

Developing
New
Products
With

TQM

658.4013
G-396D

Charles Gevirtz



McGRAW-HILL INTERNATIONAL EDITIONS
Industrial Plant Engineering Series

Contents

Preface	xv
Acknowledgement	xvii

Chapter 1. The Importance of Preventative Total Quality and Overview of the Planning Process	1
Introduction	1
Project Team Organization	2
Reward/Recognition system	2
Background of TQM	2
Common Pitfalls with TQM Implementation	3
Avoiding the Pitfalls	4
The Importance of a Preventative Approach	5
Independent Quality Department	10
Lower Decision-Making Authority	11
Self-Directed Work Teams	11
The Product Development Cycle	12
Activities to be performed at different phases of a program	12
References	20
Chapter 2. Statistical Methods	23
Population Mean	23
Population Standard Deviation	23
Sample statistics	24
Sample average \bar{X}	24
Sample Standard Deviation (S)	24
The normal distribution	24
Assessing Process (Capability and Process Centering)	26
The Quality Loss Function	29
Traditional Quality Concept	31
Statistical Process Control	33
Selecting Critical Characteristics	33
From a design standpoint	33
From a processing standpoint	34
From a quality control standpoint	34
\bar{X} and R Charts	34

The Individual and Moving Range Chart	38
<i>P</i> Charts	40
<i>U</i> Charts	45
Gaging Issues	45
Gage repeatability and reproducibility	46
Interpretation of the results	47
Hypothesis Testing— <i>F</i> Test	50
Hypothesis Testing— <i>t</i> Test	52
Linear Correlation Studies	55
Reference	56

Chapter 3. Reducing Product Development Time 59

Tradeoff Considerations	60
Reducing Development Time	61
Utilize product teams	61
The Team Leader	62
Maximizing resource utilization	63
Coordination between project teams	64
Developing standard part manuals	64
New project selection	65
Product development objectives	65
Timely reviews after each development phase	65
Scheduling	66
Improved up-front planning	67
Reducing Product Engineering Time	67
Tracking Prototypes	69
Specification Writing	70
Process Mapping	71
Conjoint Analysis	71
Helpful Hints	72
Incentives	74
References	74

Chapter 4. Performing Market Research 75

Types of Market Research	75
The Research Process	77
Research Methods	77
Focus groups	77
Sources of new product ideas	79
Mail surveys	79
Telephone surveys	80
Personal interviews	81
Field trials	81
Customer database analysis	81
Market trends analysis	82
Customer satisfaction surveys	82
Questionnaire Design	83
Likert scale	83
Semantic-differential scale	84
Stapel scale	84

Adjective Checklist	84
Rank order comparison	85
Paired comparison	85
Comparative scale	86
Constant sum scale	86
Multiple choice questions	86
Issues to Remember When Developing Questionnaires	87
Other Issues to Consider When Developing Questionnaires	90
Designing the format	90
Determining sample size	92
Auditing the survey	94
Data analysis	94
Research Process	95
Researching the Market Correctly	97
References	99

Chapter 5. Quality Function Deployment 101

Benefits	101
The House of Quality	103
Preliminary Research Required to Perform QFD	108
Project Planning Recommendations	110
The Completed QFD Matrix—Examples	111
References	114

Chapter 6. Failure Mode and Effects Analysis 115

Design FMEA	116
Design Reviews	116
How to Perform a Design FMEA	117
Process FMEA	123
How to Perform a Process FMEA	124

Chapter 7. Reliability Testing and Design Verification 133

Documenting Test Procedures	133
Design Handbooks and Guides	134
Design Verification	136
Weibull Analysis	140
Procedure to perform a Weibull analysis	142
System Reliability	148
Parallel Systems	151
Design Verification Planning and Reporting	151
Planning for Reliability Testing	151
Test Phases	153

Chapter 8. Supplier Strategies 155

Source Selection Criteria	156
Performing Supplier Audits	157
Benefits and liabilities	157
Preparing for the audits	157

Administrative (Financial, Purchasing, Materials Management) Audits	158
Financial concerns	158
Management stability and capability	162
Costing systems and controls	163
Materials management and delivery scheduling systems	165
Purchasing systems and supplier selection strategies	165
Quality Assurance Audit	166
Preventative Planning	166
Administrative management practices	166
Quality Control Procedures	167
Engineering and document control	167
Inspection and measuring equipment	167
Statistical and analytical problem-solving methodology	168
Purchased material controls	168
In-process controls	168
Final product verification	168
Nonconforming product	169
Manufacturing Audits	169
Manufacturing or process engineering	169
Productivity improvements	170
Engineering Audits	170
Design engineering and testing capabilities	170
Research and development on emerging technologies	171
Requesting an Improvement Plan	172
Other Supplier Strategies	172
Hidden costs	172
Recommended contract clauses	174
Early supplier selection	174
Supplier-customer partnership meetings	175
Single sourcing	175
Approved commodity list	176
Supply base commodity review	176
Value improvements for existing products	176
Bibliography	177
Chapter 9. Manufacturing Process Flow and Productivity Analysis	179
Suggestion System Rewarding Efficiency	179
Key Process Efficiency Issues	181
Time Motion Studies	181
Human factors	184
Workplace considerations	186
Time conservation	186
Ergonomic considerations	186
Improving line balance	187
Quick-Changeover Strategies	188
Advanced preparation	189
Setup tasks	189
Setup approval	193
Total Productive Maintenance	195
Machinery Improvement	201
Process Flow Analysis	202

The Lean Production-Demand Flow System	209
Minimize manufacturing cost	209
Eliminate waste	209
Manufactures only to customer demand	210
A flow process	210
A balanced line	211
Quick changeovers	211
Well-trained personnel	212
Highly automated system	212
Inspecting to prevent defects	212
Independent verification of quality	213
The Kanban inventory control method	213
Transforming a plant to a lean production operation	213
Minimizing total process cycle time	215
Minimizing inventory	215
Accounting—applying fixed overhead	216
Prioritizing improvements	217
An atmosphere of problem solving	217
Gradually phasing in a lean production system	218
Hydrogen embrittlement	218
Reviewing lean production—summary	218
Production Capacity Constraint Analysis	219
Applying constraint theory to product development	221
Summing Up the Decision-Making Process	221
Design for Manufacturing—Concurrent Engineering	225
Bibliography	226

Chapter 10. Tooling Issues, Process Verification, and Continuous Improvement Planning 227

Machine Design Considerations	229
Early involvement before designing equipment	229
Packaging design	229
Process Verification	229
Manufacturing Planning and Analysis	231
Assembly Operation Instructions	237
Operator Workstation	241
Continuous Improvement Planning	244
Developing Performance Indicators	246
Internal Machinery Modification Capability	248
Bibliography	248

Chapter 11. Activity-Based Cost Accounting 253

Problems with Traditional Accounting Approaches	253
Accounting Issues to Address	254
Applying Corporate Overhead	255
Activity-Based Cost Accounting and Cost Drivers	256
Considerations When Selecting Cost Drivers	258
Summary	260
Bibliography	260

Chapter 12. Value Analysis	261
Information Gathering	262
Function Analysis and Feature Costing	263
Innovation Phase—Identifying Design Alternatives	264
Prioritizing and Identifying Opportunities	266
Follow-up and Implementation	266
Value Analysis Example: Wine Bottle Opener	268
Summary	270
Bibliography	270
Chapter 13. Marketing Strategies: Advertising, Promotion, and Packaging	271
Product Marketing Plan	271
Situation analysis	271
Marketing challenges	272
Opportunities	272
Sales strategies and objectives	273
Brand and product name	274
Markets and sales estimates	275
Distribution channel	275
Target markets	276
Pricing	278
Competitive comparisons	279
Identifying user habits and needs	279
Identifying the image to project and the product message	280
Advertising, promotion budget, and allocation	281
Advertising to Sell the Product	281
Promotions	282
Package design	285
Selling emphasis	285
Communication and Timing	285
Free Publicity	286
Summary	286
Bibliography	286
Chapter 14. Performing Corrective Action	287
A Seven-Step Corrective Action Process	287
Program Status Reviews	288
Brainstorming	290
Consensus decision making	291
Grouping	292
Cause-and-Effect Diagram	292
The Pareto Chart	294
The Check Sheet	294
Experimental Designs	295
Stratification	296
Scatter Plots	296
Histograms	296

Conducting Meetings	298
Resolving Warranty Issues	301
Continuous Improvement Planning	301
Bibliography	302

Index	303
-------	-----