify the Desired Outcomes in Advance 82
- Step 2: Identify and Bound the Critical Process 82
- Step 3: Document the Existing Process (the "Current State" Map) 83
- Step 4: Analyze the Process and Identify Opportunities for Improvement 86
- Step 5: Recommend Appropriate Changes to the Process (the "Future State" Map) 90
- Step 6: Implement the Changes and Monitor Improvements 92

Other Processing Mapping Tools 92

- Supplement Summary 94
- Key Terms 94
- Problems 94
- Selected Readings and Internet Sites 95

CHAPTER 4 Product/Process Innovation 96

The Role of Product/Process Innovation in Supply Chain Operations Management 98

- The Product Life Cycle 99
- How Product/Process Innovation Affects Firm Performance 100

Operational Product/Process Innovation Competencies 101

- Idea and Opportunity Development 101
- Innovation Portfolio Planning 102
 - Get Real:** Procter and Gamble's Connect + Develop Process 102
- Innovation Project Management 103
- New Product/Process Launch and Learning 104
- Codevelopment 104

Product/Process Design and Development 105

- The Stage-Gate Process 106
- Integrated Product/Process Design and Development: Concurrent Engineering 106
- Design for the Customer 108
- Design for Supply Chain Operations 113
 - Get Real:** Mattel's Serious Approach to DFM for Toys 115

Enabling Technologies for Product/Process Innovation 116

- Get Real:** TI Builds a Green Wafer Factory 117

Chapter Summary 119

- Key Terms 119
- Discussion Questions 120
- Problems 120

- Case: The ALPHA Timer Development Project (A) 121
- Case: The ALPHA Timer Development Project (B) 122
- Selected Readings and Internet Sites 122

CHAPTER 5 Manufacturing and Service Process Structures 124

Capacity Planning 126

- Economies and Diseconomies of Scale 126

Get Real: Demand Outpaced Capacity for the Wii 127

- Time Frame for Capacity Changes 128

Process Structures 128

- Product-Process Matrix 129
- Aligning Process Structure and Market Orientation 132

Get Real: Personalized M&Ms 132

Unique Aspects of Service Processes 133

- Service Process Matrix 133
- Managing Front-Office and Back-Office Processes 134
- Service Blueprinting 135

Operations Layout 136

- Fixed-Position Layout 136
- Process Layout 136
- Product Layout 137
- Line Balancing in Product Layouts 138
- Cellular Layout 140

Process Automation 140

- Get Real:** Starbucks Weighs the Pros and Cons of Automation 142

Comparing Process Costs with Break-Even Analysis 142

Chapter Summary 145

- Key Terms 145
- Discussion Questions 146
- Solved Problems 146
- Problems 149
- Case: Coffee Roasters 152
- Selected Readings and Internet Sites 152

CHAPTER 6 Managing Quality 154

Defining the Dimensions of Quality 156

Get Real: Ritz-Carlton: Where Quality Is Always First and Foremost 157

- Functional Roles in Quality Management 157
- Core Values and Concepts of Quality Management 160

TQM: A "Total" View of Quality 160

- Recognizing the Total Impacts of Quality Performance 160

Get Real: Applying Cost of Quality Analysis to a Hotel Restaurant 164

- An Inverted View of Management 165
- Process-Oriented Focus on Prevention and Problem Solving 166
- Viewing Quality Management As a Never Ending Quest 167
- Building an Organizational Culture Around Quality 167

Guiding Methodologies for Quality Management 168

- Plan-Do-Check-Act Cycles (Deming Wheel) 168
- Six Sigma: A Systematic Approach to Quality Management 169
- DMAIC: The Six Sigma Process 171
- Design for Six Sigma 172
- Get Real:** Applying DMAIC to Cough Drops 172
- Implementing Six Sigma 173

Certifying Progress in Quality Management 173

- ISO 9000: An International Quality Standard 173
- Get Real:** Does Six Sigma Stifle Innovation? 174
- Attaining ISO 9000 Certification 174
- The Malcolm Baldrige Quality Award 175

Chapter Summary 179

- Key Terms 179
- Discussion Questions 180
- Case: A Comment on Management Attitude 180
- Selected Readings and Internet Sites 182

CHAPTER 6 Supplement Quality Improvement Tools 184

Overview 185

Standard Problem Solving Approach 185

Quality Improvement Tools 185

- Pear Computer: Using Quality Tools to Improve Performance 186
- Histograms 186
- Cause and Effect Diagrams 188
- Check Sheets 189
- Pareto Analysis 190
- Scatter Diagram 191
- Process Flow Diagram 193
- Process Capability Analysis: C_p and C_{pk} 193
- Process Control Charts 196
- Taguchi Methods/Design of Experiments 201
- Other Quality Control Tools 201

Supplement Summary 202

- Key Terms 202
- Solved Problems 203
- Problems 205
- Selected Readings and Internet Sites 209

CHAPTER 7 Understanding Inventory Fundamentals 210

Types and Roles of Inventory 212

- Types of Inventory 212
- The Roles of Inventory 213

The Financial Impact of Inventory 213

- Balance Sheet Considerations 214
- Costs Related to Inventory 214

Measures of Inventory Performance 215

- Asset Productivity: Inventory Turnover and Days of Supply 215
- Service Level 218

Get Real: How Amazon Aims to Keep You Clicking 219

Managing Inventory 219

- Inventory Classification: ABC Analysis 220
- Inventory Information Systems and Accuracy 222
- Get Real:** American Apparel Introduces RFID 224

Managing Inventory Across the Supply Chain 225

- Inventory Value in the Supply Chain 225
- The Bullwhip Effect 225
- Integrated Supply Chain Inventory Management 226
- Get Real:** Vendor-Managed Inventory at Stryker Instruments 227

Chapter Summary 228

Key Terms 228

Discussion Questions 229

Solved Problems 229

Problems 231

Case: Inventory at Champion Electric 232

Selected Readings and Internet Sites 232

CHAPTER 8 Lean Systems 234

Lean Systems Defined 236

- Origins of Lean Systems and Just-in-Time Production 237
- Strategic Benefit of Lean Systems 239
- Lean Systems Objectives, Culture, and Guiding Principles 239

Get Real: "Picturing" Waste and Value: A Process Mapping Story 242

Implementing Lean Systems: Tools and Techniques 244

- Total Productive Maintenance (TPM) 244
- Group Technology—Cellular Manufacturing 245
- Focused Factories 245
- TAKT Time Flow Balancing 245

Get Real: Applying the Focused Factory Idea to an Insurance Firm 246

Kanban (Pull) Scheduling 246

Level, Mixed-Model Scheduling 246

Get Real: Using Kanbans to Schedule a Steel Mill 247

Setup Reduction 247

Statistical Process Control 248

Visual Control 248

Quality at the Source 248

Get Real: Example of Visual Control in Action: Andon Board 249

Kaizen Events 249

Get Real: Using an Andon Board to Spot a Problem 249

Process Analysis/Value Stream Mapping 250

Poka-Yoke 250

5-S Program 251

Simplification/Standardization 251

Lean Systems: Range of Application 251

Applying Lean Systems within the Firm 252

Applying Lean Systems Across the Supply Chain 252

Applying Lean Systems to Product Innovation 253

Chapter Summary 255

Key Terms 256

Discussion Questions 256

Case: Good Guy Hospital Supply 257

Selected Readings and Internet Sites 258

Part 3

INTEGRATING RELATIONSHIPS ACROSS THE SUPPLY CHAIN 259

CHAPTER 9 Customer Management 260

Customer Service 263

- Product Availability 263
- Lead-Time Performance 264
- Service Reliability 265
- The Perfect Order 266
- Limitations of Customer Service 266

Customer Satisfaction 267

- Customer Expectations 267
- Customer Satisfaction Model 268
- Limitations of Customer Satisfaction 270

Customer Success 271

- Achieving Customer Success 271
- Get Real:** Co-Opting Change at True Value 272
- Customer Relationship Management 273
- Get Real:** Amazon's Automated CRM Technology 274

Customer Management and Relationship Strategy 275

Chapter Summary 276

Key Terms 277

Discussion Questions 277

Solved Problem 278

Problems 278

Case: Tiler Industries 279

Selected Readings and Internet Sites 281

CHAPTER 10 Supply Management 282**Supply Management's Impact on Firm and Supply Chain Performance 284**

Ensure Timely Availability of Resources 284

Reduce Total Costs 285

Get Real: Rethinking Outsourcing in Fashion 286

Enhance Quality 287

Access Technology and Innovation 287

Get Real: Supplier Quality Causes Problems for Audi 287

Foster Social Responsibility 288

Make an Insourcing/Outsourcing Decision 289

Examining the Strategic Sourcing Process 291

Analyze Spend and Understand Supply Markets 292

Develop a Sourcing Strategy 292

Number of Suppliers 293

Capabilities and Location 294

Type of Supplier Relationship and Contract

Length 294

Get Real: Supplier Partnerships at Ford Brazil 295**Identify Potential Suppliers 296****Assess and Select Suppliers 296**

Competitive Bidding 296

Online Reverse Auctions 298

Negotiation 298

Manage the Ongoing Supplier Relationship 299

Information Sharing and Coordination with Suppliers 299

Supplier Performance Monitoring and Improvement 300

Supplier Relationship Management (SRM) 300

Chapter Summary 301

Key Terms 301

Discussion Questions 302

Solved Problem 302

Problems 303

Case: Strategic Sourcing at Best Banks 306

Case: Trail Frames Chassis: Insourcing/Outsourcing Decision 306

Selected Readings and Internet Sites 308

CHAPTER 11 Logistics Management 310**The Role of Logistics in Supply Chain Management 312**

Logistics Service Benefits 313

Logistics Cost Minimization 313

Inventory Management 314

Order Processing 314

Transportation Management 315

Government's Role in Transportation 315

Transportation Economics 316

Consolidation 316

Transportation Modes 317

Carrier Types 321

Transportation Service Selection 321

Warehouse Management 322

Primary Functions of Warehousing 322

Get Real: Cross-Docking Spruces Up Urban

Outfitters 325

Warehouse Operations 325

Materials Handling and Packaging 326**Get Real:** General Dynamics Develops AS/RS for the Navy 328**Network Design 328**

Facility Location 329

Number of Facilities 330

Logistics Postponement 331

Integrated Service Providers 332**Get Real:** Kimberly-Clark Redesigns the Network 333

Chapter Summary 334

Key Terms 334

Discussion Questions 335

Solved Problems 335

Problems 336

Case: Lear Corporation 338

Selected Readings and Internet Sites 339

Part 4**PLANNING FOR INTEGRATED OPERATIONS ACROSS THE SUPPLY CHAIN 341****CHAPTER 12 Demand Planning: Forecasting and Demand Management 342****Demand Planning: An Overview 344**

The Role That Demand Planning Plays in Operations Management 344

Planning Activities 345

Demand Forecasting 346

Components of Demand 346

Get Real: The Tribune's Famous Fallacious Forecast 346

Designing a Forecasting Process 347

Judgment-Based Forecasting 349

Get Real: Two Examples of Grassroots Forecasting 350

Statistical Model-Based Forecasting 350

Assessing the Performance of the Forecasting Process 356

Demand Management 358

Improving the Constraints on Demand Planning 359

Improving Information Accuracy and Timeliness 359

Get Real: Destination Maternity Corporation, Customer Quickstep 360

Reducing Lead Time 360

Get Real: Calyx and Corolla Delivers Freshness by Redesigning the Supply Chain 361

Redesigning the Product 361

Collaborating and Sharing Information 361

Get Real: HP Improves the Constraints on Forecasting through Postponement 362

Chapter Summary 363

Key Terms 364

Discussion Questions 364

Solved Problem 365

Problems 366

Case: C&F Apparel, Inc. 368

Selected Readings and Internet Sites 369

CHAPTER 12 Supplement Advanced Forecasting and Tracking Models 370

Estimating Trends 371

Exponential Smoothing with Trend Effects 371

Determining Trend Factors 372

Simple Linear Regression: Time Series 372

Simple Linear Regression: Causal Modeling 374

Comparing the Models 375

Adjusting Forecasts for Seasonality 375

Forecast Error and Signal Tracking 379

Tracking Forecast Error Acceptability 381

Supplement Summary 383

Key Terms 383

Discussion Questions 383

Solved Problem 384

Problems 387

Selected Readings 389

CHAPTER 13 Sales and Operations Planning 390

Sales and Operations Planning 392

S&OP Benefits 393

The S&OP Process 394

Get Real: One-Number Forecasting at Heinz 394

Aggregate Production Planning 396

Relevant Aggregate Planning Costs 396

Aggregate Production Strategies 397

Get Real: Canon Struggles to Shrink Level of Digital Camera Inventory 399

Creating an Aggregate Production Plan 400

Level Production Plan 401

Chase Plans 401

Hybrid Plans 404

Comparing Aggregate Production Plans 404

Aggregate Planning for Service Industries 405

Yield Management 405

Get Real: Yield Management in the Hotel Industry 406

An Example of a Service Aggregate Plan 407

Chapter Summary 409

Key Terms 409

Discussion Questions 409

Solved Problem 410

Problems 411

Case: Med-Chem Products: Hospital Division 415

Selected Readings and Internet Sites 417

CHAPTER 14 Independent Demand Inventory Planning 418

The Continuous Review Model 420

The Case of No Variability 420

How Much to Order: Economic Order Quantity 421

When to Order: The Reorder Point 423

EOQ Extensions 424

Get Real: Pentagon Buys Components in Bulk 426

Enter Variability and Uncertainty 427

Determining the Standard Deviation of Demand During Lead Time 428

Determining a Service Level Policy 428

Revisiting ROP and Average Inventory 430

The Periodic Review Model 431

Single Period Inventory Model 432

Impact of Location on Inventory 434

Managerial Approaches to Reducing Inventory Costs 435

Managing Cycle Stocks 435

Managing Safety Stocks 435

Managing Locations 436

Implementing Inventory Models 436

Get Real: Tractor Supply Company 437

Chapter Summary 438
 Key Terms 438
 Discussion Questions 439
 Solved Problems 439
 Problems 442
 Selected Readings and Internet Sites 445

CHAPTER 15 Materials and Resource Requirements Planning 446

Materials Requirements Planning (MRP) 449

MRP Inputs 449

Get Real: MRP in Services 450

Bill of Materials (BOM) 451

Master Production Schedule (MPS) 451

Inventory Records 454

MRP Process 455

MRP Outputs and Use 459

Distribution Requirements Planning (DRP) 461

Understanding Capacity Requirements Planning (CRP) 462

Advances in Planning Systems 463

Enterprise Resource Planning (ERP) 464

Advanced Planning and Scheduling (APS) 464

Get Real: ERP Improves Performance at Elizabeth

Arden Red Door Spas 465

Chapter Summary 465

Key Terms 466

Discussion Questions 466

Solved Problems 467

Problems 469

Case: The Casual Furniture Company 476

Selected Readings and Internet Sites 478

Part 5

MANAGING CHANGE IN SUPPLY CHAIN OPERATIONS 479

CHAPTER 16 Project Management 480

Projects and Project Management 482

How Projects Succeed 483

Stages in the Life of a Project 484

Project Definition 485

Organizing the Project: Pure, Functional, and Matrix Projects 485

Selecting a Project Manager 487

Organizing Project Teams 488

Establishing a Project Charter 489

Project Planning 489

Budgeting for Time and Cost 490

Get Real: Managing an "Olympic"-Sized Project 491

Detailed Scheduling Using the Critical Path Method 492

Get Real: The History of CPM and PERT 492

Analyzing Resources and Trade-Offs 496

Making Time-Cost-Scope Trade-Offs 496

Planning for Uncertainty 496

Get Real: Project Management Software Helps Get the Job Done 497

Project Execution 499

Project Completion 500

Managing a Portfolio of Projects 501

Chapter Summary 502

Key Terms 502

Discussion Questions 503

Solved Problem 503

Problems 506

Case: Monolith Productions 509

Selected Readings and Internet Sites 511

CHAPTER 16 Supplement Advanced Methods for Project Scheduling 512

Project Crashing: Making Time-Cost Trade-Offs 513

Scheduling a Project with Probabilistic Task Duration Estimates 516

Supplement Summary 519

Key Terms 519

Discussion Questions 519

Solved Problems 520

Problems 523

Selected Readings and Internet Sites 525

CHAPTER 17 Evolving Business Models and Change Drivers in the Supply Chain 526

The Business Model: The Vehicle for Integration and Competitive Advantage 528

Capability Enabling Technologies in the Supply Chain 529

Sustainable Operations Management 534

A Broader View of Waste 534

Get Real: Computer Makers Make Environmental Responsibility a Corporate Priority 534

Get Real: Herman Miller Goes Green with the Mirra Chair 536

Preventing Rather than Minimizing Waste 537

Incorporating Sustainability into Operations Objectives 537

ISO 14000: The Standard for Environmental Management Systems 537

Operations Management, People, and Culture 539

National Culture 539

Get Real: Dabbawallahs: Managing the Lunchtime Food Supply Chain in Bombay, India 540

Organizational Culture 541

Get Real: Zappos Culture Sows Spirit 542

Chapter Summary 542

Key Terms 543

Discussion Questions 543

Solved Problem 544

Problems 545

Case: Western Telephone Manufacturers 545

Case: The HyperCar 547

Selected Readings and Internet Sites 549

APPENDIX A Table of Cumulative Probability of the Normal Distribution (One-Tail) 550**APPENDIX B Answers to Selected Problems 551****PHOTO CREDITS 563****NAME INDEX 564****SUBJECT INDEX 567**