

TQM 15.760

TOTAL QUALITY MANAGEMENT

FOUR LEVELS OF QUALITY

FOUR THOUGHT REVOLUTIONS

Customers first

Continuous Improvement

Total Participation

Societal Learning

ORGANIZATIONAL MANAGEMENT

Information & Measurement Systems

Education

Incentive Systems

Organizational Change

Four Levels of Quality

1. FITNESS FOR STANDARD

- inspection oriented**
- no consciousness to customer/mkt**

2. FITNESS FOR USE

- Must satisfy customer need for use**
- Hotel shampoo & body oil**

3. FITNESS FOR MARKET

- Must achieve low cost as well as 1 & 2**

4. FITNESS FOR LATENT REQ'TS

- Listening to the voice of the customer**
- V-8 engine, Swatch**
- Uncovering latent req't adds value**
 - ==> need continuous innovation**

TQM: Four Thought Revolutions

1. Customer-First Revolution

From "Product-out (PUSH what you can do)

to

"Market-in" (Learn and develop what the market wants)

PRODUCT DEVELOPMENT LEVERAGE

APPROXIMATELY 75% OF LIFE CYCLE (DESIGN AND MANUFACTURING) COSTS ARE DETERMINED DURING THE PRODUCT DEVELOPMENT PROCESS

See Concurrent Design of Products and Processes
Whitney & Nevins, et al McGraw-Hill 1989

PRODUCT DEVELOPMENT IN THE JAPANESE AUTO INDUSTRY (COMPARED WITH U.S.):

--25% FASTER

--50% FEWER ENGINEERING HOURS

(EUROPEANS ARE FARTHER BEHIND)

see Product Development Performance

Clark, K. & Fujimoto, T.
HBS Press 1991

DEMONSTRATE TO CUSTOMERS:

Quality at the Source

Process Capability

Declining Nonconformities

Declining WIP, LT, Space, Flow Dists

Operators

- cross-trained, doing Prev Maint**

- presenting on SPC, Setup Reduction**

- charting probs, processes/methods**

- trained in JIT/TQC**

Concurrent Design

Competitive Analysis

Flexibility of labor and equipment

Dedicated Capacity

Exact counts in standard containers

2. Continuous Improvement Revolution

Fundamental Concept: PDCA
(Observe, Assess, Design, Intervene)

Quality Control:

Manage known sources of variation
-process control charts
-management by exception
-ROI control

Reactive Quality Management:

Problem solving
-application of SQC tools
(Pareto analysis, process flow chart,
fishbone diagrams, histograms)

Proactive Quality Management:

Finding hidden opportunities

MANAGEMENT BY FACT:

"IN GOD WE TRUST;

ALL OTHERS BRING DATA"

QUALITY DECISION TOOLS AND DATA ANALYSIS

DEMING: SIX SQC TOOLS THAT EVERYONE SHOULD KNOW AND USE

1. Pareto Analysis
2. Process Flow Chart
3. Fishbone (Cause & Effect) Diagrams
4. Histograms
5. Control Charts
6. Scatter Plots

Donald Berwick

"Controlling Variation in Health Care"

Subject: Control & Reduction of Variation

**TQM = customer satisfaction +
 organ. culture (empowerment) +
 continuous improvement**

Concept of variation categorized by

- special causes**
- common causes**

Identify disconnected alarm systems

Beware: local excellence, systemic garbage

Tells what (articulately) but not how

QUALITY INFORMATION SYSTEMS

OBJECTIVE: RAPID FEEDBACK

From Customers: -Field personnel reports
-Customer interviews & surveys

From Competitors/External Studies:
-Benchmarking

In the Production/Delivery System:

Rapid Feedback Systems: Detailed, Comprehensive, Fast

- Who are customers/suppliers?
- Faster flow times==>less tracking
- Tight Feedback Loops

Provide Data on:

- Defects, Downtime, Warranties, Returns
- Inventories, Lead Times, Cycle Times
- Injuries, Absenteeism, Turnover
- Process Capability, Learning Rates
- Vendor Quality
- Quality Costs

Measuring Quality

Customer Satisfaction

Defect Rates

Cost of Poor Quality

Inventory

Productivity

Innovativeness

Complexity

Order Lead Times

Manufacturing Cycle Times

Product Development Cycle Times

Injuries

Machine Downtime

Absenteeism and Turnover

Changeover time improvements

Rate of Product Introduction

Rates of Learning and Process Imp.

Workforce Training and Education

Workforce Suggestions

Teamwork, Morale, Pride

Vendor Cooperation

WE HAVE TOOLS FOR TWO TYPES OF DATA:

1. NUMERICAL DATA

- HISTOGRAMS***
- PARETO DIAGRAMS***
- CONTROL CHARTS***
- SCATTER PLOTS***
- PROCESS CAPABILITY***

2. LANGUAGE DATA

- CAUSE & EFFECT DIAGRAMS***
- KJ (or "LP" PROCESS*
(AFFINITY DIAGRAMS)**

**MANY OF THE LANGUAGE DATA TOOLS
ARE NOT WIDELY TAUGHT IN THE WEST.**

Quality Economics

- Macro: International Competitiveness**
- Micro: Quality/Productivity Relation
(Economics of DIRTFT)**
- Cost of Quality:**
 - Careful Analysis and Accounting**
 - Failure Costs**
 - Appraisal Costs**
 - Prevention Investments**
 - Revenue effects of quality**

Contributions of Taguchi

- Quality Loss Function**
- Two-step process for parameter optimization
(control variance and mean)**
- Orthogonal Arrays for experimental design**

3. Total Participation Revolution

- Total Involvement of CEO (Leadership)**
- Quality Specialist ----> All Employees**
- Build Infrastructure: goals, training, promotion, feedback, diagnosis, etc.**

Customer-driven Requirements

Suppliers (Vendor Management)

Company-wide Involvement

- Manufacturing**
- Marketing**
- Engineering (Design of Products, Processes, Systems)**
- Purchasing**
- Quality Assurance**
- Workforce Participation**
- Distribution and Field Service**
- Personnel**

EMPLOYEE INVOLVEMENT

"IF A FIRM THAT UTILIZES THE MINDS OF ONLY 50% OF ITS EMPLOYEES COMPETES WITH A FIRM THAT UTILIZES THE MINDS OF 100% OF ITS EMPLOYEES, WHICH DO YOU THINK WILL PREVAIL?"

EI OBJECTIVES:

**EMPLOYEE INITIATIVE
OWNERSHIP
ENTHUSIASM
LOYALTY**

EI METHODS:

**STRONG LEADERSHIP
TEAMWORK PROGRAMS
RECOGNITION AND REWARDS
INDIVIDUAL RESPONSIBILITY
TRAINING AND TOOLS
INCENTIVES**

PRINCIPLES OF LEADERSHIP

1. LEADERS LEAD BY EXAMPLE

- LEADERS MUST BE ROLE MODELS**
- LIVE YOUR LIFE AS A LEADER**

2. LEADERS LEAD BY THEIR COMMITMENT

- STATE CLEARLY YOUR COMMITMENTS**
- DEMONSTRATE YOUR COMMITMENT**
- HONOR YOUR COMMITMENTS**

3. SET STANDARDS FOR

- DISCIPLINE**
- ETHICS**
- ENTHUSIASM**

4. MAKE EACH EMPLOYEE FEEL THAT HE/SHE MATTERS

5. CELEBRATE/RECOGNIZE ACHIEVEMENTS

6. BE A GOOD LISTENER

7. BE CONSISTENT AND PREDICTABLE

CONTINUOUS TRAINING AND EDUCATION

- General Quality Concepts**
- Statistical Quality Control**
- Cost of Quality**
- Problem Solving**
- Decision Making**
- Teamwork**
- Experimental Design**
- Parameter Optimization**
- Customer/Supplier Analysis**
- Design for Manufacturability**

WHO GETS WHAT TRAINING?

WHO DOES THE TRAINING?

WHO DESIGNS THE CURRICULUM?

MOTIVATION FOR LEARNING

TQM GOAL:

HABITUAL, CONTINUOUS IMPROVEMENT IN PURSUIT OF PERFECT PRODUCTION

- Zero Defects**
- Zero Inventories**
- Zero Lead Times & Cycle Times**
- Zero Injuries**
- Zero Machine Downtime**
- Zero Customer Returns**
- Zero Warranty Costs**
- Zero Absenteeism**
- Process Capability > 2 and incr.**
- Rapid Product Introduction**
- Rapid Learning**
- Teamwork**
- High Morale**
- Pride**

4. Societal Learning Revolution

**Success stories need wide diffusion
(Baldrige, Deming Awards)**

In Japan: progression through

- Process industries**
- Mass Production**
- Small Volume Manufacturing**
- Construction**
- Services**

Role of outside change agents

- Deming, Juran, Shiba**

Role of University/Industry Consortia

- MIT: Center for Quality Management
Leaders for Manufacturing**

Baldrige Quality Award

Categories for Scoring

- 1. Leadership--symbolism & involvement**
- 2. Info systems/analysis--internal, benchmk**
- 3. Strategic Quality Planning**
Plans and Goals that are
concrete, focused, integrated, aggressive
- 4. Human Resource Utilization**
-empowerment, teamwork, skills
- 5. Quality Assurance of Pdts & Services**
-process quality drives product quality
- 6. Quality Results**
-data on quality and defects, etc.
- 7. Customer Satisfaction**
-systems and results

Award's Merits

stimulate debate
raise consciousness
decathalon: composite

Award's Demerits

ignores finan. perf.
downplays product qua.
self-nominating
no definition of quality
examiners also consult
aims too low
thermometer
 -not instructive
philosophically agnostic
not focused on
 world-class
too process oriented
bureaucratic

Baldrige Quality Award

Criticisms

- 1. requires large expenditures**
- 2. fails to predict financial performance**
- 3. not focused on superior product or service quality**

Judging

- 1. Deployment** - horizontal and vertical
- 2. Integration** - alignment, communication
 - speed

Legacy

Spirit of Cooperation

IMPLEMENTATION OF TQM

-Major Cultural Transition

(Trust as the lubricant)

-Education and Training are Critical

-Tailor the process to the specific firm

-Quality Improvement Teams

(Harnessing the Collective Genius)

Top Management Leadership:

-Importance of Quality

-Goals and Objectives

-Commitment to these Goals

-Responsibility for these Goals

DEMING'S FOURTEEN POINTS

- 1. Create constancy of purpose for improvement of product and service.**
- 2. Adopt the new philosophy -- poor quality cannot be tolerated.**
- 3. Cease dependence on inspection to achieve quality.**
- 4. End the practice of awarding contracts on the price tag alone; work with a single supplier.**
- 5. Improve constantly and forever every process for planning, production, and service.**
- 6. Institute training on the job.**
- 7. Adopt and institute leadership.**
- 8. Drive out fear.**
- 9. Break down barriers among staff areas.**
- 10. Eliminate slogans, exhortations , and targets for workers.**
- 11. Eliminate numerical quotas for the workforce and numerical goals for management.**
- 12. Remove barriers that rob people of their pride of workmanship. Eliminate the annual rating or merit system.**
- 13. Institute a vigorous program of education and self-improvement for everyone.**
- 14. Put everybody in the company to work to accomplish the transformation.**

Some Words from Dr. W. Edwards Deming

“The prevailing system of management has destroyed our people. People are born with intrinsic motivation, self-esteem, dignity, curiosity to learn, joy in learning. The forces of destruction begins with toddlers--a prize for the best Halloween costume, grades in school, gold stars--and on up through the university. On the job, people, teams, divisions are ranked--reward for the one at the top, punishment for the one at the bottom.”

-Top Management Leadership

- Habitual Continuous Improvement**
- Rapid Feedback Systems
(Who are customers/suppliers?)**
- Data-Driven Decision Support Tools
(Statistical Quality Control,
Cost of Quality, Taguchi Methods)**
- Continuous training and education**
- Company-wide participation**
- Supply-Chain Management**
- TQM Implementation**
- Employee Involvement**

Peter Senge

***"Building Learning Organizations:
The Real Message of the Quality Movement"***

First Wave of Quality:

- champion continuous improvement**
- remove impediments that disempower people**
- support new practices**

Second Wave of Quality:

Improve Management Processes

The industrial engineering of management work

Third Wave of Quality

- institutionalize learning w/5 disciplines:**

Shared Vision

Personal Mastery

Mental Models

Team Learning

Systems Modeling

Intrinsic vs. Extrinsic motivation

Schaffer and Thompson

Successful Change Programs Begin with Results

The Activity-Centered Fallacy:

- 1. Not keyed to specific results**
- 2. Too large-scale and diffused**
- 3. Results is a four-letter word
(avoid appearance of short-termism)**
- 4. Delusional Measurements**
- 5. Staff and Consultant Driven**
- 6. Bias to orthodoxy, not empiricism**

Results Driven

- 1. Introduce Managerial and Process innovations only as needed**
- 2. Empirical testing reveals what works**
- 3. Frequent reinforcement energizes**
- 4. Use lessons of each phase to design next phase (i.e., continuous process)**

How to get started

- 1. Create the context and
Identify the crucial business challenges**
- 2. Ask each unit for a few ambitious short-term goals**
- 3. Monitor progress, capture the essential learning, reformulate strategy**

Institutionalize only what works

FALSE STARTS & FAILURE MODES IN TQM PROGRAMS

- 1. TRAINING CAPACITY**
- 2. RESISTANCE TO CHANGE**
- 3. FEAR OF FIRING**
- 4. CAPITAL CRUNCH**
- 5. WORK OVERLOAD**
- 6. SATISFIED CUSTOMERS**
- 7. COST OF QUALITY**
- 8. LOVED TO DEATH (institutionalized)**

JUST-IN-TIME PRODUCTION

OBJECTIVE:

- Constant Improvement of the Production/Delivery System, as measured by Quality, Cost, Lead Times, Service, Flexibility

METHOD:

- Simplify the Production System
- Rapid Feedback on Problems Thru Tightly Integrated Production
- Pull System for Inventory Control
- Exploratory Stress to Drive Improvement
- Effective Management of Capital Equipment

SIMPLIFY THE PRODUCTION SYSTEM

Fewer Suppliers

Reduced Parts Counts

Focused Factories

Scheduling by rate, not lots

Fewer storage containers

More Frequent Deliveries

Smaller Plants

Shorter Distances

Less Reporting

Fewer Inspectors

Less Buffer Stock

Fewer Job Classifications

RAPID FEEDBACK

"A DEFECT IS A TREASURE"

ACTION STEPS:

- 1. REMOVE FEEDBACK DELAYS
--ESPECIALLY WIP INVENTORIES**
- 2. LINE WORKERS STOP PRODUCTION
WHEN PROBLEMS ARISE**

BENEFITS:

INSTANT FEEDBACK TO PROBLEM SOURCE

JOB ENRICHMENT

-UTILIZE MENTAL POWERS

INCENTIVES TO AVOID DEFECTS

-CAUSE IS EASILY TRACEABLE

PULL SYSTEM FOR PRODUCTION AND INVENTORY CONTROL

PRODUCE EXACTLY

- WHAT IS NEEDED**
- WHEN IT IS NEEDED**

**KANBAN OR CARD CONTROL REPLACES
COSTLY COMPUTERIZED PLANNING
AND TRACKING SYSTEM**

**PROBLEMS ARE QUICKLY FELT
THROUGHOUT THE SYSTEM**

ELIMINATES JUST-IN-CASE INVENTORIES

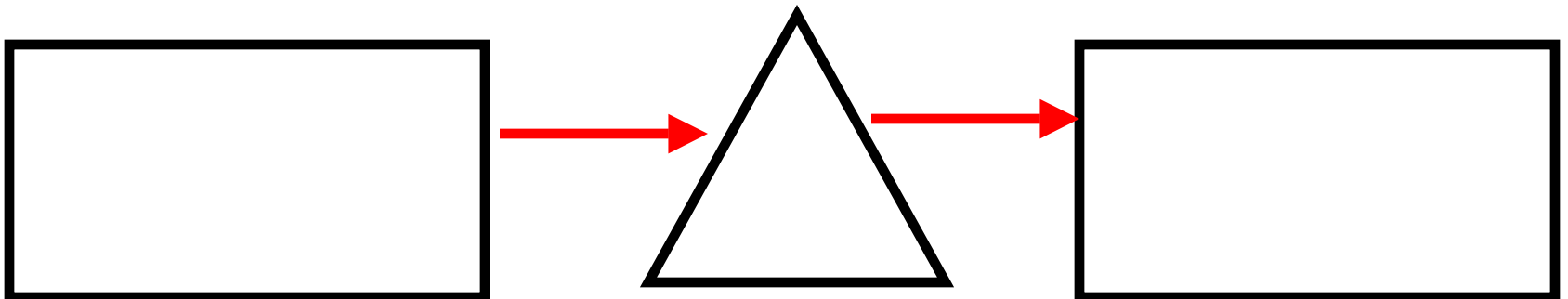
REQUIRES

- FLEXIBILITY**
- FAST CHANGEOVERS**
- SMALL LOT SIZES**

**EXPLORATORY STRESS TO DRIVE IMPROVEMENT
TO EXPOSE PROBLEMS**

**REDUCE BUFFERS
REDUCE CYCLE TIME TARGETS
REDUCE LABOR ALLOCATIONS**

**PROBLEM EXPOSURE DRIVES EMPLOYEES TO WORK ON
SETUP REDUCTION
VARIABILITY REDUCTION
CYCLE TIME REDUCTION**



MANAGING CAPITAL EQUIPMENT

TOTAL PREVENTIVE MAINTENANCE

- ASSURES BETTER UPTIME RELIABILITY**
- OFTEN PROVIDES MORE TOTAL UPTIME**
- OPERATORS PERFORM REGULAR MAINT.**

PRE-AUTOMATION

- PRODUCT DESIGN FOR ASSEMBLY**
 - REDUCE PARTS COUNT**
 - UTILIZE MODULARITY**
 - SET SPECIFICATIONS EFFICIENTLY**
 - Know cust. needs and mfg capability**
- PROCESS DESIGN FOR ASSEMBLY**
 - REDUCE FLOW DISTANCES**
 - UTILIZE FAIL-SAFE DEVICES**
 - LOCATE TOOLS CONVENIENTLY**
 - STREAMLINE BEFORE AUTOMATING**

ADD CAPITAL INCREMENTALLY

- SEVERAL SMALL MACHINES MORE FLEXIBLE**
 - MATCH SUPPLY WITH DEMAND**
 - LESS CYCLE INVENTORY NEEDED**
 - MOVABILITY PERMITS DEDICATED CELLS**

JIT IMPLEMENTATION ISSUES

- 1. INVENTORY AS A SECURITY BLANKET**
 - 2. REDUCE INVENTORY CARRYING COSTS**
- VS.**

REDUCE SOURCES OF VARIABILITY

3. SUPPLIER MANAGEMENT

- BULLYING VS. COOPERATION**
- HOW TO SHARE THE PAINS & GAINS**
- GET OWN HOUSE IN ORDER FIRST?**

4. PHYSICAL DISTANCES

- BETWEEN PLANTS**
- BETWEEN WORKSTATIONS**

5. COOPERATIVE EFFORTS AMONG

- MANUFACTURING**
- MARKETING**
- PURCHASING**
- ENGINEERING**

6. PATIENCE