

GLOBAL
EDITION



Managing Quality

Integrating the Supply Chain

SIXTH EDITION



S. Thomas Foster

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PEARSON

MANAGING QUALITY

INTEGRATING THE SUPPLY CHAIN

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Sixth Edition
Global Edition

MANAGING QUALITY

INTEGRATING THE SUPPLY CHAIN

S. Thomas Foster
Brigham Young University

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To Camille: You Rock!

BRIEF CONTENTS

PART 1 Understanding Quality Concepts 25

- Chapter 1* Differing Perspectives on Quality 26
- Chapter 2* Quality Theory 48
- Chapter 3* Global Supply Chain Quality and International Quality Standards 73

PART 2 Designing and Assuring Quality 105

- Chapter 4* Strategic Quality Planning 106
- Chapter 5* The Voice of the Customer 130
- Chapter 6* The Voice of the Market 154
- Chapter 7* Quality and Innovation in Product and Process Design 176
- Chapter 8* Designing Quality Services 205
- Chapter 9* Managing Supplier Quality in the Supply Chain 236

PART 3 Implementing Quality 263

- Chapter 10* The Tools of Quality 264
- Chapter 11* Statistically Based Quality Improvement for Variables 302
- Chapter 12* Statistically Based Quality Improvement for Attributes 339
- Chapter 13* Lean-Six Sigma Management and Tools 361

PART 4 Forever Improving the Quality System 395

- Chapter 14* Managing Quality Improvement Teams and Projects 396
- Chapter 15* Implementing and Validating the Quality System 426

Appendix 445

Glossary 448

Index 463

CONTENTS

Preface 20

Part 1 Understanding Quality Concepts 25

Chapter 1 DIFFERING PERSPECTIVES ON QUALITY 26

■ A CLOSER LOOK AT QUALITY 1-1: Buying Clothing in Asia 27

What Is Quality? 27

Product Quality Dimensions 27

Service Quality Dimensions 29

Why Does It Matter That Different Definitions of Quality Exist? 30

Differing Functional Perspectives on Quality 30

A Supply Chain Perspective 31

An Engineering Perspective 32

An Operations Perspective 34

A Strategic Management Perspective 34

A Marketing Perspective 36

■ QUALITY HIGHLIGHT 1-1: Quality Strategy at Hyundai 36

A Financial Perspective 38

The Human Resources Perspective 39

Is Quality Management Its Own Functional Discipline? 40

The Three Spheres of Quality 40

■ QUALITY HIGHLIGHT 1-2: Federal Express Corporation 41

Other Perspectives on Quality 42

The Value-Added Perspective on Quality 42

Cultural Perspectives on Quality 43

Arriving at a Common Understanding of Quality Using a Contingency Perspective of Quality 43

Summary 43

Key Terms 44

Discussion Questions 44

► CASE 1-1: FedEx: Managing Quality Day and Night 45

► CASE 1-2: Graniterock Company: Achieving Quality through Employees 46

Chapter 2 QUALITY THEORY 48

What Is Theory? 48

Is There a Theory of Quality Management? 50

■ A CLOSER LOOK AT QUALITY 2-1: Quality and Management Fads 50

History of Quality Management 51

Leading Contributors to Quality Theory: W. Edwards Deming 51

Deming's 14 Points for Management 53

- Leading Contributors to Quality Theory: Joseph M. Juran* 56
 - The Juran Trilogy 56
 - Control versus Breakthrough 57
 - Project-by-Project Improvement 57
 - **A CLOSER LOOK AT QUALITY 2-2: Juran on the Past Century of Quality** 58
- Leading Contributors to Quality Theory: Kaoru Ishikawa* 58
 - The Basic Tools of Quality 58
- Leading Contributors to Quality Theory: Armand Feigenbaum* 59
 - The 19 Steps of TQC 59
- Leading Contributors to Quality Theory: Philip Crosby* 60
- Leading Contributors to Quality Theory: Genichi Taguchi* 61
 - Definition of Quality 61
 - Quality Loss Function 61
 - Robust Design 61
- Leading Contributors to Quality Theory: The Rest of the Pack* 62
 - Robert C. Camp 62
 - Stephen R. Covey's "8" Habits 62
 - Michael Hammer and James Champy 63
 - **A CLOSER LOOK AT QUALITY 2-3: Selling Quality Fads** 64
- Viewing Quality Theory from a Contingency Perspective* 64
- Resolving the Differences in Quality Approaches:
An Integrative View* 65
 - Leadership 65
 - Employee Improvement 65
 - Quality Assurance 65
 - Customer Focus 66
 - Quality Philosophy 66
 - Information Analysis 67
 - Strategic Planning 67
 - Environment or Infrastructure 67
 - Team Approach 67
 - Focus of the Quality Department 67
 - Breakthrough 67
- Theoretical Framework for Quality Management* 67
 - Summary* 68
 - Key Terms* 69
 - Discussion Questions* 69
 - ▶ **CASE 2-1: Rheaco, Inc.: Making a Quality Turnabout by Asking for Advice** 70
 - ▶ **CASE 2-2: Has Disney Developed a Theory of Quality Guest Services Management?** 71

Chapter 3 GLOBAL SUPPLY CHAIN QUALITY AND INTERNATIONAL QUALITY STANDARDS 73

- Managing Quality for the Multinational Firm (MNF)* 74
 - **QUALITY HIGHLIGHT 3-1: Global Supply Chain Quality at Trek** 77
- Quality Improvement: The American Way* 78
- The Baldrige Performance Excellence Program* 78
 - **A CLOSER LOOK AT QUALITY 3-1: Who Was Malcolm Baldrige?** 84
 - The Baldrige Process 84
 - Baldrige Scoring 86
 - Being a Baldrige Examiner 86
 - **QUALITY HIGHLIGHT 3-2: Honeywell Federal Manufacturing & Technologies** 88
 - State Awards 88
- Quality Improvement: The Japanese Way* 89
 - Deming Prize 89
 - Other Japanese Contributions to Quality Thought 89
 - Lean Production 90
 - **QUALITY HIGHLIGHT 3-3: The Humbling of Toyota** 91
 - Japanese Total Quality Control (TQC) 91
- Quality Improvement: The European Way* 93
 - European Quality Award 93
 - ISO 9000:2015 94
 - Quality Management Principles Underlying ISO 9000:2015 95
 - Selecting a Registrar 95
 - The ISO 9000:2015 Process 96
 - ISO 14000 97
- Quality Improvement: The Chinese Way* 98
- Does Chinese Quality Management Exist?* 99
 - **A CLOSER LOOK AT QUALITY 3-2: Outsourcing Woes** 100
- Are Quality Approaches Influenced by Culture?* 100
 - Summary* 101
 - Key Terms* 101
 - Discussion Questions* 101
 - ▶ **CASE 3-1: Denver International Airport Becomes ISO 14001 Certified** 102
 - ▶ **CASE 3-2: Wainwright Industries: An Entirely New Philosophy of Business Based on Customer Satisfaction and Quality** 103

Part 2 Designing and Assuring Quality 105

Chapter 4 STRATEGIC QUALITY PLANNING 106

- Strategy Content* 106
- The Importance of Time in Quality Improvement* 107
 - **A CLOSER LOOK AT QUALITY 4-1: Bad Measurement Systems Result in Poor Outcomes** 108

- Leadership for Quality* 109
 - Leadership Dimensions 109
 - **QUALITY HIGHLIGHT 4-1: Solectron Corporation** 111
- Quality and Ethics* 112
- Quality as a Strategy* 112
 - Costs of Quality 112
 - PAF Paradigm 113
 - Accounting for Quality-Related Costs 114
 - Lundvall-Juran Quality Cost Model 115
 - Differentiation through Quality 116
 - Focus through Quality 116
 - Order Winners 117
 - Quality as a Core Competency 118
- Quality Strategy Process* 118
 - Forced-Choice Model 118
- Deploying Quality (Hoshin Kanri)* 119
 - **A CLOSER LOOK AT QUALITY 4-2: A Mature Strategic Planning Process** 119
- Does Quality Lead to Better Business Results?* 120
 - Quality and Price 121
 - Quality and Cost 122
 - Quality and Productivity 122
 - Quality and Profitability 122
 - Quality and Sustainability 123
- Supply Chain Strategy* 123
 - Summary* 125
 - Key Terms* 125
 - Discussion Questions* 125
 - Problems* 126
 - ▶ **CASE 4-1: Mallinckrodt Pharmaceuticals: Realizing Multiple Benefits through Improved Quality** 127
 - ▶ **CASE 4-2: MidwayUSA** 129

Chapter 5 THE VOICE OF THE CUSTOMER 130

- **A CLOSER LOOK AT QUALITY 5-1: Online Review of Merchandise** 131
- Customer-Driven Quality* 131
 - The Pitfalls of Reactive Customer-Driven Quality 131
- Customer-Relationship Management* 132
 - Complaint Resolution 133
 - Feedback 134
 - Guarantees 134
 - Corrective Action 135
- The “Gaps” Approach to Service Design* 135
- Segmenting Customers and Markets* 137

<i>Strategic Supply Chain Alliances between Customers and Suppliers</i>	137
Process-Chain-Network (PCN) Tool for Service Design	139
The Role of the Customer in the Supply Chain	140
<i>Communicating Downstream</i>	141
<i>Actively Solicited Customer-Feedback Approaches</i>	142
Telephone Contact	142
Focus Groups	142
Customer Service Surveys	142
■ A CLOSER LOOK AT QUALITY 5-2: Misusing Surveys	143
<i>Passively Solicited Customer-Feedback Approaches</i>	146
Customer Research Cards	146
Customer Response Lines and Web Sites	147
<i>Managing Customer Retention and Loyalty</i>	147
<i>Customer-Relationship Management Systems</i>	148
<i>A Word on Excellent Design</i>	150
Summary	150
Key Terms	150
Discussion Questions	150
Problems	151
▶ CASE 5-1: Irish Transport Provider: Continuous Quality Improvement through a Commitment to External and Internal Customers	152
▶ CASE 5-2: India-based Life Insurer Improves Customer Retention through Six Sigma and Quality Tools	152

Chapter 6 THE VOICE OF THE MARKET 154

<i>Gaining Insights through Benchmarking</i>	154
Process Benchmarking	156
Financial Benchmarking	156
Performance Benchmarking	156
Product Benchmarking	156
Strategic Benchmarking	157
■ QUALITY HIGHLIGHT 6-1: Pal's Sudden Service	157
Functional Benchmarking	158
<i>Purposes of Benchmarking</i>	158
<i>Difficulties in Monitoring and Measuring Performance</i>	159
<i>Commonly Benchmarked Performance Measures</i>	161
Why Collect All These Measures?	163
Key Business Factors	163
<i>Business Process Benchmarking</i>	163
Robert Camp's Business Process Benchmarking Process	165
<i>Leading and Managing the Benchmarking Effort</i>	166
Training	166
■ A CLOSER LOOK AT QUALITY 6-1: Benchmarking at PwC	166
■ A CLOSER LOOK AT QUALITY 6-2: The Legal Environment of Benchmarking	167

Baselining and Process Improvement 168

Problems with Benchmarking 168

Summary 169

Key Terms 169

Discussion Questions 169

Problems 170

▶ **CASE 6-1: Amgen Corporation: Using Benchmarking as a Means of Coping with Rapid Growth** 173

▶ **CASE 6-2: AT&T Teleholdings: Making Benchmarking a Part of the Process Improvement Tool Kit** 174

Chapter 7 QUALITY AND INNOVATION IN PRODUCT AND PROCESS DESIGN 176

Designing Products for Quality 176

The Design Process 177

■ **QUALITY HIGHLIGHT 7-1: Apple's Watch: A Philosophy of Design** 179

Quality Function Deployment (QFD) 180

Technology in Design 185

Other Design Methodologies 188

Organizing the Design Team 188

The Product Life Cycle 189

■ **A CLOSER LOOK AT QUALITY 7-1: Ski Design** 189

Product Families and the Product Life Cycle 190

Complementary Products 190

Designing Products That Work 190

■ **A CLOSER LOOK AT QUALITY 7-2: It Takes a Scientist to Design a Winter Coat** 191

Design for Manufacture Method 192

Design for Maintainability 193

Designing for Reliability 194

■ **QUALITY HIGHLIGHT 7-2: Designing Reliable Luxury at Vuitton** 194

Reliability Analysis Tools 195

Failure Modes and Effects Analysis 195

How FMEA Works 196

Fault-Tree Analysis 197

Failure Modes, Effects, and Criticality Analysis 197

Product Traceability and Recall Procedures 198

Environmental Considerations in Design 199

Summary 199

Key Terms 200

Discussion Questions 200

Problems 201

▶ **CASE 7-1: Keeping Apple's iPhone Competitive** 203

▶ **CASE 7-2: Food Processing Plant: Creating a Quality Product using Blending Improvement Methods** 204

Chapter 8 DESIGNING QUALITY SERVICES 205

- Differences between Services and Manufacturing* 206
 - Internal versus External Services 206
 - Voluntary versus Involuntary Services 207
 - How Are Service Quality Issues Different from Those of Manufacturing? 207
 - **A CLOSER LOOK AT QUALITY 8-1: Service Warranties: Profitable or a Rip-off—You Decide** 208
 - How Are Service Quality Issues Similar to Manufacturing? 208
- What Do Services Customers Want?* 208
 - **QUALITY HIGHLIGHT 8-1: Ritz-Carlton Hotels** 210
- SERVQUAL* 211
 - Expectations 211
 - Perceptions 213
 - Gap Analysis 213
 - Assessing Differences in Expectations and Perceptions by Using the Differencing Technique 215
- Designing and Improving the Services Transaction* 218
 - Services Blueprinting 218
 - Moments of Truth 219
 - **A CLOSER LOOK AT QUALITY 8-2: Quality in Health Care** 220
 - Poka-yoke 221
- The Customer Benefits Package* 222
- Service Transaction Analysis* 223
- Improving Customer Service in Government* 226
 - **A CLOSER LOOK AT QUALITY 8-3: Government Service Quality: A Stop-and-Go Process** 226
- Quality in Health Care* 227
- Supply Chain Quality in Services* 227
- A Theory for Service Quality Management* 228
 - Summary* 229
 - Key Terms* 229
 - Discussion Questions* 229
 - Problems* 230
 - ▶ **CASE 8-1: Google Designs Quality Services with Customers in Mind** 234
 - ▶ **CASE 8-2: UPS: Delivering the Total Package in Customer Service** 235

Chapter 9 MANAGING SUPPLIER QUALITY IN THE SUPPLY CHAIN 236

- The Value Chain* 236
 - The Chain of Customers 237
 - Managing the Supply Chain 237
- Supplier Alliances* 237
 - **A CLOSER LOOK AT QUALITY 9-1: Supply Chains Disruption and Risk Mitigation** 240

- Single-Sourcing Examples 240
 - **QUALITY HIGHLIGHT 9-1: A Bumpy Ride at Boeing** 241
- Supplier Development* 242
 - **QUALITY HIGHLIGHT 9-2: Integrating Forward along the Supply Chain: 3M Dental Products Division** 243
- Supplier Awards 244
- Supplier Relationship Management Systems (SRMS) 244
- Applying the Contingency Perspective to Supplier Partnering* 245
- A Supplier Development Program: ISO/TS 16949* 245
 - ISO/TS 16949 245
 - Quality Management System 245
 - Management Responsibility 246
 - Resource Management 247
 - Product Realization 247
 - Measurement, Analysis, and Improvement 247
- Building an Understanding of Supply Chain Quality Management* 247
 - Summary* 248
 - Key Terms* 248
 - Discussion Questions* 248
 - ▶ **CASE 9-1: AT&T: Setting High Standards for Suppliers and Rewarding Supplier Performance** 249
 - ▶ **CASE 9-2: Managing the Supply Chain at Honeywell** 250

Part 3 Implementing Quality 263

Chapter 10 THE TOOLS OF QUALITY 264

- Improving the System* 264
- Ishikawa's Basic Seven Tools of Quality* 265
 - Process Maps 266
 - **A CLOSER LOOK AT QUALITY 10-1: Extended Value Stream Mapping of Supply Chains** 270
 - Check Sheets 272
 - Histograms 273
 - Scatter Diagrams 274
 - Control Charts 276
 - Cause-and-Effect (Ishikawa) Diagrams 276
 - Pareto Charts 278
- The Seven New Tools for Improvement* 281
 - The Affinity Diagram 283
 - The Interrelationship Digraph 285
 - Tree Diagrams 286
 - Prioritization Grid 288
 - Matrix Diagram 290

Process Decision Program Chart	291
Activity Network Diagram	291
Reflections on the Managerial N7 Tools	293
<i>Other Tools for Performance Measurement</i>	293
Spider Charts	293
Balanced Scorecards	293
Dashboards	295
<i>Summary</i>	295
<i>Key Terms</i>	295
<i>Discussion Questions</i>	295
<i>Problems</i>	296
▶ CASE 10-1: Corporate Universities: Teaching the Tools of Quality	299
▶ CASE 10-2: Zurich: Creating Quality Customer Care	300

Chapter 11 STATISTICALLY BASED QUALITY IMPROVEMENT FOR VARIABLES 302

<i>Statistical Fundamentals</i>	303
What Is Statistical Thinking?	303
■ QUALITY HIGHLIGHT 11-1: Statistical Tools in Action	303
Why Do Statistics Sometimes Fail in the Workplace?	304
Understanding Process Variation	304
Process Stability	306
Sampling Methods	306
Random Samples	306
Systematic Samples	306
Sampling by Rational Subgroups	306
Planning for Inspection	307
Control Plans	307
<i>Process Control Charts</i>	307
Variables and Attributes Control Charts	307
A Generalized Procedure for Developing Process Charts	309
Understanding Process Charts	309
\bar{x} and R Charts	311
Interpreting Control Charts	312
Using Excel to Draw \bar{x} and R Charts	317
\bar{X} and Moving Range (MR) Charts for Population Data	318
Using Excel to Draw \bar{X} and MR Charts	319
Median Charts	320
Using Excel to Draw Median Charts	321
\bar{x} and s Charts	322
Using Excel to Draw \bar{x} and s Charts	323
Other Control Charts	323

Moving Average Chart	323
Cusum Chart	324
<i>Some Control Chart Concepts for Variables</i>	324
Choosing the Correct Variables Control Chart	324
Corrective Action	326
How Do We Use Control Charts to Continuously Improve?	326
Tampering with the Process	326
<i>Process Capability for Variables</i>	326
■ A CLOSER LOOK AT QUALITY 11-1: A Justification for Meeting Standards in Software Quality	327
Population versus Sampling Distributions	327
Capability Studies	329
Ppk	331
The Difference between Capability and Stability	331
<i>Other Statistical Techniques in Quality Management</i>	331
Summary	332
Key Terms	333
Discussion Questions	333
Problems	333
▶ CASE 11-1: Ore-Ida Fries	337

Chapter 12 STATISTICALLY BASED QUALITY IMPROVEMENT FOR ATTRIBUTES 339

<i>Generic Process for Developing Attributes Charts</i>	340
<i>Understanding Attributes Charts</i>	340
<p> <i>p</i> Charts for Proportion Defective</p>	340
Using Excel to Draw <i>p</i> Charts	342
<i>np</i> Charts	343
Using Excel to Draw <i>np</i> Charts	345
<i>c</i> and <i>u</i> Charts	345
Using Excel to Draw <i>c</i> and <i>u</i> Charts	347
<i>Attributes Charts Summary</i>	348
<i>Choosing the Right Attributes Chart</i>	348
<i>Reliability Models</i>	349
Series Reliability	349
Parallel Reliability	350
Measuring Reliability	351
Mean Time to Failure (MTTF)	352
■ A CLOSER LOOK AT QUALITY 12-1: Quality Control at GNC	352
System Availability	353
Summary	354
Key Terms	354

Discussion Questions 354

Problems 354

► **CASE 12-1: Decision Sciences Institute National Conference** 358

Chapter 13 LEAN-SIX SIGMA MANAGEMENT AND TOOLS 361

What Is Six Sigma? 362

Organizing Lean-Six Sigma 363

Packaging Lean with Six Sigma 365

■ **A CLOSER LOOK AT QUALITY 13-1: Lean/Six Sigma at Textron** 365

DMAIC Overview 366

■ **A CLOSER LOOK AT QUALITY 13-2: DMAIC in Action** 367

Define Phase 367

Developing the Business Case 368

Project Evaluation 368

Pareto Analysis 371

Problem Definition 371

Measure Phase 371

Selecting Process Outcomes 371

FMEA 375

Verifying Measurements 375

Gauge R&R 376

Using Excel to Perform Gauge R&R Analysis 379

Analyze Phase 379

Defining Objectives 379

Identifying Xs 379

Analyzing Sources of Variation 379

Improve Phase 380

Control Phase 380

Taguchi Design of Experiments 381

Robust Design 381

Background of the Taguchi Method 382

Taguchi Definition of Quality 382

Quality Loss Function 382

The Taguchi Process 384

Using Excel to Solve Taguchi Experiments 386

Design for Six Sigma 387

Lean-Six Sigma from a Contingency Perspective 388

Summary 388

Key Terms 388

Discussion Questions 389

Problems 389

► **CASE 13-1: The Neiman-Marcus Cookie** 394

Part 4 Forever Improving the Quality System 395

Chapter 14 MANAGING QUALITY IMPROVEMENT TEAMS AND PROJECTS 396

Why Employees Enjoy teams 397

Leading Teams for Quality Improvement 397

Employee Empowerment and Involvement 397

■ **A CLOSER LOOK AT QUALITY 14-1: Empowerment in Action** 399

Flattening Hierarchies for Improved Effectiveness 399

Team Leader Roles and Responsibilities 400

Team Roles and Responsibilities 401

Team Formation and Evolution 401

Team Rules 402

Types of Teams 403

Process Improvement Teams 403

Cross-Functional Teams 403

Tiger Teams 403

Natural Work Groups 403

Self-Directed Work Teams 404

Virtual Teams 404

■ **A CLOSER LOOK AT QUALITY 14-2: Lessons from Effective Teams Outside the Business World** 404

Implementing Teams 405

Meeting Management 406

Conflict Resolution in Teams 407

Saving Quality Teams from Failure: Diagnosing Problems and Intervening Before it Is Too Late 409

Managing and Controlling Projects 410

Qualifying Projects 410

Project Charters 411

Force-Field Analysis 412

Work Breakdown Structure (WBS) 413

Identifying Precedence Relationships 414

Identifying Outcome Measures 414

Identifying Task Times 414

Activity Network Diagrams 415

Arrow Gantt Charts 419

Managing Multiple Projects 419

Summary 420

Key Terms 421

Discussion Questions 421

Problems 422

▶ **CASE 14-1: General Motors: Technical Problem Solving Group Drives Excellence** 424

Chapter 15 IMPLEMENTING AND VALIDATING THE QUALITY SYSTEM 426

Building Blocks for the System of Quality Improvement 427

People 427

Organizational Learning and Knowledge 428

Culture 429

Closeness to Customers 429

Information and Finance 430

The Three Spheres of Quality 430

The Integrative Approach 430

Alignment between the Quality System and Strategy 431

■ **QUALITY HIGHLIGHT 15-1: Back to Basics at Ford** 431

Internal Validation: Documenting and Assessing the Quality System 431

■ **A CLOSER LOOK AT QUALITY 15-1: A Simple Self-Assessment Tool** 434

Quality Audits 437

Quality Audit Process 438

Types of Audits 439

Qualitative and Quantitative Elements in Audits 440

Validating the Quality System 440

Summary 441

Key Terms 441

Discussion Questions 442

Problems 442

► **CASE 15-1: Setting Priorities Using the Baldrige Criteria** 442

Appendix 445

Glossary 448

Index 463

PREFACE

Welcome to the sixth edition of *Managing Quality: Integrating the Supply Chain*. We are using the theme of supply chain management as a unifying theme for quality improvement. Previous adopters of *Managing Quality* will note that the coverage of quality topics is just as comprehensive as ever. We simply adopt the unifying theme of the supply chain to enhance our emphasis on the integration of systems with customers, suppliers, technology, and people. We think you will find that your customers—the students—will find this quality management course ever more relevant and interesting. Of course, the new edition of the text has been updated with many changes to keep our coverage of quality topics on the cutting edge.

NEW TO THIS EDITION

- The acceptance sampling supplement to Chapter 9 is back. It provides coverage of important quality management tools.
- We have added coverage of process chain network (PCN) diagramming. This little-known tool provides an excellent way to redesign services processes.
- The main theme for this update is *currency*. We have worked hard to update vignettes and references to keep the book state-of-the-art.
- Many references have been updated to reflect the state of the art in research.
- This book includes the ISO 9000:2015 standard and the most recent Baldrige criteria available at the time of publication.
- All Excel templates (and MS Project) have been updated to the most recent version.
- There is increased focus on lean in this edition.
- Many other changes, too numerous to mention, have been incorporated into this book. However, while adding new content, we have not added to the bulk of the book. This allowed us to keep our focus on a lean and mean book that will hold the interest of students.

MAJOR THEMES

Supply Chain as a Unifying Theme

Today's firms are ever more focused on improving supply chain performance, and key to this improvement is quality management. As we look upstream, we need to develop our suppliers. Downstream, we focus on customer service and after-sales service. Implicit in this process is service design. In your classes, you can drive these concepts home by emphasizing the systems view implicit in supply chain management. This unifying theme provides a linkage between the roots of quality management (Shewhart and Deming) and new developments such as Six Sigma and service quality. *For clarification, this is not a supply chain management text. This is a quality management text that uses supply chain management as a unifying theme.*

Integrative Approach

Workers and managers in organizations are somewhat limited by their particular functional preparation and specialization (going back to their educational training). This narrow presentation filter is how they analyze and cognitively interpret information. However, quality management has emerged as a discipline that is not owned by any of the functional areas such as operations management, supply chain management, human resources, or marketing. We all have to work together to satisfy customers.

Contingency Approach

This is a concept we have emphasized for a long time that is gaining traction in the research and practitioner literature. We passionately believe that the future of quality management will involve learning the contingencies associated with managing quality. There is no “one way” or “magic pill” that companies can implement to improve quality. Therefore, the contingency approach is used to instruct students how to assess the current position of the firm and identify an effective strategy for improvement based on a profound understanding of their company, market, customers, and so on. Thus improvement is based on the contingent variables that are operative in the firm as it exists. This contingency approach is introduced in Chapter 1 and permeates the rest of the text.

The author and more than 300 universities around the world have successfully taught quality management using this contingency approach. This approach, coupled with the unifying theme of the supply chain, makes it pedagogically even more powerful. To manage quality effectively, a few conditions must be present: Students must understand their businesses, understand the quality body of knowledge, understand the available tools, and have a method for planning quality based on this knowledge. This text provides a basis for accomplishing this—when combined with an instructor’s insight.

SUPPORT FOR THIS EDITION

Active Models

There are interactive Excel spreadsheets located at www.pearsonglobaleditions.com/Foster that correspond to examples in Chapter 12 and Chapter 13 and allow the student to explore and better understand important quantitative concepts. Students or instructors can adjust inputs to the model and, in effect, they can answer a whole series of “what if” questions that are provided (e.g., What if variation in the process changes? What if the process indicates changes are needed? What if we change the sample size?). These Active Models are great for classroom presentation and/or homework.

FOR THE INSTRUCTOR

Besides the changes and additions to the text, we’ve made substantial revisions to the support materials for this book.

Instructor’s Resource Center

At the Instructor Resource Center, www.pearsonglobaleditions.com/Foster, instructors can easily register to gain access to a variety of instructor resources available with this text in downloadable format. If assistance is needed, our dedicated technical support team is ready to help with the media supplements that accompany this text. Visit <https://support.pearson.com/getsupport/s> for answers to frequently asked questions and toll-free user-support phone numbers.

The following supplements are available with this text

- Companion Website
- Instructor’s Resource Manual
- Test Bank
- TestGen® Computerized Test Bank
- PowerPoint Presentation

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Tom is on the editorial boards of the *Journal of Operations Management*, the *Quality Management Journal*, and *Decision Sciences*. He has published more than 80 quality-related research articles in journals such as *The Journal of Operations Management*, *Decision Sciences*, the *International Journal of Production Research*, the *Quality Management Journal*, and *Quality Progress*. He is listed in *Who's Who in America* and *Who's Who in the World*.

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Tom has ten children and fourteen grandchildren, and is married to the former Camille Curtis. In his spare time, he skis, enjoys the Rocky Mountains, and plays his Gibson Les Paul Custom.

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PART ONE

Understanding Quality Concepts

To understand quality in the supply chain, we need a common language. In the general public, the language of quality is imprecise and inconsistent. The language of quality professionals is much more precise and consistent.

To understand the advanced concepts in the later chapters, in Chapters 1 through 3 we build a conceptual foundation of quality theory. This forms the basis of the contingency approach. To apply quality improvement on a contingent basis, you need to understand the foundation that has been laid by leaders in the quality movement such as W. Edwards Deming, Joseph Juran, Philip Crosby, Kaoru Ishikawa, and others. These people have made huge contributions to the world of quality and a knowledge of their teachings and ideas is necessary for quality application.

In Chapter 3, we consider important frameworks, such as ISO 9000, the Deming Prize, and the Baldrige criteria. They provide models for improvement that are being used in many countries around the world.

Differing Perspectives on Quality

Chapter Objectives

After completing this chapter, you should be able to:

1. Recognize that different dimensions of quality.
2. Be able to discuss quality dimensions.
3. Communicate the seven different functional perspectives on quality.
4. Understand why it is important to know that the different perspectives exist.
5. Define a quality system using the three spheres.
6. Understand how the three spheres complement each other.
7. Understand the value-added perspective on quality.
8. Discuss differing cultural perspectives on quality.

Quality management involves flows. There are process flows, information flows, material flows, and flows of funds. Each of these flows has to operate effectively, efficiently, and with outstanding quality. Like a river, we refer to these as upstream and downstream flows. The sums of these flows comprise the supply chain.

Considering the **supply chain** causes us to think about quality differently. One of the problems with quality efforts has been that they tend to be too internally oriented. The supply chain causes us to expand our vision as we *externalize* processes that had previously been *internalized*. They include **upstream** processes relating to our dealing with suppliers—negotiating, selecting, and improving supplier performance—and **downstream** processes—delivering products and services and serving customers.

The supply chain encompasses many differing functions and processes. It includes all the core activities from the raw materials stage to after-sale service. To execute all of these processes correctly involves integrating differing functions, expertise, and dimensions of quality. This need for integration increases the requirement for flexible, cross-functional problem solving and employees who can adapt to rapidly changing markets.

There are many different definitions and dimensions of quality in the supply chain. We present several of these definitions and dimensions in this chapter. For the present, you can view quality as a measure of goodness that is inherent to a product or service. Employees working for the same firm often view quality differently. Think of the different functions involved in creating

A CLOSER LOOK AT QUALITY 1-1 Buying Clothing in Asia

One of the benefits of the global supply chain has been the opening of new markets in places such as China and India. A recent study by PwC¹ shows that Asian preferences for apparel among affluent shoppers are very different from the United States and Europe. It is fair to say that wealthy Asian shoppers are addicted to luxury-brand products. Affluent Asian shoppers are four times more likely to pay high prices for luxury brands such as Gucci, Prada, and Hermes than U.S. and European consumers. Why is this true? In Asian cultures, these name-brand products signal a shopper's wealth or social status. Affluent Asians crave conspicuous consumption.

In developing Asia, product quality and guaranteed authenticity are more important than price. In developed countries, price is considered a much more important purchase criterion. In developing countries, upward mobility is a newer reality, and luxury products are seen as a method for moving up the social ladder and tapping into the newest fashions. Asians are twice as likely as developed country people to use the Internet and social media to identify which brands are currently the hottest.

As a result, retailers moving into Asian countries can maximize their success by building brand equity, using web-based brand advocates, and tapping celebrities to advertise their products. Using social media in this way can influence perceptions of quality in these rapidly growing markets.

¹Based on Shah, S., et al., "The Rise of the Affluent Asian Shopper," PwC's Experience Radar 2013, PwC, 2013.

products and services. They include design engineering, marketing, operations, cost accounting, financial management, and others throughout the supply chain. A product design engineer might feel that customer satisfaction is mostly influenced by product design and product attributes, and take great pains to design a product that satisfies the customer. However, the product also needs to satisfy marketing's need for quick design cycle times and accounting's need for low-cost products. So perceptions differ on a variety of levels, including what our goals for the product or service are. A Closer Look at Quality 1-1 illustrates this point by comparing Asian perceptions concerning apparel purchases.

Perceptions affect every aspect of our world—including the business world. To communicate effectively about quality, managers need to recognize that differences in perceptions of quality exist. Although this observation may not seem too startling, many managers have strong opinions about what quality is. Sometimes these opinions can be at variance with the beliefs of the majority of their customers, which may hurt the competitiveness of a firm. For that reason, in this chapter we study quality from a variety of perspectives. Later we provide a means for recognizing and resolving differences in perception. Finally, we introduce the contingency view of quality management that we emphasize throughout this book.

WHAT IS QUALITY?

If you ask 10 people to define quality, you probably will probably get 10 different definitions.

Product Quality Dimensions

There are several definitions of quality, or **quality dimensions**. One of the most respected collections of quality dimensions was compiled by David Garvin² of the Harvard Business School (see Table 1-1).

Garvin developed a list of eight quality dimensions (see Table 1-1). These dimensions describe product quality specifically in the following paragraphs.

²Garvin, D., "What Does 'Product Quality' Really Mean?" *Sloan Management Review* (Fall 1984): 25–43.

TABLE 1-1 Product Quality Dimensions

Performance
 Features
 Reliability
 Conformance
 Durability
 Serviceability
 Aesthetics
 Perceived quality

Source: © 1984 from MIT Sloan Management Review/
 Massachusetts Institute of Technology.

Performance refers to the efficiency with which a product achieves its intended purpose. This might be the return on a mutual fund investment, the fuel efficiency of an automobile, or the acoustic range of a pair of stereo speakers. Better performance is usually synonymous with better quality.

Features are attributes of a product that supplement the product's basic performance. They include many of the "bells and whistles" contained in products. A visit to any television or computer retail store will reveal that features such as surround sound, HDTV capability, 3-D, and size are powerful marketing tools for which customers will pay a premium. A full-line television retail store may carry televisions priced from \$200 to \$12,000. This range represents a 6,000% price premium for additional features!

Reliability refers to the propensity for a product to perform consistently over its useful design life. A subfield in quality management has emerged, called *reliability management*, based on the application of probability theory to quality. A product is considered reliable if the chance that it will fail during its designed life is very low. For example, if a refrigerator has a 2% chance of failure in a useful life of 10 years, we say that it is 98% reliable.

Conformance is perhaps the most traditional dimension of quality. When a product is designed, certain numeric dimensions for the product's performance are established, such as capacity, speed, size, durability, or the like. These numeric product dimensions are referred to as *specifications*. The number of ounces of pulp allowed in a half-gallon container of "pulp-free" orange juice is one example. Specifications typically are allowed to vary a small amount called *tolerance*. If a particular dimension of a product is within the allowable range of tolerance of the specification, it conforms.

The advantage of the conformance definition of quality for products is that it is easily quantified. However, it is often difficult for a service to conform to numeric specifications. For example, imagine trying to measure the quality of a counselor's work versus that of a carmaker. Because counseling is intangible, it is almost impossible to measure.

Durability is the degree to which a product tolerates stress or trauma without failing. An example of a product that is not very durable is a lightbulb. Lightbulbs can be damaged easily and cannot be repaired. In contrast, a trash can is a very durable product that can be subjected to much wear and tear.

Serviceability is the ease of repair for a product. A product is very serviceable if it can be repaired easily and cheaply. Many products require service by a technician, such as the technician who repairs your personal computer. If this service is rapid, courteous, easy to acquire, and competent, the product generally is considered to have good serviceability. Note that different dimensions of quality are not mutually exclusive.

Aesthetics are subjective sensory characteristics such as taste, feel, sound, look, and smell. Although vinyl interiors in automobiles require less maintenance, are less expensive, and are more durable, leather interiors are usually considered more aesthetically pleasing. We measure aesthetic quality as the degree to which product attributes are matched to consumer preferences.

Perceived quality is based on customer opinion. As we said in the beginning of this chapter, quality is as the customer perceives it. Customers imbue products and services with their understanding of their goodness. This is perceived quality. We can witness an example of the effect of perceived quality every year in college football polls that rank teams. In many cases, the rankings are based on past records, team recognition, university tradition, and other factors that are generally poor indicators of team quality on a given Saturday. In the same way that these factors affect sportswriters' perceptions, factors such as brand image, brand recognition, amount of advertising, and word of mouth can affect consumers' perceptions of quality.

The Garvin list of quality dimensions, although it is the most widely cited and used, is not exhaustive. Other authors have proposed lists of additional quality measures, such as safety. Carol King³ identified dimensions of service quality such as *responsiveness*, *competence*, *access*, *courtesy*, *communication*, *credibility*, *security*, and *understanding*. Allowed time, you probably could think of additional dimensions as well.

Service Quality Dimensions

Service quality is even more difficult to define than product quality. Although services and production share many attributes, services have more diverse quality attributes than products. This often results from wide variation created by high customer involvement. For example, the consumer of a fountain pen probably will not care that the factory worker producing the pen was in a foul mood (as long as the quality of the pen is good). However, excellent food served in a restaurant generally will not suffice if the server is in a foul mood. In addition, a consumer probably will not consider a pen poor quality if he or she is in a bad mood when using the pen. However, food and service in a restaurant could be excellent and still be perceived poorly if the patron is feeling bad.

Parasuraman, Zeithamel, and Berry (PZ&B), three marketing professors from Texas A&M University, published a widely recognized set of service quality dimensions. These dimensions have been used in many service firms to measure quality performance. The PZ&B dimensions are defined here (see Table 1-2).

Tangibles include the physical appearance of the service facility, the equipment, the personnel, and the communication materials. For example, a hotel with yellowed linens will be rated low for quality. Hair salons catering to an elite clientele might invest in ambient lighting and employ only well-dressed hairstylists. That the hairstylist is dressed well does not affect the service being provided; however, clients believe that their hair will be better styled by someone who is dressed stylishly.

Service reliability differs from product reliability in that it relates to the ability of the service provider to perform the promised service dependably and accurately. For example, a firm might hire a consultant based on reputation alone. If the consultant delivers what the customer wants, the customer will be satisfied and pay the consultancy fee. If the consultant delivers something other than what the customer expects, the customer will not pay the consultancy fee.

TABLE 1-2 PZ&B's Service Quality Dimensions

Tangibles
Service reliability
Responsiveness
Assurance
Empathy

Adapted from Parasuraman, A., Zeithamel, V., and Berry, L., "A Conceptual Model of Service Quality" (Report No. 84-106). Copyright © 1984 by Marketing Science Institute. Reprinted by permission.

³King, C., "A Framework for a Service Quality Assurance System," *Quality Progress* 20, 9 (1987): 27-32.

Responsiveness is the willingness of the service provider to be helpful and prompt in providing service. When you last called your bank for service, how long did it take for a response? Were your problems taken care of quickly, or did you have to wait while you listened to “elevator music” for an hour? Does your service provider always respond to you within three rings of the phone—without forwarding your call to another location?

Assurance refers to the knowledge and courtesy of employees and their ability to inspire trust and confidence. If you needed heart surgery, you probably would not opt for a doctor who appeared forgetful and disorganized during an office consultation. Rather, you would want assurance that the doctor is competent.

Finally, consumers of services desire **empathy** from the service provider. In other words, the customer desires caring, individualized attention from the service firm. A maxim in the restaurant industry is that “if you are in it for the money, you probably won’t survive.” A restaurant in which the employees are constantly focused on efficiency will not give the customers the feeling that their needs are important. Therefore, no empathy will be shared, and restaurant employees will not adequately provide service that will make customers want to return again and again.

Just as there are many quality dimensions relating to production, there are several other dimensions of service quality, such as *availability*, *professionalism*, *timeliness*, *completeness*, and *pleasantness*. Note that service design strives to address these different service dimensions simultaneously. It is not sufficient for a services firm to provide only empathy if responsiveness and service reliability are inadequate.

Why Does It Matter That Different Definitions of Quality Exist?

One problem with having multiple dimensions of quality is communication. It is difficult to devise a coherent strategic plan relating to quality when communication is imprecise. One important attribute of a strategic plan is functional alignment or consistency. If different departments in a company understand quality differently, the strategic plan will not be in alignment. Understanding that different definitions and dimensions of quality exist allows measures to be taken to provide a good basis for communication and planning. By sharing a common definition of quality, each department within a company can work toward a common goal. In addition, understanding the multiple dimensions of quality desired by consumers can lead to improved product and service design. Hewlett-Packard Corporation, a producer of laser printers, understands this concept very well. Early in its quality journey, Hewlett-Packard developed products that consistently conformed to specifications. This involved years of product design, process control, and process improvement. Once the printers conformed to specifications, the company emphasized reliability. After the printers were found to be reliable, the company was able to improve the aesthetics of its printers. After years of working on these different quality dimensions, Hewlett-Packard embarked on a “customer one-on-one” program that emphasized customer interaction with production workers. In this program, Hewlett-Packard production workers take time to call customers on the phone to assess and improve the “relationship” that the customer has with a printer.

DIFFERING FUNCTIONAL PERSPECTIVES ON QUALITY

One of the important determinants of how we perceive quality is the functional role we fulfill organizationally. Just as artists and scientists process information differently, so do employees who perform different functions in an organization.

Differences between artists and scientists are only one instance of different perspectives created by functional differences. Accountants are interested in information for accounting and tax purposes, operations people want information for process control and scheduling, finance people need information to manage cash, and marketing needs information to see whether sales quotas are being met.