

**D. H. Stamatis**

**SIX SIGMA  
AND BEYOND**

**Foundations  
of Excellent  
Performance**



St. Lucie Press

---

# **SIX SIGMA AND BEYOND**

**Foundations  
of Excellent  
Performance**

---

# **SIX SIGMA AND BEYOND**

---

**A series by D.H. Stamatis**

---

**Volume I**  
**Foundations of Excellent Performance**

**Volume II**  
**Problem Solving and Basic Mathematics**

**Volume III**  
**Statistics and Probability**

**Volume IV**  
**Statistical Process Control**

**Volume V**  
**Design of Experiments**

**Volume VI**  
**Design for Six Sigma**

**Volume VII**  
**The Implementing Process**

**D. H. Stamatis**

**SIX SIGMA  
AND BEYOND**

**Foundations  
of Excellent  
Performance**

---

**SL<sup>t</sup>**

**ST. LUCIE PRESS**

---

A CRC Press Company

Boca Raton London New York Washington, D.C.

## Library of Congress Cataloging-in-Publication Data

---

Stamatis, D.H., 1947-

Six sigma and beyond: foundations of excellent performance / Dean H. Stamatis.  
p. cm.—(Six Sigma and beyond series)

Includes bibliographical references.

ISBN 1-57444-311-9 (v. 1 : alk. paper)

1. Quality control—Statistical methods. 2. Production management—Statistical methods. 3. Industrial management. I. Title. II. Series.

TS156 .S73 2001

658.5'62—dc21

2001041635

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 N.W. Corporate Blvd., Boca Raton, Florida 33431.

**Trademark Notice:** Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation, without intent to infringe.

**Visit the CRC Press Web site at [www.crcpress.com](http://www.crcpress.com)**

---

© 2002 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 1-57444-311-9

Library of Congress Card Number 2001041635

Printed in the United States of America 1 2 3 4 5 6 7 8 9 0

Printed on acid-free paper

# *Dedication*

---

*This volume is dedicated  
to the new engineer in the family,  
Cary*



---

# Preface

Whether one agrees or not with the methodology of six sigma, at this juncture, it is an academic argument. The fact of the matter is that major corporations all over the world are following this particular methodology with the hopes that customer satisfaction will increase and the financial position of the organization will strengthen.

So, what is this six sigma phenomenon? Basically, it is a statistical measure that defines variation. Specifically, if a company is operating under the six sigma philosophy, then it would produce 3.4 nonconformances per million opportunities. (We prefer the term *nonconformance* for legal reasons. The traditional verbiage has been defective.) A nonconformance is a deviation from the requirement.

Whereas the six sigma methodology is nothing new, it does provide a structured approach to improving the *process* and that in itself may prove to be worthwhile. On the other hand, we believe that the return of an organization's effort will be much more favorable to the "bottom line" if the six sigma methodology was focused on the design and not the product. More about this will be found in Volume VI of this series.

This work will attempt to focus on six sigma and beyond for both manufacturing and transactional organizations. Specifically, we will discuss the foundations of quality, and progressively, we will move into what is called the six sigma methodology from a design perspective. We will discuss some of the tools used in the methodology and close this series with an implementation scheme that, if followed, will help any organization improve both their processes and financial status.

Moreover, in this work, we are going to address the issue of quality from a fundamental point of view and continue in an advanced path to demonstrate the results of planning for quality rather than appraising quality.

Our focus is to show the tools one needs for improvement, but also to demonstrate how these tools can be used to optimize the process for six sigma (99.99966%) and beyond. To do this we have separated the work into seven volumes. Each one is independent of one another and may be read or followed in any order that the reader needs the appropriate and applicable information.

Each volume's content is summarized below.

## **SIX SIGMA AND BEYOND: FOUNDATIONS OF EXCELLENT PERFORMANCE, VOLUME I**

In this volume, we focus on the very fundamental issues of all quality systems and we give an overview of the six sigma concept. This is the volume in which we define quality and recognize some of the elements that both management and nonmanagement personnel must understand for success.



In addition, this volume addresses the issues of team and the mechanics of teams as they relate to quality. Quality is the result of everyone, which is the premise of this work, and as such the topic of teams is a fundamental one, especially when one tries to go beyond six sigma constraints.

We believe that quality depends on the *team* effort of everyone and it is through synergy that process optimization occurs. However, since the topic of teams has been written about extensively, in this volume we focus on teams, their behaviors, their assumptions, and their benefits as they relate to quality, and we do that by question and answer rather than full text discussion. An extensive bibliography is given for the reader to pursue each topic on his own.

In this volume we also include what we think is the body of knowledge for an effective six sigma program. As of now, the body of knowledge has not been officially designated.

## **SIX SIGMA AND BEYOND: PROBLEM SOLVING AND BASIC MATHEMATICS, VOLUME II**

In this volume, we focus on the problem solving methodology which is very fundamental to any quality initiative. We begin by addressing what is a problem and then systematically we define the process of resolving the problem.

The second part of this volume addresses basic mathematics that are used in all phases of quality. The approach we have taken is to introduce the mathematical concept, give an example, and then proceed with several exercises for the reader.

## **SIX SIGMA AND BEYOND: STATISTICS AND PROBABILITY, VOLUME III**

In this volume, we address the essential topics of statistics and probability as they are used in the field of quality. We address topics for both measurable and attribute characteristics. In addition we make the connection between statistics, probability, and reliability.

## **SIX SIGMA AND BEYOND: STATISTICAL PROCESS CONTROL, VOLUME IV**

Statistical Process Control (SPC) has been covered in the literature quite extensively. However, in this volume we take a simplistic approach to the topic by emphasizing the “why we do” and “how to do” SPC in all kinds of environments.

In addition, we address issues that concern measurement, service SPC, as well as issues that concern short runs and capability.

## **SIX SIGMA AND BEYOND: DESIGN OF EXPERIMENTS, VOLUME V**

In this volume, we attempt to demystify the topic of Design of Experiments (DOE). We begin by explaining the concept of variation and the need for experimentation and we follow through with applications. The strength of this volume is in the fact that it also addresses “robust designs” by including the Taguchi methodology of experimentation.

## **SIX SIGMA AND BEYOND: DESIGN FOR SIX SIGMA, VOLUME VI**

This volume addresses improvement from a preventive perspective by introducing the reader into a sequence of disciplines, so that a six sigma design may be reached. The minimum required disciplines are identified as:

- Customer satisfaction
- Quality function deployment
- Benchmarking
- Systems engineering
- Value engineering
- Reliability and maintainability
- Design for manufacturability
- Mistake proofing
- Failure mode and effect analysis
- Project management
- Financial concepts

## **SIX SIGMA AND BEYOND: THE IMPLEMENTING PROCESS, VOLUME VII**

This final volume of the series is a summary of the curriculum that a typical six sigma program should follow. It also provides what we believe are the objectives for a successful and rewarding implementation of each phase in training for the six sigma methodology.

It begins by summarizing some key objectives for a six sigma professional and then it addresses the specific requirements and training schedule for each of the categories. The categories are:

1. Champions
2. Green belts
3. Black belts
4. Shogun six sigma master

## **TARGET AUDIENCE**

Our target audience, by design, is everyone, i.e., academics and practitioners, who desire to know about quality systems, the six sigma concept, or to review specific topics within the six sigma quality body of knowledge in a timely manner and with specificity.

The primary users will be the ones who actually are about to embark in the six sigma methodology and this work is going to help them understand the concepts and the constraints of implementation as well as the benefits of attaining the six sigma status.

The secondary users will be the individuals who want to know specific tools, concepts, definitions, and generally educate themselves about the six sigma methodology.

## **HOW TO USE THESE VOLUMES**

By design these volumes may be used independently of each other or sequentially. Each volume obviously builds on the previous volume in the content domain, but some readers may not need that information.

Our intent for this series is to discuss the issue of six sigma from a very elementary level to an advanced level. As such some volumes, for example, Volumes III, V, and VI, are very technical and demand that the reader spend some time studying the issues and content of these volumes. For the casual reader, the series may be used as a reference to the six sigma methodology.

---

# Acknowledgments

In a typical book, the author has several, if not many, individuals who have helped in the process of completion. In this mammoth work, I have so many individuals that have helped that I am concerned that I may forget someone.

To write a book is a collective undertaking by many people. To write a book that conveys hundreds of thoughts, principles, and ways of doing things is truly a Herculean task for one individual. Since I am definitely not a Hercules or a Superman, I have depended on many people over the years to guide me and help me formulate my thoughts and opinions about many things, including this work. For me to thank everyone by name who has contributed to this work is impossible, although I am indebted to all of them for their contribution. However, there are some organizations and individuals who do stand beyond the rest and who, without them, this series would not be possible.

In any case, there are some individuals who pushed me to actually write this series of books and have reviewed and commented on several of the drafts. There are also individuals who have helped me in solidifying some of the items covered in this work, through lengthy discussions.

The individuals who fall in these categories are M. Heaffy, H. Bajaria, J. Spencer, V. Lowe, L. Lemberson, R. Roy, R. Munro, E. Rice, and G. Tomlison. Their encouragement and thought-provoking discussions helped me tremendously in formalizing not only the content but also the flow of the material, as well as the depth.

I would like to thank the Six Sigma Academy, for granting me permission to use some of their material in comparing the classical approach to the new approach of defects as well as the chart in significance of differences between the  $3\sigma$ ,  $4\sigma$ ,  $5\sigma$ , and  $6\sigma$ .

I would like to thank the American Marketing Association for granting me permission to summarize the fake and mining data articles from the *Marketing News*. (Reprinted with permission from “Data mining: Race for mission-critical information” and “Improve your research through fake data,” from the “January 3, 2000 issue of *Marketing News*,” published by the American Marketing Association, Vol. 34.)

I would like to thank the Tennessee Associates U.S.A., Inc., for granting me permission to use some of their material on team development and team roles and responsibilities.

I would also like to thank the TRACOM Co. for granting me permission to use the material on the four social styles model.

In addition, I would like to thank the American Society for Quality (ASQ) for granting me permission to summarize: (1) some key issues about teams from “making perfect harmony with teams” published in their *ONQ* magazine (reprinted with permission from *On Q*, ASQ’s journal of record, November 1995), and (2) summa-

alize some definitions and the characteristics of quality from *The Certified Quality Manager Handbook* (1999) (reprinted with permission of ASQ Quality Press).

I would like to thank Mr. C. H. Wong for his persistence over the last 4 years to write this book. His faith in me and encouragement will never be forgotten.

I would like to thank Dr. J. Farr for his thoughtful suggestions throughout the writing process and his insight on teams.

I would like to thank Dr. W. Landrum for teaching me what teams are all about and why we must pursue the concept in the future. His futuristic insight has been an inspiration. His practice of teams has been a model for me to follow. Thanks, Bill!

I would like to thank my colleagues, Dr. R. Rosa, Mr. H. Jamal, Dr. A. Crocker, and Dr. D. Demis as well as Mr. J. Stewart and Mr. R. Start for their countless hours of discussions in formulating the content of these volumes in its final format.

In addition, I want to thank J. Malicki, C. Robinson, and S. Stamatis for their computer work in making some of the earlier drafts and final figures in the text.

I would like to thank as always my personal inspiration, bouncing board, navigator, and editor, Carla, for her continual enthusiastic attitude in my most trying times. Especially with this work, she has demonstrated her extraordinary patience, encouragement, and understanding in putting up with me even during the time we moved into our new home. What can I say, Carla Jeanne? You are the greatest! You have been tremendous in every sense of the word. Thanks, Carla Jeanne!

Special thanks goes to the editors of the series for their suggestions and improvements of both the text and its presentation in the final format.

Finally, my greatest appreciation is reserved for my seminar participants and the students of Central Michigan University, who through their input, concerns, and discussions, I was able to formulate these volumes, so that they could become a reality. Without their active participation and comments, these volumes would never have been finished. I really appreciate their efforts.

---

# About the Author

**D. H. Stamatis, Ph.D., ASQC-Fellow, CQE, CMfgE** is currently president of Contemporary Consultants, in Southgate, Michigan. He received his B.S. and B.A. degrees in marketing from Wayne State University, his Master's degree from Central Michigan University, and his Ph.D. degree in instructional technology and business/statistics from Wayne State University.

Dr. Stamatis is a certified quality engineer for the American Society of Quality Control, a certified manufacturing engineer with the Society of Manufacturing Engineers, and a graduate of BSI's ISO 9000 lead assessor training program.

He is a specialist in management consulting, organizational development, and quality science and has taught these subjects at Central Michigan University, University of Michigan, and Florida Institute of Technology.

With more than 30 years of experience in management, quality training, and consulting, Dr. Stamatis has served and consulted for numerous industries in the private and public sectors. His consulting extends across the United States, Southeast Asia, Japan, China, India, and Europe.

Dr. Stamatis has written more than 60 articles and presented many speeches at national and international conferences on quality. He is a contributing author in several books and the sole author of 12 books. In addition, he has performed more than 100 automotive-related audits and 25 preassessment ISO 9000 audits, and he has helped several companies attain certification.

He is an active member of the Detroit Engineering Society, the American Society for Training and Development, the American Marketing Association, and the American Research Association, and a fellow of the American Society for Quality Control.



---

# Figures

- Figure 1.1 Plan phase.
- Figure 1.2 A typical flowchart structure.
- Figure 1.3 Do phase.
- Figure 1.4 A typical cause-and-effect diagram.
- Figure 1.5 A structural example of a cause-and-effect diagram.
- Figure 1.6 A typical structure of a Pareto chart.
- Figure 1.7 Study phase.
- Figure 1.8 A typical structure of a histogram.
- Figure 1.9 A typical structure of a scatter diagram.
- Figure 1.10 A typical run chart.
- Figure 1.11 A typical control chart.
- Figure 1.12 Act phase.
- Figure 1.13 The process of continual improvement with focus on the system/process.
- Figure 1.14 The process of getting started (steps up the ladder to a quality system).
- Figure 1.15 The feedback loops and relationship of supplier–organization–customer.
- Figure 1.16 The relationship of improved performance and goals.
- Figure 1.17 The process of selecting projects and action plans.
- Figure 1.18 The basic performance improvement cycle.
- Figure 1.19 Loss function.
- Figure 1.20 The relationship between the PDSA and the seven-step model.
- Figure 2.1 The DMAIC model with its detail.
- Figure 2.2 A model of six sigma strategy.
- Figure 2.3 The SIPOC model.
- Figure 3.1 Understanding customer’s needs.
- Figure 3.2 Collection method interrelationship matrix.
- Figure 5.1 Leadership as a continuum.
- Figure 5.2 Forces interacting to suggest an appropriate style of leadership.
- Figure 7.1 The strategic architecture of teams.
- Figure 7.2 Teams and expectations.
- Figure 7.3 The human relationship in the organization.
- Figure 7.4 A learning model.
- Figure 7.5 The process of developing interrelationships.
- Figure 7.6 Factors influencing the team.
- Figure 7.7 Team relationships.
- Figure 8.1 Action plan.
- Figure 8.2 Elements of team dynamics and their relationships.
- Figure 8.3 The model of SDWT.



- Figure 8.4 The path of personal change.
- Figure 8.5 The bullseye model.
- Figure 8.6 The GRPI model.
- Figure 8.7 The team goal-setting process model.
- Figure 8.8 Facilitator's duties — a visual perspective.
- Figure 9.1 Improvement team evolution.
- Figure 9.2 Process management structure (PMS).
- Figure 9.3 Organizational quality improvement cycle.
- Figure 10.1 Levels of participation.
- Figure 10.2 The leadership continuum.
- Figure 11.1 Outline format of a storyboard.

---

# Tables

Table I.1	Six Sigma Goal with a $\pm 1.5\sigma$ Shift
Table I.2	Comparison of Standards
Table 1.1	Typical Waste Items
Table 1.2	Typical Time-Consuming Cultural Changes
Table 1.3	Benchmarking Matrix
Table 1.4	Stages of People Involvement
Table 1.5	Typical Approach to Analyze Customer Requirements
Table 1.6	A Typical Flow of Measurability
Table 1.7	A Guide for Process Evaluation
Table 1.8	A Guide to Identify Improvement Opportunity
Table 1.9	A Guide for Prioritization
Table 1.10	A Typical Sequence for Process Improvement
Table 2.1	A Typical Example of a Six Sigma Deployment Time Line
Table 2.2	The Relationship of Complexity, Effort, and Return on Investment
Table 2.3	14 Keys to Service Quality
Table 3.1	Sampling Guidelines
Table 5.1	Examples of Different Interdependencies
Table 5.2	Steps in Team Building
Table 5.3	Team Development Process
Table 5.4	Maturity Level of Group and Related Level of Maslow's Hierarchy of Needs
Table 6.1	Guidelines for Communication Distances
Table 6.2	Gender Theme — Power
Table 6.3	Gender Theme — Support
Table 6.4	Gender Theme — Intimacy and Sexuality
Table 6.5	Gender Theme — Accountability
Table 7.1	Some Symptoms of Potential Worker Obsolescence
Table 7.2	Potential Causes of Worker Obsolescence
Table 8.1	Attributes for Success
Table 8.2	SDWT Issues
Table 8.3	Challenges during the Five Stages of Development
Table 8.4	The Team Roles
Table 8.5	Six Levels of Freedom
Table 8.6	Implementation Examples
Table 10.1	The Consequences of Power Base
Table 10.2	Four Types of Strategies and Change Factors
Table 10.3	The Four Behavior Styles and Their Behavior in a Team
Table 10.4	Types of Questions
Table 10.5	Guidelines for Phrasing Questions

Table 10.6	Questioning Techniques
Table 10.7	The Decision-Making Styles, Best Applications, and Primary Dangers
Table 10.8	Communicating with Four Types of Individuals
Table 10.9	Characteristics of Individuals
Table 10.10	Individual Stereotypical Characteristics

---

# Table of Contents

## ***PART I Quality***

Introduction..... 3

**Chapter 1 The Foundations of Any Quality System..... 9**

Set True Customer Requirements..... 11

Concentrate on Prevention, Not Correction..... 11

Reduce Chronic Waste..... 11

Reduce Variation..... 12

Measurement..... 13

    Data Mining ..... 14

    Fake Data ..... 16

Empowerment..... 17

    Have Patience..... 17

    Exercise Hope ..... 18

    Be a Watchful Monitor ..... 18

    Do What You Say..... 18

Leadership..... 18

Leadership in the Quality Domain..... 20

The Role of the Quality Professional ..... 23

    What the Dialogue Session Is Not ..... 27

    Use Structured Methodology for Process Improvement..... 29

    Quality Control ..... 29

    Quality Assurance ..... 31

Common Misconceptions in Quality ..... 32

    Total Quality Management ..... 33

Plan Phase (Management Responsibility)..... 33

    State Goal..... 34

        Relevant ..... 34

        Measurable ..... 34

    Describe Process Flow..... 34

    Define Desired Changes in Outcomes..... 36

Do Phase (Process Action Team Responsibility)..... 37

    Identify Potential Causes of Quality ..... 37

    Develop Baseline for Process Outputs ..... 37

    Develop an “As Is” Flowchart..... 38

Perform Cause and Effect Analysis.....	38
Identify Process Measures .....	40
Establish Data Collection Procedures.....	41
Collect Baseline Process Information.....	41
Perform Pareto Analysis .....	42
Check Phase (PAT/Management Responsibility).....	43
Collect and Analyze Data .....	43
Histograms .....	44
Scatter Diagrams .....	44
Run Charts.....	44
Control Charts .....	44
Determine Types of Process Causes.....	46
Act Phase (Management/PAT Responsibility) .....	46
Select “Causes” to Change .....	46
Take Action on “Special Causes” .....	47
Develop Changes for “Common Causes” .....	47
Implement Common Cause Change on a Trial Basis.....	48
Evaluate Effects of Changes .....	48
Successful Recommendations on Quality Initiatives .....	50
Step 1 — Establish the Quality System, Management, and	
Cultural Environment.....	50
Long-Term Commitment .....	51
People Involvement.....	54
Disciplined Methodology.....	55
Support Systems.....	56
Training .....	57
Step 2 — Define Mission of Each Component of the Organization .....	58
Step 3 — Set Performance Improvement Opportunities, Goals,	
and Priorities .....	59
Step 4 — Establish Improvement Projects and Action Plans .....	60
Step 5 — Implement Projects Using Improvement Methodologies .....	61
Define Process, Identify Customer and Supplier Requirements.....	61
Develop and Establish Measures .....	61
Assess Conformance to Customer Needs.....	61
Analyze Improvement Opportunities.....	63
Identify and Rank Improvement Opportunities.....	63
Improve Process Quality.....	64
Step 6 — Evaluate Improved Performance .....	64
Step 7 — Review and Recycle.....	66
References.....	67
Selected Bibliography.....	67
<b>Chapter 2 Six Sigma Overview .....</b>	<b>69</b>
The Model of Six Sigma.....	75
Essential Elements of the Six Sigma Methodology .....	75

Commit to Self-Development.....	77
Develop and Maintain Technical Knowledge.....	77
Adopt an Orientation to Action and Results.....	78
Expect Top Performance.....	78
Commit to Quality and Continual Improvement.....	79
Be Customer Driven.....	81
Make Timely and Value-Driven Decisions.....	81
Solve Problems Effectively.....	82
Be Flexible.....	83
Support Risk Taking.....	84
Provide Recognition.....	84
Coaching.....	85
Perform with Integrity.....	89
Organizational Values.....	90
Accept and Meet Responsibilities.....	90
Frequent Questions about Six Sigma Methodologies.....	91
Organizations Love New Initiatives. Isn't Six Sigma Another Flavor of the Month?.....	91
Does Senior Management Have the Patience to See This Through? Is There a True Commitment?.....	92
Isn't Six Sigma Really Just Another Cost-Reduction Initiative?.....	92
How Soon Does an Organization Begin to See Results?.....	92
How Can Six Sigma Work with Ongoing Technical Training Plans?.....	92
What Can Individual Employees Do Proactively to Embrace Six Sigma?.....	92
What are Black Belts and How Do They Fit into the Current Structure of an Organization?.....	93
Are There Special Compensation Incentives for Black Belts?.....	93
Does an Organization Committed to the Six Sigma Methodology Have to Add More Resources to Start the Program, i.e., Replacing the Black Belts with New People?.....	93
Does Six Sigma Compete or Conflict with Other Internal Programs?.....	94
Isn't Six Sigma the Same as TQM or Other Quality Initiatives?.....	94
How Does It Affect Me and the Way I Do My Job?.....	94
Can Six Sigma Be Applied to Nonproduction or Nontechnical Functions, Such as Human Resources, Purchasing, Marketing, and the Like?.....	94
What Is the Deployment Time Line? When Does It Get to My Group?.....	95
What Is the Difference between Six Sigma and Consumer Six Sigma?.....	95
What Is the Difference between Sigma ( $\sigma$ ) and Standard Deviation?.....	95
What Is the 1.5 Sigma Shift?.....	95
What Is Defects per Opportunity?.....	96
What Is the Defect per Million Opportunity (DPMO)?.....	96
What Is the Hidden Factory?.....	96

- What Is the CTX (Process) Tree? ..... 96
- What Is the SIPOC Model? ..... 97
- What Is the DMAIC Model ..... 97
- How Did Six Sigma Originate? ..... 98
- A Critical Perspective of the Six Sigma ..... 99
- Beyond the Six Sigma Phenomenon ..... 101
- Typical Implementation of the Six Sigma Strategy ..... 104
- Candidate Qualifications and Training ..... 105
  - Six Sigma Champion Training ..... 107
  - Six Sigma Executive Overview ..... 107
- Project Selection ..... 107
  - External Sources ..... 109
  - Internal Sources ..... 109
  - Understanding the Improvement Project Itself ..... 109
  - Criteria for Proper Project Selection ..... 110
- References ..... 111

**Chapter 3 Gearing Up and Adapting Six Sigma in Your Organization..... 113**

- Recognition ..... 113
- Define ..... 114
  - Team Charting ..... 115
    - The Business Case for the Project Selection ..... 115
    - Preliminary Problem Statement ..... 115
    - Project Scope ..... 115
    - Goals and Milestones ..... 115
    - Roles ..... 115
  - Customer Focus ..... 116
    - Definition of Quality ..... 116
    - Types of Customers ..... 116
    - Voice of the Customer Sources ..... 117
    - Methods of Collecting Customer Requirements ..... 117
    - Voice of the Customer Analysis ..... 117
- Process Mapping ..... 118
  - Process Definition ..... 119
  - Business Process Map ..... 119
  - Mapping Guidelines ..... 119
- Measure ..... 120
  - Measurement ..... 120
    - Input/Output Process Measures ..... 120
    - Effectiveness and Efficiency Measures ..... 121
  - Variation ..... 121
    - Process Variation ..... 121
    - Types of Variation ..... 121
  - Data Collection ..... 122
    - 5 Step Data Collection Process ..... 122

Types of Data .....	123
Sampling.....	123
Process Capability.....	123
Analyze.....	124
Data Analysis .....	124
Process Analysis.....	125
Root Cause Analysis .....	125
Quantify Opportunity .....	125
Improve .....	126
Generate Solutions .....	126
Select Solutions.....	127
Implementation Planning .....	127
Control.....	128
Document and Institutionalize .....	128
Monitor the Process .....	129
References.....	129
Selected Bibliography.....	129

**PART II Teams**

<b>Chapter 4</b> A General Overview .....	135
Make Great Products and Profits Will Follow; Never Vice Versa .....	136
The Job of Management Is to Serve the People under It, Not to Rule Them .....	137
Train Right or Not at All .....	137
Put Creative People at the Top of the Organization .....	138
Encourage Positive Nonconformity .....	138
Big Is “Okay,” but Small Is “Beautiful” .....	139
Allow People to Show Their Individuality in Their Jobs Once Their Jobs Have Been Clearly Defined .....	140
Open and Honest Communication.....	141
References.....	142
<b>Chapter 5</b> The Changing Workplace.....	143
Antecedent and Consequent Conditions .....	144
Antecedent.....	145
Consequent.....	145
Implications of the Theory .....	145
Employee Development.....	146
Strategy for Change.....	148
Leadership Styles and Effectiveness.....	148
Forces in the Manager .....	153



Forces in the Subordinate .....	154
Forces in the Situation .....	155
Leadership Style Outputs.....	155
Short Run vs. Long Run.....	157
Effectiveness of Style: The Third Dimension .....	157
Job Maturity Scales.....	157
Team Overview .....	158
Stages in Team Building .....	159
When May Team Building Be Needed?.....	159
When May Team Building Not Be Appropriate? .....	159
Characteristics of Productive Teams.....	161
Characteristics of Unproductive Teams .....	161
Factors Influencing Team Functioning .....	162
The Team Effectiveness Critique .....	163
How to Build Trust in a Team.....	166
Pick Team Players.....	168
Define a Single Purpose.....	168
Use of the Team Effectiveness Critique .....	169
Team Effectiveness Questionnaire.....	169
Stages of Group Development.....	170
The Role of the Consultant or Trainer .....	171
A Summary Thought.....	173
Conclusion .....	173
References.....	174
Selected Bibliography.....	175
<b>Chapter 6</b> Communicating Communication .....	177
Factors Affecting the Sender .....	177
Self-Feelings.....	177
Belief in Assertive Rights .....	178
The Sender's Perception of the Message .....	178
The Sender's Feelings about the Receiver .....	178
Suggestions for Effective Expression .....	178
Points for the Listener .....	179
Responses That Can Block Effective Communication .....	180
Awareness of One's Own Feelings .....	181
Change through Training and Interpersonal Skills .....	182
How Operators and Quality Personnel Communicate.....	184
Changing Your Messages .....	186
Communication Issues in Work Environment .....	187
Nonverbal Language .....	187
Spatial Relationship .....	188
Body Language .....	188
Vocal Dimensions.....	189
Environment .....	190

Gender Themes .....	190
Diversity .....	194
Communication and Cultural Diversity .....	195
Conclusion .....	195
References.....	196
Selected Bibliography.....	196
<b>Chapter 7</b> Team Development .....	199
The Concept of Teams Is Based on Participation Philosophy. What Is Participation Philosophy?.....	199
What Is a Team? .....	199
Is There a Real Proof That the Team Concept Really Works?.....	200
What Is the Strategic Architecture of a Team? .....	200
What Are Some of the Predominant Indicators in Forming Teams?.....	201
What Is the Recipe for a Successful Team?.....	202
Clarity in Team Goals.....	202
An Improvement Plan .....	203
Clearly Defined Roles .....	203
Clear Communication .....	204
Beneficial Team Behaviors .....	204
Well-Defined Decision Procedures .....	205
Balanced Participation .....	205
Established Ground Rules.....	205
Awareness of the Team Process.....	206
Use the Scientific Approach .....	206
How Does a Group Develop into a Team? .....	206
Orientation.....	207
Power and Influence.....	207
Team Production and Feedback (Most Cohesive Phase).....	208
What Are the Prerequisite Conditions for Normal Team Development? ...	209
What Is the Development Sequence of the Team Process?.....	209
What Are Some Concerns in the Preparation Phase?.....	210
What Are Some Concerns in the Start-Up Phase?.....	210
What Are Some Concerns in the Transition Phase? .....	211
What Are Some Concerns in the Continuous Improvement Phase? .....	211
What Are the Expectations of a Team?.....	212
What Are the Characteristics of “Best” and “Worst” Teams?.....	212
What Are the Common Elements of Successful Teams?.....	214
Considering Human Behavior, What Kinds of Behaviors Will Help Attain the Goals and Objectives of a Team?.....	215
Considering Human Behavior, What Kinds of Behaviors Will Hinder the Goals and Objectives of a Team?.....	215
What is a Guidance Team? .....	216
What Are the Primary Obligations of a Guidance Team? .....	216
What Can the Guidance Team Do to Improve the Process? .....	216

What Is a Process Action Team (PAT)? .....	217
What Is a Quality Circle (QC)?.....	217
What Is a Self-Directed Work Team (SDWT)? .....	217
What Is the Traditional Relationship between the Individual and That of the Organization?.....	218
What Is the “New” Relationship between the Individual and That of the Organization?.....	218
<b>Chapter 8 Implementation.....</b>	<b>221</b>
When Do We Use a Team?.....	221
What Is the Eight-Step Model? .....	222
What Is the Purpose for the Use of Criteria When Selecting an Opportunity?.....	224
What Are the Components of the Opportunity Statement? .....	225
What Is an Action Plan?.....	225
What Are the Elements of Team Dynamics? .....	226
What Are the Three Most Anti-Team Behaviors?.....	226
Does Management Play a Role in the Success of a Team?.....	226
How Can Management Show Commitment?.....	227
What Is the Right Environment for a Self-Directed Work Team (SDWT)? .....	229
What Are the Requirements for SDWT Success?.....	229
What Are the Preparation Concerns for Self-Managed Teams?.....	230
What Are the Steps to Implement SDWT?.....	231
What Is the Path to SDWT? .....	231
What Are the Challenges during the Five Stages of Team Development?.....	232
Teams Provide an Efficient Way of Operating Many Organizations Due to Synergy. As a Result, Many Organizations Find Themselves with a Flat Structure. What Are the Steps to Flatten the Organization?.....	233
Why Is the Understanding of “Change” a Mandatory Requirement When Teams are Involved?.....	233
How Do We Change the Culture to Support Teams? .....	234
What Is the Process for Change? .....	234
What Makes Cultural Change Difficult? .....	235
What Is the Path of Personal Change?.....	235
What Is the Bullseye Model? .....	236
What Is the GRPI Model? .....	236
What Is the Team Goal-Setting Process Model? .....	237
How Can We Facilitate the Implementation of Teams in the Organization? .....	237
What Are Some of the Effective Behaviors for Process Facilitation?.....	238

What Are Some of the Generic Facilitative Behaviors to Be Used by the Leader, Facilitator, and Every Member in a Team Environment? .....	239
What Is Process Facilitation? .....	240
What Are the Most Important Skills of Facilitation? .....	240
What Does the Facilitator Focus on in the Phases of Team Development?.....	240
What Are the Typical Roles in a Team? .....	241
What Are the Leader’s Duties?.....	241
What Are the Facilitator’s Duties? .....	242
What Are the Recorder’s Duties?.....	243
What Are the Timekeeper’s Duties?.....	244
What Are the Team Member’s Duties? .....	244
What Are the Management’s Duties?.....	245
What Are the Most Common Problems in a Team Environment?.....	245
Is There a Way to Prevent These Problems?.....	245
How Do You Empower Your Team Members? .....	246
What Skills Are Needed for Empowerment?.....	246
How Does Authority Differ in the Team Environment from the Traditional One?.....	246
What Is the Future of the Supervisor in the Team Environment?.....	246
What Is a Typical Schedule for Implementing Teams in the Work Environment? .....	247

**Chapter 9 Team Improvement .....** 251

What Is the Improvement Evolution of Teams? .....	251
How Does Process Team Management Relate to the Process Management Structure? .....	251
How Is the Traditional Approach Changed into Team Performance?.....	253
What Makes Teams Most Effective?.....	253
Your Team Has Been Formed. Now the Question Becomes: “What Is the Road to High Performance?”.....	253
What Makes Teams Least Effective? .....	254
What Are the Steps of Solving “Easy” Problems in a Team Environment? .....	254
What Are the Characteristics of a “Major” Problem in a Team Environment? .....	254
Is There a Way to Identify the Employee Involvement in a Team Environment? .....	255
How Do We Continually Improve (Kaizen Approach or a “Little” at a Time) Given the Team Environment? .....	255
How Can the Team Continue to Improve Performance?.....	256
What Is “the” Quality Improvement Process? .....	256

What Are the Responsibilities of a Guidance Team during the Process Improvement Cycle?.....	257
Can the Effectiveness of the Team Be Measured?.....	258

**Chapter 10** General Issues ..... 259

Meetings Are an Integral Part of Any Team Environment. What Are the Elements of a Successful Meeting?.....	259
What Are the Ingredients of an Effective Meeting? .....	260
What Are Ground Rules?.....	260
What Is the Role of the Meeting Facilitator? .....	260
What Are the Characteristics of a Good Team Member?.....	261
What Are the Most Common Problems in a Team Environment?.....	261
How Is Conflict Being Resolved in the Team Environment?.....	262
Who Are the Main (Focal) Participants in a Quality Team Environment? .....	262
What Is Total Involvement (Commitment)?.....	265
What Is Empowerment?.....	266
What Is the 5S Approach?.....	266
What Types of Strategies Can We Use for Change? What Are the Factors for Change? .....	267
What Is the Benefit of a Team?.....	267
What Is the Payoff of the SDWT? .....	267
What Are the Criteria for Installing a Team in the Work Environment? .....	268
What Are the Pay Considerations for the SDWT? .....	268
How Can Management Motivate the Team after the Objectives of the Team Have Been Attained? .....	269
What Are the Four Typical Behavior Styles in a Team? .....	269
What Constitutes an “Effective” Team Member? .....	269
What Constitutes an “Effective” Team Facilitator? .....	270
As a Facilitator You Must Ask Probing Questions. What Are Some of the Questioning Skills? .....	270
What Are the Typical Decision-Making Styles in Teams? .....	271
What Is Consensus Decision Making?.....	271
How Do We Reach Consensus? .....	273
How Can We Recognize Consensus?.....	273
If the Consensus Method to Decision Making Is Not Workable, How Does the Team Proceed to Make a Decision?.....	274
What Is Listening?.....	275
What Is Active Listening? .....	276
What Are Some Active Listening Skills?.....	276
Listening Is Very Difficult for Many of Us. Is There a Way to Improve? .....	277

What Is Paraphrasing? .....	278
What Is a Meeting Process Check?.....	278
What Is Commitment?.....	279
What Are the Levels of Involvement?.....	279
What Is Feedback?.....	279
How Do You Manage Feedback? .....	279
How Are People Handled in the Team Environment?.....	280
Even in Team Environments, We Still Have to Deal with Individuals.	
What Are Some of the Different Work Situations That a Team May Be Faced with?.....	280
Recognizing That Individuals Are Unique, What Are Some of the Stereotypical Observation Clues That May Help Us in the Team Process?.....	280
What Are Team Operating Procedures (Mechanics)?.....	280
What Is a Team Mission? .....	284
What Are the Characteristics of a Team Mission Statement? .....	284
What Is the Team Chartering Process? .....	284
How Do You Deal with Dysfunctional Activity in the Team Environment? .....	287
Floundering .....	287
Unquestioned Acceptance of Opinions as Facts .....	288
Rush to Accomplishment.....	288
Discounts and Plops.....	289
Digression and Targets.....	289
Feuding Members .....	290
How Do You Deal with Problem Individuals?.....	290
Overbearing Members.....	290
Dominating Members .....	291
Reluctant Members .....	292
Attribution .....	292
How Can a Team Be Led?.....	292
How Can the Team Avoid “Group-Think?” .....	295

<b>Chapter 11</b> An Introduction to Problem Solving: Selected Tools and Methodologies as Used in a Team Environment .....	297
What Is Problem Solving?.....	297
How Do We Go about Identifying the Problem?.....	297
What Is the People Problem Solving Process? .....	298
How Can Planning be Utilized in a Team Problem-Solving Environment? .....	299
What Are the Principles of Team Problem Solving?.....	299
How Do We Zero-In on the Problem Definition?.....	300
How Do We Use the Problem-Solving Process? .....	301

How Do We Identify Problems in a Specific Work Area, for the Team to Work On?.....	302
What Are the Basic Tools That Teams Use in Their Work Environment for Problem Solving?.....	303
What Are the Basic Management Tools That Management Must Be Aware of in Facilitating Teams? .....	303
What Are Some of the Advanced Tools That Teams May Use in Their Work Environment?.....	304
What Is Concern Analysis? .....	304
How Do We Use Concern Analysis?.....	304
Quality Function Deployment (QFD) Is One of the Most Frequent Tools to Identify the Voice of the Customer. How Does the Team Scope the Project, Using the QFD Method?.....	305
Using the QFD, How Does the Team Approach the Analysis of the Problem? .....	305
Using QFD, How Does the Team Gather Customer Wants?.....	306
Using QFD, How Is the Voice of the Customer Analyzed? .....	306
Using QFD, How Does the Team Plan for the Matrix for the Priorities? .....	306
Using QFD, How Does the Team Generate and Evaluate Concepts?.....	307
Another Frequent Technique Used in Identifying Process Improvement Is the Survey. How Is the Survey Instrument Constructed? .....	307
One of the Latest Techniques Used in Team Environments Is Storyboarding. What Is It and How Is It Used? .....	308
 Epilogue .....	 311
Appendix A: A Cursory View of the Six Sigma Methodology.....	313
Appendix B: The Core Competencies of the Six Sigma Methodology.....	317
Appendix C: Cross-Reference List of Terms Used in the Team Environment....	333
Appendix D: Problem Solving/Decision Making .....	335
Glossary .....	343
Selected Bibliography.....	361
<b>Index</b> .....	<b>369</b>

# *Part I*

---

*Quality*





---

# Introduction

Acting in accord with our beliefs and values, or as some would say, walk the talk, is one of the greatest challenges each of us faces every day. It is true for individuals in all aspects of life... and equally true for organizations of every kind and size.

Most organizations talk good management through their stated mission, vision, and values. These displays of good intentions are excellent reminders of what we stand for. But the real worth of our values comes from what is practiced rather than merely professed. It is how we actually behave that ultimately defines our success and determines how we will be judged.

Since the early '80s most people have come to understand that previously acceptable norms of goods and services are no longer acceptable. Customer satisfaction, reliability, productivity, costs, market share, profitability, and even survival are directly affected by the quality of an organization's products and performance.

Quality is indeed in the forefront of every discussion that pertains to any organization's products and or performance. We have, as a society, indeed been inundated with concepts, theories, and approaches to improve, change, and modify past practices of quality because we have found that the "old" is not as good as we thought, even though it was very useful a time long ago.

Whereas these theories, concepts, and approaches do provide a different approach to looking at things from a quality perspective, all of them have advantages and disadvantages. All of them can provide a positive result if only they are adhered to. All of them will improve quality if the strategy of the organization is to improve — **for real** — the product and or performance.

So the question is: if all these theories, methodologies, concepts, and approaches are good enough, why in the world do we need one more? Why do we need a six sigma methodology? Better yet, what is so different about the six sigma that a previous methodology could not provide? The answer is simple and yet complicated.

First, let us admit that variation is indeed the archenemy of all productivity in all organizations. So far, all methodologies invented, thought of, and implemented in all organizations have indeed a common thread in their approach of eliminating variation. So does the six sigma methodology. However, that is where the similarity stops. The focus of this new approach is the definition of improved quality, which is redefined to the limit of plus or minus  $6\sigma$  or 99.99966%. That means that an organization has to focus on decreasing its variability and be able to produce 3.4 nonconformances per million opportunities. Sigma is a Greek letter used in statistics as a unit of measure to identify dispersion in a distribution. In essence, this sigma reflects capability. It turns out that the sigma scale of measure is perfectly correlated to such characteristics as defects per unit, parts per million defective, and the probability of failure or error. Therefore, the six sigma has become a *goal* of many organizations, because it provides a uniform metric for measuring performance in any organization. A simple comparison of the six sigma goal can be seen in Table I.1.

**TABLE I.1**  
**Six Sigma Goal with a  $\pm 1.5\sigma$  Shift**

Process Capability(ies)	Nonconformances per Million Opportunities (ppm)
6	3.4
5	233
4	6,210
3	66,807
2	308,537

From *The Vision of Six Sigma: A Roadmap for Breakthrough*, 5th ed., 1997, vol. 1, pp. 2.12, Six Sigma Academy. With permission.

Another way to see and understand the effect of the progression in quality thinking is in Table I.2. In this table we depict the historical standard of  $3\sigma$ , the current standard for most organizations which is  $4\sigma$ , and the new standard of  $6\sigma$ .

**TABLE I.2**  
**Comparison of Standards**

Sigma	Time	Distance	Area	Money	Spelling
$3\sigma$	3.5 months per 100 years	New York to California trip	Approximately the floor space of a small hardware store	For every \$1 billion in assets, there is \$2.7 million indebtedness	1.5 misspelled words per page in an $8 \times 11$ book
$4\sigma$	2.5 days per 100 years	45 minutes of freeway driving in any direction	Approximately the average floor space of a living room	For every \$1 billion in assets, there is \$63,000 indebtedness	1 misspelled word per 30 pages in an $8 \times 11$ book
$5\sigma$	30 minutes per 100 years	A trip to the local gas station	Approximately the size of the bottom of an average telephone unit	For every \$1 billion in assets, there is \$570 indebtedness	1 misspelled word in a typical set of an encyclopedia
$6\sigma$	6 seconds per 100 years	4 steps in any direction	Approximately the size of a typical diamond	For every \$1 billion in assets, there is \$2 indebtedness	1 misspelled word in all of the books found in a small library

From *The Vision of Six Sigma: A Roadmap for Breakthrough*, 5th ed., 1997, vol. 2, pp. 21.33, 22.6, Six Sigma Academy. With permission.

Second, the six sigma methodology asks the organization to have a paradigm change in everything it does. This change is essential and it demands not only flowery words, slogans, and exhortations, but real actions all the way from senior management to the lowest level of employee. It demands commitment from the leadership and demands accountability and acceptance of ownership from those individuals who will partake in the change process.

The goal of all this? Six sigma is the methodology that will harvest and uncover potential improvements in the organization, by (1) focusing on specific items and (2) bringing all the resources together to identify, measure, analyze, improve, and control the process. This is indeed revolutionary if it can be done. At least in theory it is possible and some organizations have claimed success using this methodology. Examples are General Electric, Motorola, and others.

In our opinion, to implement such a megamethodology demanding so much from everything and everyone it becomes essential to develop attitudes and systems — at all levels of an organization — that promote and implement continual improvement of procedures, processes, products, and services. The implementation, however, of these attitudes and systems in any organization must take into consideration such factors as the organization's unique product or service, culture, customers, employees, level of both corporate and employee knowledge, and experience. As a consequence, in the process of implementing a quality system in any organization, innovative approaches are encouraged.

To be sure, the six sigma methodology is not a novice idea for improvement. However, this idea needs an innovative approach for implementation; otherwise, it will end as other methodologies of the past. One of those innovative approaches has been the introduction of teams. Increasingly, organizations of all types are using teams in the workplace to pursue the power of collective wisdom and effort. Organizing workers, from assembly line to boardroom, into teams seems to be part of the natural order of business in the '90s, and the new millenium.

Teams are indeed an integral part of the human experience and the more we understand their dynamics the more effective we can make them. From the beginning of time, humans have recognized the power of collective wisdom and effort. However, in the last 10 to 15 years, the effort of understanding the makeup, behavior, and the general dynamics of teams has been accelerating beyond everyone's expectations.

Often, teams don't realize their full potential and in some cases they do not work at all. The reason for such failure is that what organizations expect from teams is fundamentally different from what individuals expect. Recognizing the difference and learning to integrate them is the key to building and perpetuating successful teams in any organization.

Strictly speaking, the notion of team is an abstraction. There is no team that does the work however defined. There are only individuals working together as a team.

The concept of team and teamwork in the workplace can elicit strong emotional responses that have their origin in early experiences with teams. It is not unusual, when teams are introduced in the organization, to have potential members exhibit fear of the unknown, anxiety, and an attitude of wait and see.

Another innovative approach to the six sigma methodology is the focus on the customer from a quality system criteria perspective. The six sigma methodology is unique in this respect for it focuses on:

**Driver.** Senior executive leadership guides the sustained pursuit of customer value and improvement of organizational performance via the six sigma methodology.

**System.** Processes are well-defined and well-designed to meet organization's customer requirements as well as quality and performance requirements for the profitability of the organization.

**Measures of Progress.** These are established on a results-oriented basis for channeling actions and delivering verifiable improvements not only to the customer value but also to the organizational performance. This performance is based on specific goals from the organization with the intent to ever improve value to customers. To pull this together the following four items are necessary.

1. Senior executive leadership.
2. Customer focus.
3. Human resource development and management quality and operational results.
4. Customer satisfaction.
  - Customer satisfaction relative to other organizations.
  - Customer retention.
  - Product and service quality.
  - Productivity improvement.
  - Waste reduction and elimination.
  - Supplier quality.

This organizational quality performance is further enhanced by a strong:

**Information analysis.** The drive here is to become a data-driven company for all decisions. Information analysis is a push to effectively manage and use data and information for an optimum decision. With the proper and appropriate information we can examine the scope, validity, and analysis of data used to improve operational performance. How do the data and information systems support improvement efforts toward customer focus? What about products or services? What's the impact on internal operations? These questions help you learn more about the organization's ability to improve operational and competitive performance. Of course, to do this, statistical tools are necessary.

**Strategic quality planning.** What planning process do you use in your organization? What long- and short-term plans are produced by a process within your organization? How are all the key quality requirements integrated into the overall plan? These questions help guide the initial steps of the strategic

quality planning process. Make sure your plans include mission performance goals. You should include, too, improvement plans for enhancing performance in all key areas for both short and long term.

We hope that in this volume the reader will be able to understand the foundations of quality and find the critical elements, as well as the issues affecting the team process, for an effective implementation of the six sigma methodology.

In the other volumes we will address specific issues and concerns for optimizing performance using the six sigma methodology and its tools.



---

# 1 The Foundations of Any Quality System

This chapter addresses the definition and characteristics of any quality system. Progressively, it introduces and discusses some of the essential items that are imperative in the success of pursuing excellence.

Attempting to write a series on the six sigma phenomenon reminds me of a saying that is credited to Abraham Herschel. He said that, “Faith is not the clinging to a shrine but an endless pilgrimage of the heart. Audacious longing, burning songs, daring thoughts, an impulse overwhelming the heart, usurping the mind — these are all a drive toward...”

Quality is no different. One must have a passion for it. One must have a drive for it. One must never rest with conspicuous results, rather one must pursue excellence all the time. Quality, after all, is a pilgrimage to perfection. Unless one understands that pilgrimage, unless one has a burning desire for perfection, unless one has an audacious longing for delighting the customer, all will be for naught.

There are many ways you may attempt to cultivate and maintain quality. One is to talk about quality as though you know something about it. In fact, the sheer conviction and the tone of the discussion will be the proof of quality efforts, rather than the results that were expected.

A second attempt to cultivate and maintain quality is to talk in contradictions and every so often change direction in the name of continual improvement. With this excuse, many quality initiatives have come and gone with no specific results nor substantial benefits. In fact, one may say that the self-fulfilling prophecy of “continual change” perpetuates contradictions in both old programs and new ones. It reminds us of a passage in the *Bible* in Psalm 137(138), verse 9, which states: “O daughter of Babylon... Happy shall he be, that taketh and dasheth thy little ones against the stones.” It is obvious that the verse not only does not make sense, but it is also offensive to our modern minds — never mind that it comes from the *Bible*. It is similar with quality initiatives. As long we are doing something, even though we do not understand it, it is okay, because we are dealing with *quality*.

Yet a third attempt to cultivate and maintain quality is to follow the path of continual improvement. It is a difficult path and the rewards do not come easily. However, the rewards are worth the effort. Learning about the organization, and the specific process, will indeed take time and effort. After all, *all* achievements require hard work. We persevere because we believe rewards will come. Quality perseverance is no different. The more we persevere, the more we understand; the more we understand, the more capable we become of offering solutions and suggestions to organizational and/or process improvement.



So, how do we focus on this continual improvement path? We suggest 10 steps. They are

1. **How you think is everything.** Always be positive. Think success, not failure. Be aware of a negative environment and do not look for any opportunity to blame anyone in particular.
2. **Decide upon your true dreams and goals.** Write down your specific goals and develop a plan to reach them. This is where the mission statement and values of the organization come in.
3. **Take action.** Goals are nothing without action. Do not be afraid to get started now. Just do it. We learn by doing and we become better by practicing. Learn to prioritize. Not everything is important at the same time. Learn to choose between alternatives.
4. **Never stop learning.** Upgrade your knowledge and skills on a continual basis. Recognize that things change, and that everything changes. It is up to the organization and the individual to be responsible for new knowledge and the introduction of new skills in the work environment.
5. **Be persistent and work hard.** Success is a marathon race, not a sprint. Never give up. Rather, reposition your organization and/or yourself for the next time. I remember reading some time ago about Lance Armstrong and his 1996 win in the Tour de France. Reporters wrote that he was flying in the hills and mountains of France during the race. When he was asked about it, he replied, "But you do not fly up a hill. You struggle slowly and painfully up a hill, and maybe, if you work hard, you get to the top ahead of everybody else."
6. **Learn to analyze details.** Get all the facts, all the input from all possible sources. Learn from your mistakes and replicate your successes. Analysis sometimes means to recognize patterns that repeat.
7. **Focus your time and money.** Everything has limitations. Constraints must be identified as early as possible. However, never allow others to distract you from your goals. Focus will keep you going when things get tough.
8. **Do not be afraid to innovate; be different.** Following the herd is a sure way to mediocrity. Be careful when benchmarking is conducted. Always ask the question: "Is this the best practice or is this the best that the competitor is doing?" If the answer is "yes" to the second question, then your organization is in trouble. The best it can hope for is to continue to be second best.
9. **Deal and communicate with people effectively.** No person is an island, no matter what the position and/or title. Learn to understand and motivate others.
10. **Be honest and dependable; take responsibility.** Otherwise, all the above points are meaningless.

Let us then begin to understand quality and its foundations by addressing the components that must be satisfied, so that quality is indeed a way of life and not a mere word of the everyday language. To begin our journey let us focus on the

customer and progressively examine the issues and concerns that people who deal with quality are asked to come to grips with daily.

## SET TRUE CUSTOMER REQUIREMENTS

For a long time “quality” meant some type of conformance based on a set of customer requirements that, if met, resulted in a product that was fit for its intended use. The trick, however, was to have knowledge of the user’s needs, wants, and expectations — from both the internal and external perspective.

It is critical that these requirements be understood and reflected accurately in specifications for products, services, and processes. One of the fundamental principles is that “conformance to requirements” only leads to user satisfaction when there is alignment between user expectations and user requirements. On the other hand, one of the most practical definitions of quality is that *quality is defined by the customer*. To understand this definition, which is quite broad, it means that not only quality professionals, but everyone in the organization must understand the implications of the Kano Model (needs, wants, expectations, and performance).

Successful organizations consistently meet or exceed customers’ needs. This category addresses the interface between each organization and those outside organizations (or individuals) it supports.

## CONCENTRATE ON PREVENTION, NOT CORRECTION

There is no doubt that prevention has more leverage when improving quality than correction does. Therefore, the efforts of quality should be focused on prevention, because the quality payoff is maximized when considered during early phases of developing a product or service. It is then that many problems can be prevented. Thereafter, the leverage of prevention is reduced as correction of problems — a more costly procedure — becomes the dominant mode. A key aspect of this concept is designing products and services that can be produced with high yield within the capability of the manufacturing or service process. Designs that are immune to manufacturing and operational use variability are said to be robust.

## REDUCE CHRONIC WASTE

Everyone involved with quality has figured out that the cost of waste in all sizes of organizations is significant. Whatever the exact numbers are, they illustrate the extraordinary opportunity for reducing costs through improvement of quality. Much of the high cost of poor quality comes from processes that are allowed to be wasteful. This waste is often chronic and is accepted as the normal cost of doing business. The conventional approach to quality is not to get rid of chronic waste but to prevent things from getting worse by “putting out the fires.” Chronic waste of time, material, and other resources can be driven down by implementing continual process improvement. Typical waste items are shown in Table 1.1.