PRINCIPLES OF



SECOND EDITION

Jill A. Swift Joel E. Ross Vincent K. Omachonu

PRINCIPLES OF

otal Cality

SECOND EDITION

J.A. Swift, Ph.D. P.E. C.O.E. Joel E. Ross. Ph.D. Vincent K. Omachonu, Ph.D.

 $\sum_{t=0}^{t} S_{t}$ St. Lucie Press Boca Raton, Florida

Library of Congress Cataloging-in-Publication Data

Catalog record is available from the Library of Congress

This book contains information obtained from authentic and highly regarded sources. Reprinted material is quoted with permission, and sources are indicated. A wide variety of references are listed. Reasonable efforts have been made to publish reliable data and information, but the author and the publisher cannot assume responsibility for the validity of all materials or for the consequences of their use.

Neither this book nor any part may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, microfilming, and recording, or by any information storage or retrieval system, without prior permission in writing from the publisher.

The consent of CRC Press LLC does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific permission must be obtained in writing from CRC Press LLC for such copying.

Direct all inquiries to CRC Press LLC, 2000 Corporate Blvd., N.W., Boca Raton, Florida 33431.

© 1998 by CRC Press LLC St Lucie Press is an imprint of CRC Press LLC

No claim to original U.S. Government works International Standard Book Number 1-57444-094-2 Printed in the United States of America 1 2 3 4 5 6 7 8 9 0 Printed on acid-free paper

PREFACE

No management issue since the scientific management movement pioneered by Frederick Taylor has had the impact of the current concern with quality and productivity. Quality expert J.M. Juran calls it a major phenomenon in this age.

It is generally agreed among U.S. executives that quality in products and services is essential in order to maintain and improve competitiveness in global markets. There is unequivocal evidence to indicate that for the individual firm, quality means greater market share and profitability. Therein lies a paradox. Despite the known benefits of quality, many firms do not perceive it as a route to greater success. Others are unwilling to take the necessary actions to overcome bureaucratic inertia. This fixation with structure and the status quo is unfortunate. It is in opposition to quality improvement as well as the quality of work life and the people dimension of management. Significant potential exists in all organizations for improving productivity and quality.

This book is about total quality management (TQM) and about operationalizing a philosophy of management, a corporate vision, and a strategic differentiation. This is achieved by integrating all functions and activities for the purpose of continuous improvement and customer satisfaction. Central to the implementation of TQM operationalization is an understanding of the organization as a collection of interrelated processes. Therefore, the practice of the basic tools and principles of process improvement is necessary.

The book is written for practitioners who are responsible for developing and implementing TQM programs in their organizations, whether in manufacturing or service industries. It is also an excellent text for college students as well as for organizational development and training programs.

The book is organized into four parts. In Part I, Management of Total Quality, the core ideas of TQM are provided. These are based on the Malcolm Baldrige Award and the criteria that are universally recognized as the standards for quality programs. These criteria are expanded and integrated with supporting management principles. Also included is the important topic of benchmarking, as well as a discussion of work teams and the other basics of organizing for quality productivity, the other side of the productivity/quality coin, is essential for rounding out a TQM program. Additionally the cost of quality is described as the basic standard of measurment for quality improvement.

Part II contains a treatment of the basic tools and techniques that are needed for data gathering and analysis related to process improvement. Part III provides criteria for quality programs that are based on the Baldrige Award, ISO 9000, QS-9000, and ISO 14000 as this latter movement accelerates in the United States.

Part IV contains a step-by-step approach for the firm applying for ISO 9000 certification and a comprehensive case study that illustrates and integrates the many dimensions of the TQM program.

THE AUTHORS

J.A. Swift, Ph.D., P.E., C.Q.E., is currently the Quality Assurance Manager for Cubic Automatic Revenue Collection Group located in Tullahoma, Tennessee. She received a B.S. and a M.S. degree in Mechanical Engineering from Memphis State University and a Ph.D. in Industrial Engineering from Oklahoma State University.

From 1987 through 1996, she was a faculty member in the Department of Industrial Engineering at the University of Miami. Also during this time, she conducted workshops and training sessions for companies such as IBM, Hughes, and Unisys, to name a few.

Dr. Swift has also been an engineer for E.I. Du Pont De Nemours & Co., a visiting scholar at The Air Force Institute of Technology, a book reviewer for McGraw-Hill and Prentice Hall, and a reviewer for many journals. She holds several awards and honors and has published articles in journals, proceedings, and books. She is the author of *Introduction to Modern Statistical Quality Control and Management*.

In addition to her involvement in many professional activities, Dr. Swift has also been actively involved in several conferences and has been an invited speaker for various companies around the world.

Dr. Joel Ross is Emeritus Professor of Management at Florida Atlantic University in Boca Raton, Florida. He graduated from Yale University and received his doctorate in business administration from George Washington University. He has been Chairman of Management and Director of the MBA Program. Prior to his academic career, Dr. Ross was a Commander in the U.S. Navy.

Dr. Ross is widely known as a platform speaker, seminar leader, consultant, and author. He has developed and conducted management

development programs for over 100 companies and organizations in the areas of general management, strategy, productivity, and quality. He has been an invited lecturer on management topics in Israel, South Africa, Venezuela, Panama, India, Ecuador, the Philippines, and Japan.

His articles have appeared in such journals as Journal of Systems Management, Business Horizons, Long Range Planning, Industrial Management, Personnel, Management Accounting, and Academy of Management Review. He is the author of thirteen books, including the landmark Management Information Systems, People, Profits, and Productivity, and Total Quality Management: Text, Cases and Readings, which has been adopted by over 250 colleges and universities.

Dr. Vincent K. Omachonu is Associate Professor of Industrial Engineering at the University of Miami. He received his Ph.D. in Industrial Engineering from the Polytechnic Institute of New York, Brooklyn. He earned masters degrees in Operations Research from Columbia University, New York and in Industrial Engineering from the University of Miami, Florida. His B.S. degree is also in Industrial Engineering from the University of Miami.

Dr. Omachonu's research interests include total quality and productivity management, the study of white-collar/knowledge work, production systems, facilities location and layout, work measurement and systems design, healthcare quality and productivity management, and technology management. He has been a consultant to a number of multinational corporations and has published several articles in national and technical journals, proceedings, and books. He is the author of a book entitled Total Quality and Productivity Management in Healthcare Organizations, which won the 1993 IIE Joint Publishers Book-of-the-Year Award.

CONTENTS

	crace Alli
Ab	out the Authors xv
PA	RT I: MANAGEMENT OF TOTAL QUALITY 1
1	Total Quality Management and the Revival of Quality in the United States The Concept of TQM 5 Antecedents of Modern Quality Management 6 The Quality Gurus 7 Accelerating Use of TQM 12 Quality and Business Performance 14 Service Quality vs. Product Quality 15 Exercises 17 Illustrative Case 18 Endnotes 18 References 22
2	Leadership

3	Information and Analysis Organizational Implications 41 Strategic Information Systems 44 Shortcomings of Accounting Systems 46 Organizational Linkages 47 Advanced Processes/Systems 49 Information and the Customer 51 The Information Systems Specialists 52 Systems Design 53 Exercises 54 Illustrative Case 55 Endnotes 55 References 58	41
4	Strategic Quality Planning Strategy and the Strategic Planning Process 60 Strategic Quality Management 61 Definition of Quality 67 Control 73 Service Quality 74 Summary 74 Exercises 75 Illustrative Cases 75 Endnotes 76 References 78	59
5	Human Resource Development and Management Involvement: A Central Idea of Human Resource Utilization 80 Organizing for Involvement 82 Training and Development 83 Selection 85 Performance Appraisal 86 Compensation Systems 87 Total Quality Oriented Human Resource Management 89 Exercises 90 Illustrative Cases 90 Endnotes 91 References 92	79
6	Management of Process Quality A Brief History of Quality Control 94 Product Inspection vs. Process Control 96 Moving from Inspection to Process Control 97 Statistical Quality Control 98	93

	Basic Approach to Statistical Quality Control 99 Manufacturing to Specification vs. Manufacturing to Reduce Variations 100 Process Control in Service Industries 101 Process Control for Internal Services 102 Quality Function Deployment 103 Just-in-Time 108 Just-in-Time or Just-in-Case 109 The Human Side of Process Control 110 Exercises 111 Illustrative Cases 112 Endnotes 113 References 115	
7	Customer Focus and Satisfaction Process vs. Customer 119 Internal Customer Conflict 120 Defining Quality 121 A Quality Focus 121 The Driver of Customer Satisfaction 123 Getting Employee Input 124 Measurement of Customer Satisfaction 125 The Role of Marketing and Sales 126 The Sales Process 127 Service Quality and Customer Retention 128 Customer Retention and Profitability 129 Buyer-Supplier Relationships 130 Exercises 132 Illustrative Cases 132 Endnotes 133 References 135	117
8	Benchmarking The Evolution of Benchmarking 137 The Essence of Benchmarking 140 Benchmarking and the Bottom Line 140 The Benefits of Benchmarking 141 Strategic Benchmarking 142 Operational Benchmarking 144 The Benchmarking Process 145 Identify the Best-in-Class 148 Measure Your Own Performance 150 Actions to Close the Gap 150 Pitfalls of Benchmarking 152	137

	Exercises 153 Illustrative Case 153 Endnotes 154 References 155	
9	Organizing for Total Quality Management Organizing for TQM: The Systems Approach 158 Organizing for Quality Implementation 163 The People Dimension: Making the Transition from a Traditional to a TQM Organization 166 Roles in Organizational Transition to TQM 169 Small Groups and Employee Involvement 171 Teams for TQM 172 Exercises 175 Illustrative Cases 176 Endnotes 177 References 180	157
10	Productivity and Quality The Leverage of Productivity and Quality 183 Management Systems vs. Technology 183 Productivity in the United States 185 Measuring Productivity 187 Basic Measures of Productivity: Ratio of Output to Input 188 White-Collar Productivity 190 Improving Productivity (and Quality) 192 Capital Equipment vs. Management Systems 196 Activity Analysis 197 Exercises 199 Illustrative Case 199 Endnotes 200 References 201	181
11	The Cost of Quality Cost of Quality Defined 203 The Cost of Quality 204 Three Views of Quality Costs 205 Quality Costs 206 Measuring Quality Costs 209 The Use of Quality Cost Information 211 Accounting Systems and Quality Management 212 Activity-Based Costing 213 Exercises 216 Endnotes 217 References 219	203

PAR	RT II: PROCESSES AND QUALITY TOOLS	221
12	The Concept of a Process What Is a Process? 223 Examples of Processes 224 Types of Processes 226 The Total Process 227 Exercises 227 Endnotes 228	223
13	Data and Sampling Introduction 229 Data 229 Sampling 234 Exercises 241 Endnotes 241 References 241	229
14	The Seven Basic Quality Control Tools Background 243 Check Sheets 244 Flowcharts 247 Graphs 248 Histograms 252 Pareto Charts 253 Cause-and-Effect Diagrams 256 Scatter Diagrams 262 Control Charts 263 Exercises 264 Endnotes 266 References 267	243
15	Control Charts for Variables Background 269 Use of Control Charts 269 Variables Control Charts 270 Application of Variables Control Charts 271 Examples of Variables Control Charts 274 Summary 282 Exercises 282 References 285	269
16	Control Charts for Attributes Control Chart for Fraction Non-Conforming (p Chart) 288 Control Chart for Number Non-Conforming (np Chart) 292	287

	Control Chart for Non-Conformities 296 Summary 301 Exercises 302 References 305	
17	When to Use the Different Control Charts Introduction 307 Example 1 307 Example 2 309 Example 3 309 Summary 310 Exercises 310	307
18	Quality Improvement Stories What Is a Quality Improvement Story? 313 Step 1: Identify the Problem Area 315 Step 2: Observe and Identify Causes of the Problem 315 Step 3: Analyze, Identify, and Verify Root Cause(s) of the Problem 316 Step 4: Plan and Implement Preventive Action 316 Step 5: Check Effectiveness of Action Taken 317 Step 6: Standardize Process Improvement 318 Step 7: Determine Future Action 318 Other Considerations 319 Exercises 320 References 320	313
19	Quality Function Deployment History 321 What Is Quality Function Deployment? 321 Benefits 324 Conclusion 326 Exercises 326 Endnotes 326 References 327	321
PAF	RT III: CRITERIA FOR QUALITY PROGRAMS	329
20	ISO 9000	331

	Choosing an Accredited Registration Service 342 ISO 9000 and Services 343 The Cost of Certification 344 ISO 9000 vs. the Baldrige Award 344 Implementing the System 345 Final Comments 345 Exercises 346 Endnotes 346 References 348	
21	What Is the Baldrige Award? Endnotes 356	351
22	European Union Directives EU Directives 360 Compliance with EU Directives 361 CE Conformity Marks 361 Cost of Non-Conformance 362 Conclusion 362 Exercises 363 References 363	359
23	QS-9000 Historical Perspective 365 Basic QS-9000 365 Structure of QS-9000 366 Document Control and Registration 367 Summary 367 Exercises 367 References 368	365
24	ISO 14000 Components of ISO 14000 369 ISO 14001 371 Registration 372 Benefits 373 Exercises 373 References 373	369
PAF	RT IV: CASES in QUALITY	375
25	ISO 9000: A Practical Step-by-Step Approach Preparing for ISO 9000 Registration 377 Pre-Audit Conducted 380 Documenting Control Procedures and Work Activities 381 Implementing a Policies and Procedures Training Program 382	377

xii ■ Principles of Total Quality

	The Final Assessment 383 GSP's Recommendations for Achieving ISO 9000 384	
26	Colony Fasteners	387
INE	DEX	415

MANAGEMENT OF TOTAL QUALITY

The concepts of quality and good management principles have been around for some time, but each has been treated separately and the two sometimes considered unrelated topics. Both concepts are integrated in Part I, where the idea is advanced that quality requires the continuing application of management principles.

In Chapter 1, the concept of total quality management (TQM) is introduced, the emergence of the movement is traced, and the pioneers who developed the principles and techniques are identified. In Chapter 2, the need for top management support and involvement is outlined, and how this should be reflected in the corporate culture and supporting management systems is described.

How information systems serve both strategic and operational needs and link organizational functions is described in Chapter 3. Elements of system design are addressed.

In Chapter 4, the process of strategy development is explained and the role of quality as the differentiating factor in strategy is explored. The idea of involvement and empowerment as the critical dimension of human resource management is presented in Chapter 5, and the need to make quality a central ingredient of these methods is examined.

The emergence of process control rather than final inspection as a means to continuous improvement is traced in Chapter 6. Quality function

deployment and just-in-time are discussed. The measurement and improvement of customer satisfaction and standards for customer retention are covered in Chapter 7. In Chapter 8, the steps involved in benchmarking—comparing oneself to best-in-class organizations—are provided.

The systems approach to a TQM organization style and how to achieve cross-functional integration with teams are described in Chapter 9. Included in Chapter 10 are the basics of productivity management and how productivity is achieved through quality improvement.

The cost of quality is covered in Chapter 11, as well as how to measure the cost of not meeting customer requirements—the cost of doing things wrong. The use of quality cost information is also discussed.