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DEPARTMENT OF DEFENSE

REVISION 8 - 18 April 1990



DRAFT

AD-A225 212

TOTAL QUALITY
MANAGEMENT
(TQM)
Awareness Seminar

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THE OFFICE OF
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BOOZ • ALLEN & HAMILTON INC.
4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814

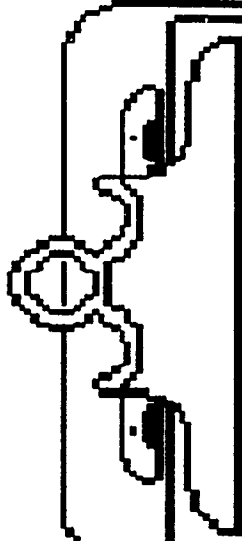
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TQM Seminar Agenda

8:30 - 8:45	Opening Remarks
8:45 - 10:00	Module 1 - Challenge of the Global Economy
10:00-10:15	<i>Break</i>
10:15 - 12:00	Module 2 - Evolution of TQM
12:00 - 1:00	<i>Working Lunch (Provided at hotel)</i> <i>Guest Speaker</i>
1:00 - 4:00	Module 2 (cont'd)
4:00 - 4:30	Participant Assignment

8:30 - 10:00	Participant Exercise
10:00-10:15	<i>Break</i>
10:15 - 12:00	Module 3 - TQM Principles
12:00 - 1:30	<i>Working Lunch (Provided at hotel)</i> <i>Video Tape Presentation</i>
1:30 - 3:00	Module 3 (cont'd)
3:00 - 3:15	<i>Break</i>
3:15 - 4:30	Module 4 - Summary Exercise

Course Objectives



Upon completion of this course, the participants will be able to:

- Identify TQM as the vehicle for building and sustaining a culture committed to continuous improvement and for guiding the Department of Defense into the future.
- Demonstrate an understanding of quality concepts.
- Explain how TQM is different from current management methodologies.
- Recognize the need for additional TQM training and identify potential sources for TQM training.

Total Quality Management

TOTAL QUALITY MANAGEMENT (TQM) AWARENESS SEMINAR

- I. INTRODUCING THE NEED: CHALLENGE OF THE GLOBAL ECONOMY
 - The U.S., the Department of Defense, and the Global Marketplace
 - Benefits of Quality Management
 - DOD Path to Total Quality Management
- II. UNDERSTANDING TOTAL QUALITY MANAGEMENT: THE TQM IMPERATIVE
 - *Exercise:* Bead Box
 - History of Quality
 - Quality Authorities
 - Elements of Quality Management
 - Process Management
- III. UNLEASHING OUR CAPABILITIES: CHANGING THE WAY WE WORK
 - Cultural Change
 - Skill for Continuous Improvement
 - *Exercise:* Interpreting Control Charts
 - DOD TQM Implementation Plan
 - Roles and Responsibilities
 - Productivity Improvement Initiatives
- IV. CREATING THE FUTURE: THE NEW WORK CHALLENGE IN TQM
 - DOD TQM Guiding Principles
 - Course Summary
 - Course/Instructor Evaluations

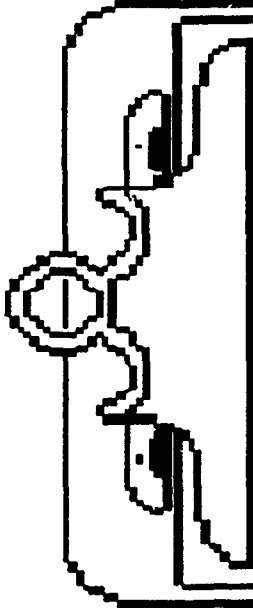
GLOSSARY:

APPENDICES:

- A. Success Stories
- B. Supporting DOD's Total Quality Management Effort -- Major Initiatives
- C. Readings
 - Consultant Advice to Senior U.S. Executives
 - Bibliography and Other Resources

MODULE ONE

INTRODUCING THE NEED:
CHALLENGE OF THE GLOBAL ECONOMY

Module 1 Objectives

Upon completion of this module, the participants will be able to:

- Recognize the Department of Defense's need to focus on creating a quality culture.
- Identify "Quality Management" as a management philosophy that will improve the effectiveness of the Department of Defense.
- Understand the need for a total quality commitment from every individual in DOD management.

Introducing the Need: Challenge of the Global Economy

For almost 20 years the United States had minimal competition in the world market; there was little reason to focus on innovation, quality and productivity. Now we are involved in a survival struggle to effectively compete in the global marketplace.

This module describes the position of the United States in the global marketplace, the reasons why various countries are thriving in today's global economy, and the Department of Defense's rationale for adopting Total Quality Management (TQM).

The U.S. and the Global Marketplace

Module 1

- The U.S., the Department of Defense, and the Global Marketplace
- Benefits of Quality Management
- DOD Path to Total Quality Management

Introducing the Need: Challenge of the Global Economy

The U.S. and the Global Marketplace

GLOBALIZATION

A REALITY WHICH STRATEGIC THINKERS ARE NOT IGNORING

- A new economic order is underway.
- Balances of power are shifting.
- What you don't know can hurt you.
E.g., the real rate of obsolescence in equipment and methods has national consequences.

Introducing the Need: Challenge of the Global Economy

GLOBALIZATION

- A pervasive reality.
- Related to brave new economics.
- Challenges nationalistic-based industrial assumptions.
- Promises 5, not 2 superpowers -- only 4 of them being sovereign states.
 - United States -- Japan
 - Soviet Union -- EEC Europe
 - China

(continued)

The U.S. and the Global Marketplace

1999 A.D.

- **EEC Europe** will demand U.S. build its factories in Europe.
- **Super Powers'** economic strength will decline. *
- **Japan** will increase its defense role.
- **China** will be 10 years from a larger economy than both Japan and Russia.

* *Quality-focused management can stem the decline.*

Introducing the Need: Challenge of the Global Economy

FACT: Russia and U.S. are limiting military efforts because of their economies.

FACT: Asian Rim countries are ascending.

FACT: By 2010, China's Eastern Seaboard will be a huge market, manufacturing and banking power.

FACT: Productivity directly affects military power.

References:

Johnson, Paul, "The Next 10 Years," OUTLOOK XIII, Booz•Allen & Hamilton Inc., 1989.

Kennedy, op. cit.

What are the Problems?

- Too much attention on invention.
- Not enough attention on continuous process innovation.
- Fault-finding misdirected to off-shore competition.

Example: Foreign companies have cheap labor.

Fact: Half of the trade deficit comes from foreign industries that pay workers higher wages than U.S. workers receive.

Introducing the Need: Challenge of the Global Economy

- Rustum Roy, director of Science, Technology and Society Programs at Pennsylvania State University, "The more inventive ideas the U.S. dreams up, the farther it will fall behind. Each invention will be just another opportunity for a foreign rival to out innovate the U.S. Company in producing it."
- Arden Bement, TRW Inc.'s Vice President of technical resources.
"The United States puts twice the resources into product innovation as we do into process innovation."
- Our competitors don't beat us with cheap labor, they beat us with **skilled** labor.

Problems (continued)

- Trade Deficit.
 - From positive trade balance in 1980 to \$154 billion deficit in 1989.
 - Projected deficit in 1995 - \$111 billion.
- Foreign Competition.
 - Getting stronger.
 - European Economic Community 1992.
 - Pacific Rim Nations.

Introducing the Need: Challenge of the Global Economy

- U.S. consumed roughly \$1 trillion in manufactured goods in 1987.
- U.S. exported only \$57 billion in services in 1987.
- If U.S. could cut its manufacturing import in half - \$500 billion, service industry would have to increase 10 fold in order to offset. Not likely.
- U.S. has to export manufactured goods.
 - Exporting requires quality products!

References:

Tribus, Myron, "Deming's Way," MIT Center for Advance Engineering Study.

Miller, Rober LeRoy, "Economics Today, the Macro View", Harper & Row, Publishers, Inc., 1982, p. 362.

The U.S. and the Global Marketplace

	1960		1987	
	GNP*	% OF WORLD GNP	GNP*	% OF WORLD GNP
UNITED STATES	1881.6	30.35	4436.1	25.94
JAPAN	291.4	4.7	1607.7	9.4

*GNP is expressed in 1987, U.S. dollars and represents billions of dollars.

Introducing the Need: Challenge of the Global Economy

- Total World GNP for 1960 (represented in 1987 U.S. dollars) was \$6,200,000,000 and in 1987 was \$17,100,000,000.
- The United States in 1960 contributed to approximately 1/3 of the world's total GNP. By 1987, the United States' contribution dropped to 1/4 of the world's total GNP.
- Japan contributed to less than 1/20 of the total world's GNP in 1960, yet in 1987, supplied 1/10 of the world's market with goods and services.
- Japan has improved their ability to compete by creating quality products at affordable prices.

Reference: *Handbook of Economic Statistics - 1988, CIA*

Per Capita Growth Rates -- Various Countries

<i>Country</i>	<i>Average Annual Rate of Growth of Income per Capita (1929-1980)</i>	<i>Real GNP Doubling Time</i>
United States	1.9 percent	38 years
Canada	2.1	34
West Germany	3.0	24
Japan	4.9	15

- Our decline in economic position today will be compounded in the future.
- The US-cannot afford to be a second-rate power – our preparedness cannot be undercut by a lack of quality.

Introducing the Need: Challenge of the Global Economy

- This chart shows the average annual growth rate of real GNP per capita for various countries.
- The difference between growth rates for the various countries is not great, generally varying by only 1 to 3 points. Let's start with \$1 trillion per year in GNP. In 50 years, \$1 trillion becomes \$4.38 trillion per year if compounded at 3% growth rate per year. With an increase of only 1 additional percentage point (4% growth rate), \$1 trillion becomes \$7.11 trillion--which is almost double the 3% amount.
- The doubling time gives you the number of years it takes for real GNP to double for various countries. For example, it will take the United States 38 years to double real GNP and only 15 years for Japan to double their annual GNP.
- The impact of the decline in per capita growth rates and GNP will be:
 - A decline in buying power
 - Decreased standard of living.

Winning Possibilities

United States:

- 1.5 million companies (no other nation comes close).
- 5.5 million scientists and engineers.
 - More Nobel Prize winners
 - Graduate schools are envy of world
- Spends twice dollars on Research & Development than Japan and Germany combined.

Conclusion: United States should be *unbeatable!*

Introducing the Need: Challenge of the Global Economy

- Students from around the world come to the United States for the best training in advanced science, mathematics and engineering.
- The United States remains the leader in ideas and technology.

Reference:

Business Week #14, Innovation.

Challenge: Self Renewal

"The biggest problems that any company in the Western world faces are not its competitors, nor the Japanese. The biggest problems are self-inflicted, created right at home by managements that are off course in the competitive world of today."

- Dr. W. Edwards Deming

Introducing the Need: Challenge of the Global Economy

- International experts working with American industries have a consistent message:

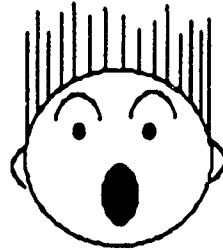
The United States is in a **survival** struggle defined by the ability to produce consistent, uniform, high-quality products and services.
- The traditional management styles, emphasizing rate-of-production at all costs (the bottom line), are not working.

"Most American managers today tend to take the system given and try to get the most out of it as is. Thus, they believe the problems of the factory are to be found in better understanding of morale, the work ethic, work standards, job definitions, more communications, slogans, exhortation, personnel selection, better record keeping, better union bargaining, and so on. They equate increased productivity only with increased capital spending (e.g., on automation) and have an easy out in blaming the tax laws, interest rates, and labor rates."

-- Deming's Way

Personal Experiences of Non-Quality

**DO YOU HAVE ANY
QUALITY HORROR
STORIES??**



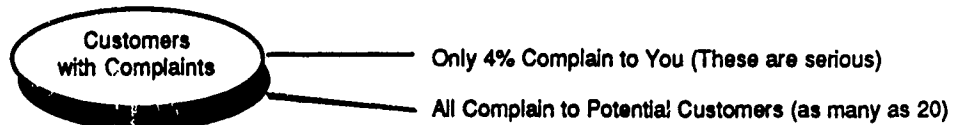
Quality horror stories involve the lack of quality in goods or services you have experienced

Introducing the Need: Challenge of the Global Economy

- In many cases, quality problems are often associated with:
 - Not understanding how complex the system really is.
 - Not understanding what the customer really wants.
 - Making the customer "pay" for poor quality.
 - Not maintaining timeliness of services.
 - Promising what can not be delivered consistently.
 - Not being able to make improvements "permanent".
 - Not being responsive to quality problems brought to light.
- Often the customer is experiencing a delivery system that is not designed and managed for quality -- but for profit or efficiency.
 - The system's logic does not reflect the customer's need.

Paradox: You Can Make Great Progress Seeking Complaints

UNDERSTANDING THE SIGNIFICANCE OF COMPLAINTS



Introducing the Need: Challenge of the Global Economy

- People with no customer contact:
 - Get preoccupied with internal concerns.
 - Often make policy or design procedures that miss customer needs.
 - Confuse system routines with essential customer mission activities.
- Have to be proactive, "by - exception" management doesn't work!

References:

Shostack, G., "Designing Services that Deliver", Harvard Business Review, Jan., 1984, p. 135.

Albrecht, Karl and Zemke, Ron, Service America: Doing Business in the New Economy, Homewood, IL, 1985, p. 6.

Success in the Global Marketplace



- Successful organizations have recognized a different way to manage.
- They developed this capability by cultivating **a total commitment to quality** that yields:
 - Greater productivity
 - Higher quality products
 - More jobs
 - Better return on investment.
- This quality approach is affecting the ability of the U.S. to effectively compete.

Introducing the Need: Challenge of the Global Economy

- The successful countries developed this capability by cultivating **a total commitment to quality** -- in every phase of their production systems. Quality is defined as meeting the customer's needs with highly uniform and superior products or services.
- One reason for the success of West Germany and Japan and other countries is that corporate managers have realized that there is a different way to manage their organization that produces quality results.
- For some industries, the decision to pursue a quality approach to business is a survival decision.

Reference:

Modic, Stanley J. "What Makes Deming Run?" Industry Week, June 20, 1988, page 2.

The U.S. and the Global Marketplace

D O D
What is at Stake?

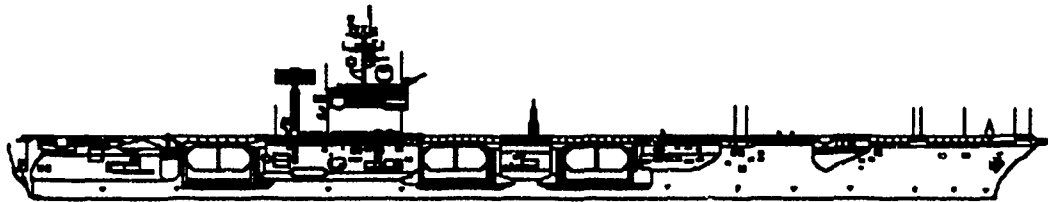
- Quality is the key to industrial-base survival (not just superiority).
 - Budget ceilings require tremendous cost reductions.
 - Quality-focused management consistently reduces costs.
 - DOD is directly linked to the industrial base -- its real strength.
 - Economic power maintains political and defense base.

Introducing the Need: Challenge of the Global Economy

- **Poor Quality Processes and Products Affect:**
 - Military capabilities, tactics, options.
 - Capacity to use innovations effectively or in a timely fashion.
 - Role and Relationship of allies (especially NATO).
- Productivity has direct military consequences.
- Economic power is the basis for national power.

The Department of Defense in the Global Marketplace

- The federal government is a major user of 215 U.S.-based product and service industries.
- The Department of Defense purchases approximately \$100 billion worth of goods and services from the global marketplace each year.
- These industries affect the quality of our defense systems and their support and maintenance.

**Introducing the Need: Challenge of the Global Economy**

- The Defense Department purchases approximately \$100 billion worth of goods and services from the global marketplace each year.
 - In some areas, such as Navy Industrial Facilities, the federal sector is in direct competition with the commercial marketplace.
- These industries, employed to support the Department of Defense, affect the quality of our defense systems and their support and maintenance.
- A study conducted by the Institute for Defense Analysis (IDA) estimates that 25%-40% of the operating budget is spent on rework, repair and repurchasing of goods and services -- 25-40 billion dollars spent on non-quality-related issues.

(continued)

Introducing the Need: Challenge of the Global Economy

- Quality improvements will result in less dollars spent on repairing or replacing flawed products, and will enable the Department of Defense to budget their dollars more effectively and efficiently.
- Quality improvement also applies to Human Resources -- our people. Emphasis on better training and education. Broadening skill base for increased flexibility as well as higher levels of participation in the quality improvement process.

Reference:

Riddel, F.R., Richanbach, P.H. (Eds.), "Report of the DOD Task Force on Productivity in the Support of Operations, Vol. II: Working Group Report.", [IDA Report R-305], July, 1986. Institute for Defense Analysis, Alexandria, VA.

Office of the Secretary of Defense (OSD)**Functions**

- Leadership
- Thinking
- Policy and Strategy
- Administering

Products

- Policy Papers
- Directives
- Programs
- Budget Justifications
- Organizational Changes

Introducing the Need: Challenge of the Global Economy

- "The Office of the Secretary of Defense (OSD) is the principal staff of the Secretary in the exercise of policy development, planning, resource management, fiscal and program evaluation responsibilities."
- OSD is chartered to:
 - Conduct analyses, develop policies, make recommendations and issue guidance (Thinking).
 - Initiate programs, actions, and tasking (Leadership).
 - Provide the focal point for departmental participation in the United States security community and other Government activities (Policy and Strategy).

Department of Defense's Commitment to TQM



- Executive Order 12637, Productivity Improvements Program for the Federal Government, April 1988.
- OMB Circular A-132, Federal Productivity and Quality Improvement, April 1988.
- DOD 5000.516, Total Quality Management Guide, Draft, August 1, 1989.
- Total Quality Management Master Plan, August 1989.

Education and Training for Total Quality Management in the DOD, July 1989.

Introducing the Need: Challenge of the Global Economy

- Excellent guidance documents.
- Emphasis on long-term efforts.
- Commitment to cultural change and training.

Department of the Defense's Commitment to TQM

Total Quality Management (TQM)

Total Quality Management (TQM) is both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. TQM is the application of quantitative methods and human resources to improve the material and services supplied to an organization, and the degree to which the needs of the customer are met, now and in the future. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach focused on continuous improvement.

Introducing the Need: Challenge of the Global Economy

Reference:

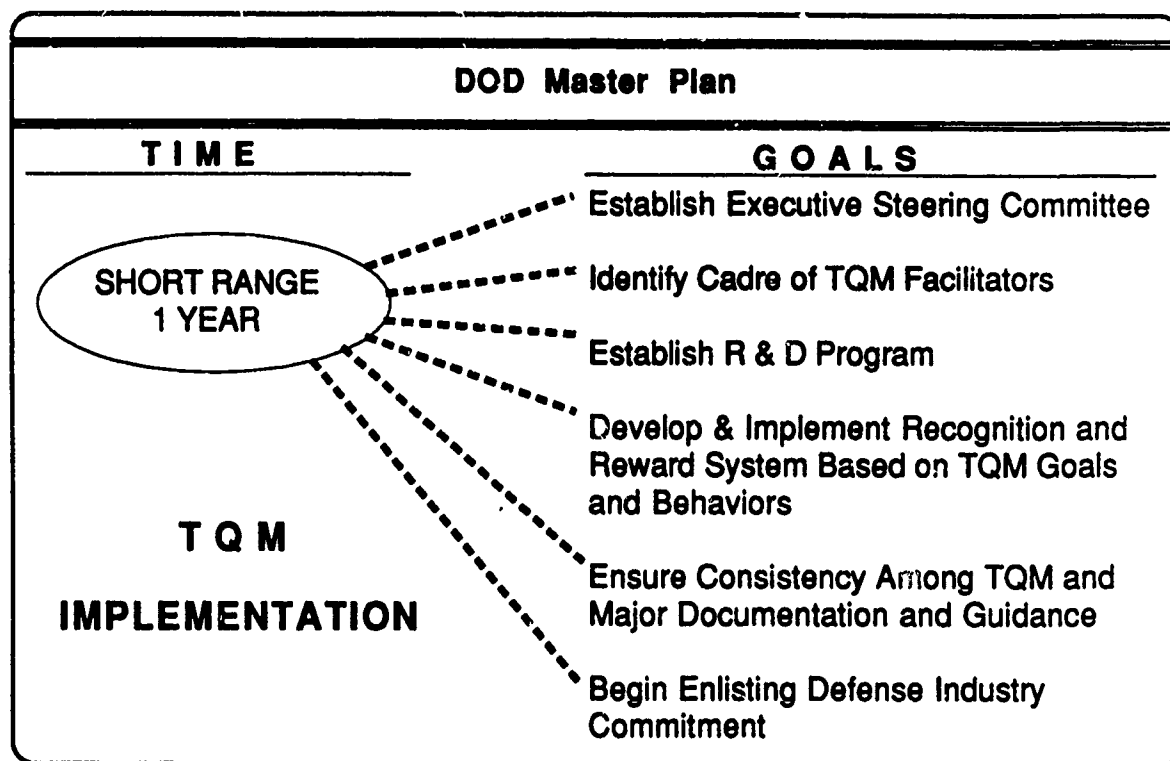
DOD 5000.51G (Draft), Total Quality Management Guide, August 1, 1989.

Deputy Secretary of Defense Donald P. Atwood

"Total Quality Management is the key phrase . . . I want you to know that Dick Cheney (Secretary of Defense) supports that, I support it, I know John Betti (Under Secretary of Defense - Acquisition) supports it, and I hope everybody in this department gets behind it . . ."

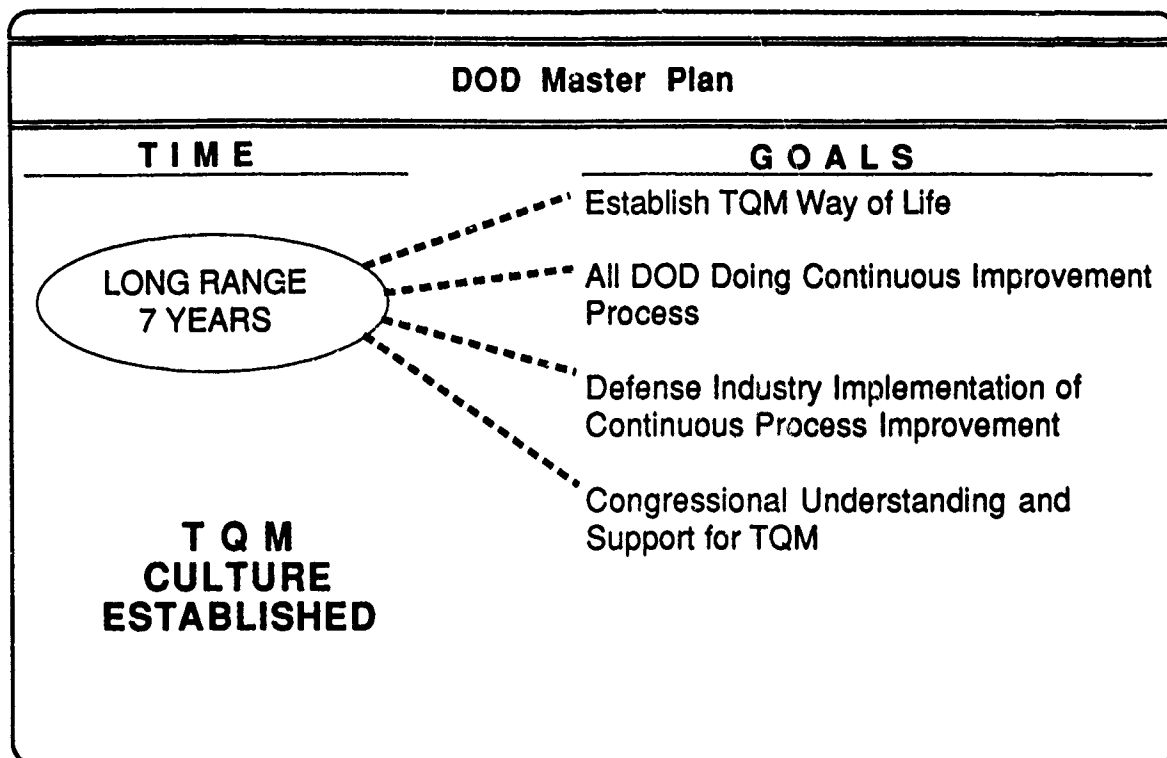
25 August 1989

Introducing the Need: Challenge of the Global Economy



Introducing the Need: Challenge of the Global Economy

- Executive Steering Committee will involve top leadership.
- Establish a core of trained facilitators to guide TQM implementation.
- Training strategy identified. Action on-going to identify training needs and develop training courses.
- Capture and publish lessons learned. Conduct research to investigate the growing TQM technology, techniques, and tools.
- Recognition and reward program will consider current performance incentives and how those incentives may affect TQM implementation. From this baseline, recognition and reward strategies will be developed to encourage TQM evolution.
- Reconcile policy documents, regulations, and other guidance documents to be consistent with TQM.
- Focus on internal TQM and encourage industry to do same.



Introducing the Need: Challenge of the Global Economy

- As a way of life, TQM label will fade because continuous improvement principles and practices become normal way of business.
- Industry will adopt continuous improvement process, resulting in stronger industrial base and reduced cost of weapons systems.
- Congressional support will have been earned by the benefits of TQM process improvement.

TQM Benefits

COUNTRY

- Regain position as a leader in the global marketplace

DEPARTMENT OF DEFENSE

- Use dollars more effectively and efficiently
- Improve capability to meet mission requirements

INDIVIDUAL

- Increase employee involvement
- Improve standard of living

Introducing the Need: Challenge of the Global Economy

- The increased emphasis on the customer and on continuous improvement provides the pathway for greater productivity and will improve the United States' market posture.
- TQM will enable the Department of Defense to acquire more hardware, improve the force structure, and meet more mission requirements by achieving unprecedented levels of quality required for future weapon systems and equipment, with the same operating budget.
- At the individual level, TQM will help increase job satisfaction because TQM provides the opportunity to remove barriers to effective management and to increase pride of workmanship. Employees are given the opportunity and resources to do a good job, and make a difference!

The Importance of the Customer

CUSTOMER-CENTERED BUSINESS

Key to survival in new economics

CUSTOMER FOCUS REDUCES WASTED EFFORTS

- Establishes external success criteria.
- Gives common purpose and priority to different functions.
- Reveals functions needing better customer orientation.
- Breaks internally-preoccupied mind sets.
- Creates motivators in workforce.

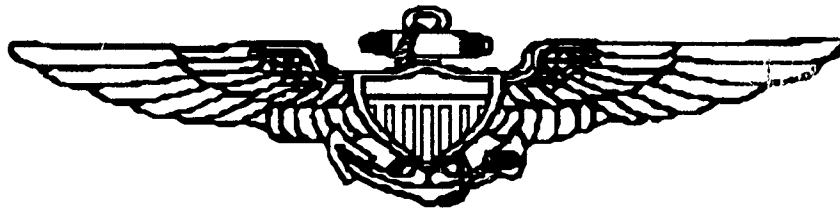
Introducing the Need: Challenge of the Global Economy

- A customer can be internal or external.
- Customer points of contact "define" the entire system, for good or ill.
 - People
 - Materials
 - Data
 - Services
- Most people perceive that the **Boss** is the customer.
- Naming the customer requires deciding who the preferred customer really is.
- Naming the customer is naming who defines your success.

Quality Efforts in the Federal Sector

**The Presidential Award for
Quality and Productivity Improvement**

Recipient:
NAVAL AIR SYSTEMS COMMAND



Introducing the Need: Challenge of the Global Economy

- The Presidential Award is for major organizations or departments.
- Competition for the Award involves quality commitment and effort in nine areas:
 - Leadership for Quality
 - Measurement and Analysis Efforts
 - Goals and Plans
 - Employee Involvement
 - Training
 - Rewards
 - Quality Assurance of Products and Services
 - Quality and Productivity Improvement Results

Quality Efforts in the Federal Sector

The President's
Quality Improvement Prototype Designation

For federal organizations achieving:

- High standards of quality
- Efficiency of operations
- Lowered costs of operations
- Satisfied customer agencies or organizations

Introducing the Need: Challenge of the Global Economy

- QIPs are intended to be **models** for federal organizations.
- QIPs usually **adopt new approaches** to managing quality.
- QIPs usually **faced threats to their existence** -- challenges to the assumption that federal agencies do not have to be competitive.
- QIPs do not necessarily have mature TQM programs -- some are not 100% implemented.
- QIPs use more than 1 approach to achieve their initial quality objectives.

Quality Improvements to the Federal Sector

**1989 QUALITY IMPROVEMENT
PROTOTYPE DESIGNEES:**

Fresno Service Center, IRS, Fresno, CA
Naval Aviation Depot, Cherry Point, NC
Naval Publications and Forms Center, Philadelphia, PA
Internal Revenue Service -- Ogden, UT
Norfolk Naval Shipyard, Norfolk, VA
Department of Veteran Affairs Medical Center, Kansas City, MO
NASA Lewis Research Center, Cleveland, OH

Introducing the Need: Challenge of the Global Economy

- Some issues originally challenging the QIP Designees were:
 - Budgets cut (current and projected).
 - Staffing reduction.
 - Customer dissatisfaction.
 - Public/Private competition.
 - Threat of being closed or absorbed into larger organization.
 - Loss of any major contributing role.
 - Obsolete methods of work slowing down interface with external customers.
 - Confidence decreasing in services provided.
 - Errors costing time and budget.
 - Deadlines missed consistently.
 - Loss of control of subordinate operations, organizations.

Quality Efforts in the Federal Sector

- Naval Shipyard, Norfolk
 - Reduced relief valve rejection rate from process average 21% during 1987 to 0% by June 1988.
 - Reduced electrical connector fabrication rework from 55% to 6%.
 - Initiated a post repair assessment to obtain customer feedback.
 - Established a Quality of Worklife Committee.
- IRS, Ogden Service Center
 - Adopted Juran approach to quality in 1984.
 - Improvements saved government \$3.5 million.

Introducing the Need: Challenge of the Global Economy

Appendix C contains a synopsis of TQM efforts.

Quality Efforts in the Federal Sector

- Naval Aviation Depot, Cherry Point
 - Total Realized Savings FY '87 -- \$39,308,000.
 - Share savings with employees in gain sharing payouts -- \$1,385 to each civilian employee in FY '88.
- Naval Publications and Forms Center, Philadelphia, PA
 - Increased quality level of receipts processing information from 91% to 95% accuracy within 5 months.
 - Improved ability to process receipts in timely manner -- in 1986 processed 63% of receipts within a week; now able to process 90% within a week.

Introducing the Need: Challenge of the Global Economy

- Above examples show what is possible.
- These kind of results were not achieved by just putting up TQM signs
 - Culture change
 - Training
 - Emphasis on quality.

Quality Efforts in the Private Sector

TQM Success Stories

- Westinghouse (1988 Baldrige Award)
- Motorola (1988 Baldrige Award)
- Global Metallurgical (1988 Baldrige Award)
- Florida Power and Light (1988 Deming Award)
- Xerox (1989 Baldrige Award)
- Milliken & Co. (1989 Baldrige Award)

Introducing the Award: Challenge of the Global Economy

- Malcolm Baldrige was a former Secretary of Commerce.
- Winners of the National Quality Award are reviewed by a Board of Examiners who validate the review procedures and recommend award recipients.
- The Award will become a means of training as well as recognizing companies for quality.

References:

- Public Law 100-107, Quality Improvement Act, August 20, 1987.
- Appendix A provides synopsis of TQM efforts of 1988 winners.

Contact:

Malcolm Baldrige National Quality Award
National Bureau of Standards & Technology
Gaithersburg, Maryland 20899
301-975-2036 / Dr. Ruth A. Haines

Introducing the Need: Challenge of the Global Economy

Xerox

- Organized 75% of its work force into more than 7,000 quality teams, saving \$116 million.
- Spent \$125 million teaching quality improvement techniques.
- Cut the number of suppliers from 5,000 to 480; taught them to deliver defect-free parts.
- Asks 55,000 customers to grade products and services each month.

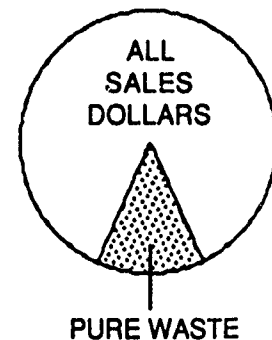
Milliken

- 'Associates' (employees) were asked to make quality improvement suggestions. Of the 115,000 suggestions made, 85% were implemented.
- Organized 1,600 teams to handle business problems and 500 teams to work with customers.
- Eliminated 700 managerial positions; each associate given authority to shut down machine if producing defects.
- Spent \$1,300 per Associate in quality improvement training.

Reference: USA TODAY, p. 10B, November 3, 1989.

A National Quality Award Winner***MOTOROLA INC., Schaumburg, IL***

- Quality Approach was a survival need.
- Discovered non-quality costs were 10% - 20% of all sales volume.
- Adopted total customer satisfaction as goal.
- Management taught itself to manage in a new way to achieve the goal.

**Introducing the Need: Challenge of the Global Economy**

- Pursued total customer satisfaction "religiously" -- management became quality evangelists.
- Pursued "Six Sigma Quality" -- 3.4 defects per million products -- including customer services.
- Products and services **designed** to accommodate the reasonable variation of supplied components but required production processes that yield extremely high consistency of final product or service.
- **All employees** monitor defects and use statistical processes as part of their job.
- Total Cycle Time is always being reduced -- customers should never wait. (NOTE: for Motorola, cycle time begins with product conception).
- Whole system is under scrutiny -- no part is exempt from improvement.

A National Quality Award Winner



MOTOROLA INC.

EMPLOYEE INVOLVEMENT IN QUALITY

QUALITY CRITERIA THROUGH COMPETITIVE
BENCHMARKING

Introducing the Need: Challenge of the Global Economy

Employees and Quality

- Participative Management Program (PMP teams).
 - Assess progress toward meeting quality goals.
 - Identify new initiatives.
 - Work on solutions (permanent).
- Savings shared in PMP bonuses (3% of payroll).
- \$170 million in training (1st 4 start-up years).

(continued)

Introducing the Need: Challenge of the Global Economy

Setting Quality Standards

- Use best **products** from 125 other companies as comparators.
- Use best **functions** from other companies to gauge own functions' qualities.

Contact:

Director of Quality
Motorola Inc.
1303 E. Algonquin Road
Schaumburg, IL 60196

Quality Efforts in the Private Sector

- Kodak Copy Products Division:
 - 50% improvement in average defects per unit, all products each month for 7.6 consecutive months
 - Continuous improvement for 3 full years.(Source: QPM p30)
- Hewlett-Packard:
 - Elimination of virtually all solder joint defects in the HP3000, and all rework associated with it.
 - Additional benefits: reduced component insertion defects; improved cycle time; less inventory; less space requirements.
 - Every time defects were reduced, productivity rose measurably.

Introducing the Need: Challenge of the Global Economy

Quality Efforts in the Private Sector

- Sun Refining & Marketing:
 - Took over a year of dialogue just to develop a meaningful organizational mission statement.
 - The benefit was breaking down departmental barriers.
(Source: Joiner Assoc)
- Craftex Mills: Early benefits of scientific approach to process improvement resulted in productivity gains equal to an increase of :
 - 5% plant capacity
 - \$1million savings in capital expenditures.
(Source: Joiner Assoc.)

Introducing the Need: Challenge of the Global Economy

Quality Efforts in the Private Sector

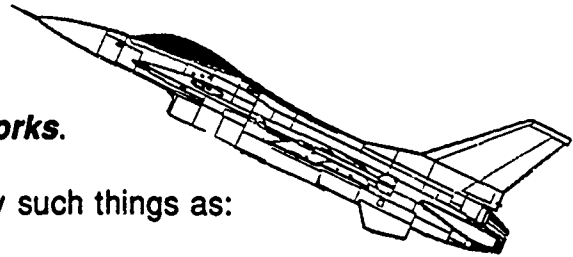
- IBM:
 - Working with vendors to improve vendor quality.
 - Resulted in 50% improvement each month for 21 months.
(Source: QPM, p.30)
- Rank Xerox Mitcheldean:
 - Defect Index showed 50% improvement each month for 10.4 months.
(Source: QPM p. 30)

Introducing the Need: Challenge of the Global Economy

What Quality Means to Forces in the Field

USAF
Goal:

To get the pilots,
Through the defenses
To the target
With equipment that **works**.



Combat Capability is measured by such things as:

- Equipment Capability
- Equipment Reliability
- Cost of Operations
- Maintainability

All of these are due to quality from the industrial base of the nation --
cultivated by the vision of defense managers

Introducing the Need: Challenge of the Global Economy

STORY: 1989, Shaw AFB F-16C Squadron.

Mission: Conduct a maximum surge mission against test range tactical targets.

24 fighters flew 160 missions in 12 hours.

Status:

- 150 times returned "Code 1" -- ready for next mission.
- 10 Non-Code-1 fixed in 2 hours.
- 29 feet was the 'average missed-distance' for ordnance.
- 30% ordnance direct hits.

Conclusion:

This is a national success story -- the reliability of equipment allowed the squadron to perform this well.

Reference: Major General Henry Viccellio Jr., USAF, Dept. Chief of Staff, Logistics; TAC Headquarters.

What Quality Means to Forces in the Field

Old Standard

F-4

Avg. Approx. 3 Missions in 24 Hours

Simulated Combat

Surge Conditions

24 Aircraft Squadron

New Standard

F-16

Avg. 6.6 Missions in 12 Hours

Simulated Combat

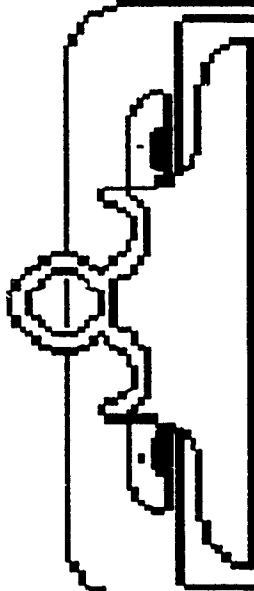
Surge Conditions

24 Aircraft Squadron

MODULE TWO

UNDERSTANDING TOTAL QUALITY MANAGEMENT:
THE TQM IMPERATIVE

Module 2 Objectives



Upon completion of this module, the participants will be able to:

- Explain how the concepts of quality evolved.
- List three major quality authorities and describe their common concepts.
- Demonstrate an understanding of the key concepts of quality management.

Understanding the Quality Management Concept

Understanding the Quality Management Concept

Module 2

- Bead Box Exercise
- Evolution of Total Quality Management
- Quality Authorities
- Elements of Quality
- Process Management

Understanding the Quality Management Concept

Exercise 1

The Bead Box

Exercise 1: The Bead Box

- Objective:** Upon completion of this exercise, participants will be able to:
- Distinguish between individual work performance problems and system problems.
 - Demonstrate an understanding of the use of the problems with our current style of management.
 - Illustrate the importance of workers and management to stay in cooperative communication to solve problems.

Players: Inspector #1
Inspector #2
Chief Inspector
3 Willing Workers
Process Observers
Recorder
Statistician
Manager

Materials: Bead Box
Flip Chart and Pen
Recorder Sheet

Scenario: This exercise simulates a typical process, using the White Bead Manufacturing Company as an example. The manager will explain the work process and management expectations to the employees. The process observers will be responsible for observing the process using the discussion questions found on the following pages.

Exercise 1: The Bead Box

**Discussion
Questions**

1. Describe the culture created by management at the White Bead Factory.

2. What is the relationship between the performance of the employee and the output of the system?

3. What is wrong with the merit system to reward the worker with the fewest red beads for the day? What is wrong with putting on probation the employee with the greatest number of beads for the day?

4. What affect does the input from the supplier have on the process?

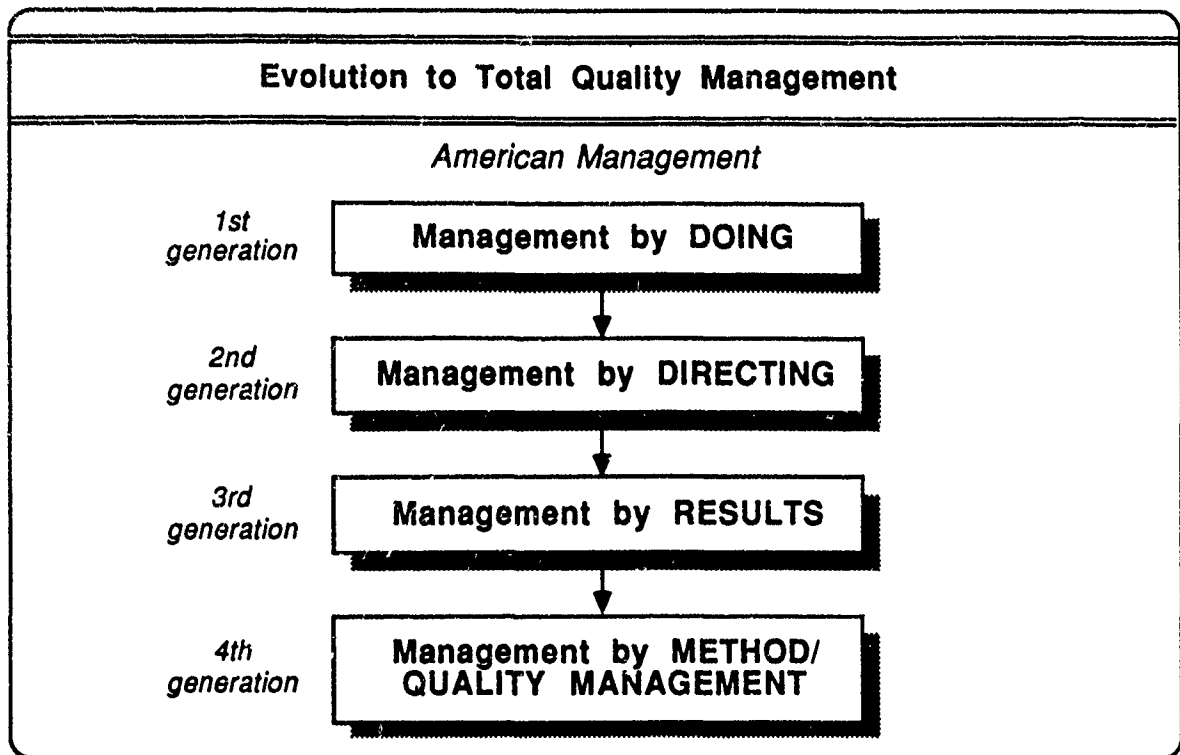
Exercise 1: The Bead Box

5. What do the red beads represent? Provide some examples from your organization.

6. Why is it futile to set three red beads as a numerical goal?

7. Is this system capable of producing only three red beads per draw? Why? What is management's responsibility? The employee's responsibility?

8. How might the willing workers improve their output of white beads if granted the privilege to try out suggestions on improvement of procedures?



Understanding the Quality Management Concept

- American management has built the strongest economy the world has known.
 - The United States' ability to produce large quantities of high-quality armaments using an unskilled labor force won World War II.
 - In the 1950's, after the war ended, the lessons on quality and productivity were essentially discarded. After World War II, the United States was expanding its economy at record rates and providing relief programs to the rest of the world.

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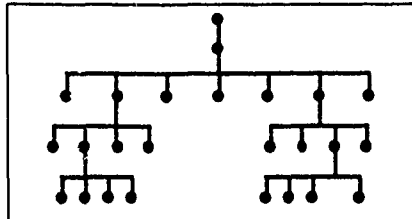
Understanding the Quality Management Concept

- American management styles have progressed through the years:
 - The first generation of management 'did it yourself'.
 - In the second generation, a master craftsman directed his apprentices.
 - The most widely used management style today in the U.S. is management by results or controls, which provides a systematic hierarchy of control and accountability.
 - The new and more effective management style to take us into the 21st century is management by method.

Reference:

Joiner, Brian L.; Scholtes, Peter R., "Total Quality Leadership vs. Management by Control." Joiner Associates Inc., Madison, WI, 1985.

Management by Results



- Sets up conflict in an organization
- Often fosters a climate of mistrust
- Success is often accidental
- There is no system for process improvement
- Creates fear as a motivator.

Understanding the Quality Management Concept

- This classic organization chart, developed 150 years ago, depicts the separation and decentralization of functions. It is also used in management by results or control to describe the hierarchy of control and accountability. Each manager, beginning at the top, is given certain goals for the year. They in turn set goals and impose controls on each of their subordinates.
- Management by Results, also termed 'Management by Objectives', seems to have been quite successful.
 - Commonly practiced in American corporations
 - Widely taught in business schools
 - Attributed by many for getting us where we are today.

(continued)

Understanding the Quality Management Concept

- Yet, this system of controls has some disadvantages. Consider a common example of management by results:

There was a surplus of large nails and a shortage of small ones in Russia. Why? Managers were held accountable for the tons of nails produced. Later the control was changed to the number of nails produced. This led to a shortage of large nails, since smaller nails gave higher counts.

- Management by Results focuses the energies of the workforce toward specific goals or results. Some of the implications include:
 - Sets up conflict in an organization, as the controls which direct one unit's short-term gain may contradict the controls which direct the short-term gains of another unit.
 - Often fosters a climate of mistrust, 'blame it on them' mentality, 'play the game' environment.
 - Success is often accidental or incidental and future success is unpredictable.
 - Though systematic in goal setting, there is no system for process improvement.
 - Creates fear as a motivator, as employees work without a method to reach often unobtainable goals.
- ***"Management by Results encourages an organization to look inward at its own structures rather than outward at the world in which the customer operates. Rather than delight in providing a product or service that works and satisfies the customer, the sense of accomplishment comes from meeting the controls. It becomes a self-reinforcing cycle."***

Reference:

Joiner, Brian L.; Scholtes, Peter R., "Total Quality Leadership vs. Management by Control." Joiner Associates Inc., Madison, WI, 1985.

Evolution to Total Quality Management

Transition to the 4th generation of management

"All workers ask for is the chance to work with pride, to work without fear."

Dr. W. Edwards Deming

- People want to do a good job, yet best efforts are not good enough to improve productivity.
- Management by Results may have contributed to our position today, but it will not contribute to our competitiveness in the future.

Understanding the Quality Management Concept

- In Management by Results, management tells people to achieve and leaves it up to them as to how the results will be reached.
 - Employees are rewarded and punished based on their achievement of results.
 - It assumes that the current system and processes are capable of attaining the results.
- People want to do a good job, yet best efforts are not good enough to improve productivity.

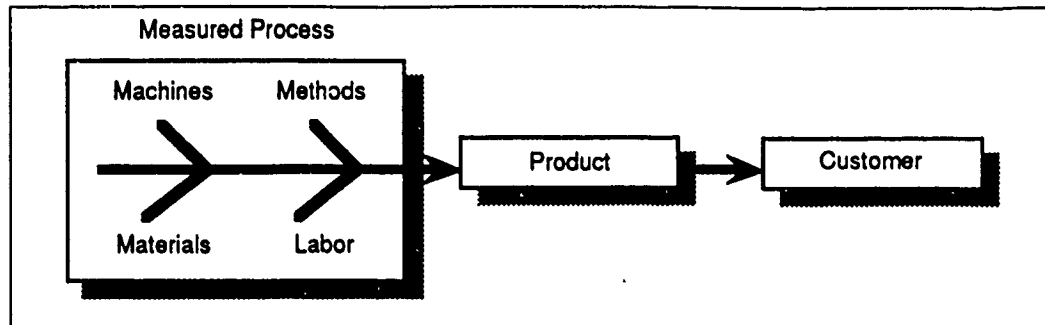
(continued)

Understanding the Quality Management Concept

- It is not enough to say that we will improve productivity by 3% this year.
 - If we could do it with existing methods, then we should have done it last year.
 - People need to know how to improve - a method for improvement.
- Management by results was assumed to be responsible for our growth after WWII.
 - Emphasis placed on rate of production, not quality.
 - No competition, so we could get away with most anything in terms of quality
- We now know that management by results won't work in a competitive world.

Reference:

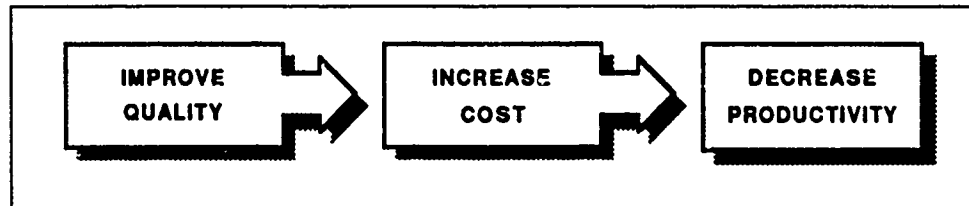
Modic, Stanley J., "What Makes Deming Run," Industry Week, June 20, 1988.

Evolution to Total Quality Management*Management by Method/Quality Management*

- Focuses on the processes by which work gets done, rather than on a hierarchy of individual accountability.
- Provides the methods to study and improve processes for better results.

Understanding the Quality Management Concept

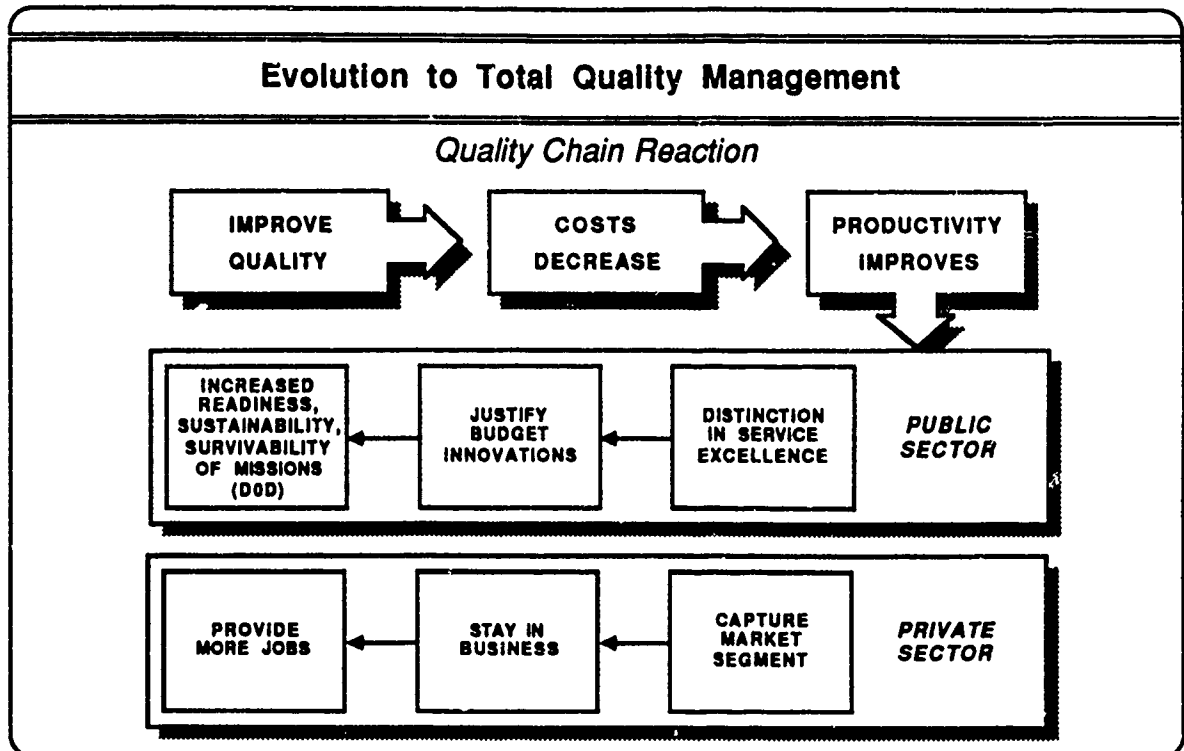
- Management by method has emerged in successful American and Japanese corporations as an approach to produce quality products and remain competitive.
- Management by method focuses on the processes by which work gets done, rather than on a hierarchy of individual accountability.
- A process is the transformation of input, using machines, materials, methods, and labor to produce a product for a customer. (This concept will be further discussed in process management.)
- Quality management emerges as a method for continuous improvement of processes. Quantitative methods are used to study the work processes and develop better methods to deliver better results.
- While management by results demands better results from the current system, quality management provides the methods to study and improve processes for better results.

Evolution to Total Quality Management*Quality/Productivity Myth*

- Historically, American managers have believed that a trade off between quality and productivity exists.

Understanding the Quality Management Concept

- Historically, American managers have believed that a trade off between quality and productivity exists: to improve quality would be at the expense of reduced productivity.
- This tradeoff relationship was a commonly held view of managers after World War II. American products dominated the global market place and U.S. companies and their managers had no concern with producing quality products.
- Meanwhile, Japan and other countries struggled to compete. With the help of quality experts, such as Dr. Deming, Japanese management began to focus on quality, realized the resultant productivity gains, and captured market segments with quality products.



Understanding the Quality Management Concept

- With the shift from management by results to management by method or quality management, we see a focus on quality.
- By focusing on quality, costs decrease and productivity improves.
 - Improved quality results from reduction in variation in service and production systems.
 - Decreased costs result from:
 - Less rework
 - Decrease in mistakes/special causes
 - Reduced delays
 - Better use of equipment
 - More efficient use of time.

(continued)

Evolution to Total Quality Management

- Decreased costs result from:
 - Less rework
 - Decrease in mistakes/special causes
 - Reduced delays
 - Better use of equipment
 - More efficient use of time.
- Productivity improvements result from:
 - Lower/stabilized costs
 - Increased budget power
 - Reduced need for capital expenditures.

Understanding the Quality Management Concept

- Productivity improvements result from:
 - Lower/stabilized costs
 - Increased budget power
 - Reduced need for capital expenditures.
- The quality chain reaction takes two separate paths:
 - In the public sector, improved productivity results in:
 - Ability to capture reputation for distinction in service excellence
 - Ability to stabilize workforce and justify all budget innovations
 - Increased readiness, sustainability, and survivability of missions supported by DOD.

Understanding the Quality Management Concept

- In the private sector, improved productivity results in:
 - Ability to capture the market segment with quality and lower prices
 - Guarantee of business in the future
 - More jobs.

Reference:

Adapted from

Deming, W. Edwards, Out of the Crisis, MIT Center for Advanced Engineering Study; Cambridge, MA, 1986.

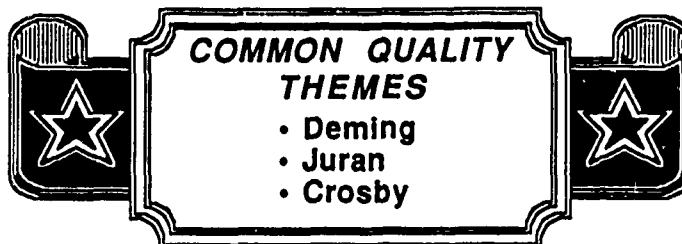
Sink, Scott D., "TQM: The Next Frontier or Just Another bandwagon to Jump On?", Quality Productivity Management, Vol. 7, No. 2, 1989, Virginia Productivity Center, pp 6-21.

Quality Authorities

- DR. W. EDWARDS DEMING
- DR. JOSEPH JURAN
- PHILIP CROSBY

Understanding the Quality Management Concept

- There are many authorities responsible for the quality revolution, in the United States and abroad, including Dr. W. Edwards Deming, Dr. Joseph Juran, Philip Crosby, Genichi Taguchi, Kaoru Ishikawa, and Armand Fiegenbaum.
- Three of the most well-known and practiced concepts are those of:
 - Dr. W. Edwards Deming
 - Dr. Joseph Juran
 - Philip Crosby.
- Though different approaches, all advocate the quality path to improved productivity.

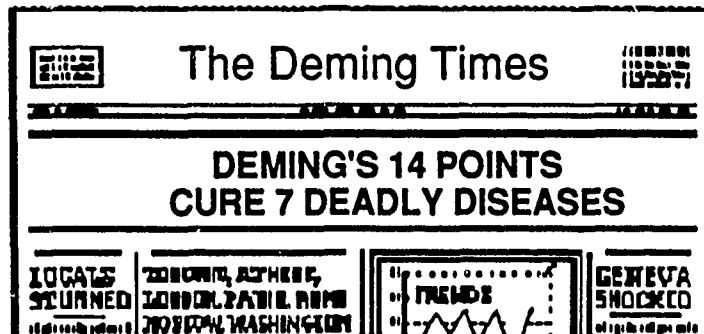
Quality Authorities

- Customer defines quality.
- Management creates the quality culture.
- Management provides for system improvements.
- Quality becomes prevention-based.
- Statistical thinking is used to study processes.
- Team approach.
- Continuous improvement.
- Education and training are vital.

Understanding the Quality Management Concept

- Deming, Juran, and Crosby, though different in approaches, all advocate the quality path to productivity. Common themes among these quality management authorities include:
 - Customer defines quality.
 - Management creates the quality culture.
 - Management provides for system improvements.
 - Quality becomes prevention-based, rather than inspection-based.
 - Statistical thinking is used to study processes and select improvement projects.
 - Team approach to problem-solving.
 - Continuous improvement.
 - Education and training are vital.

Quality Authorities



- 1. Create constancy of purpose for improvement of product and service.**
- 2. Adopt the new philosophy.**
- 3. Cease dependence on mass inspection.**

Understanding the Quality Management Concept

- Deming's famous 14 points, or obligations of management, outline his approach to the transformation of western civilization. Dr. Deming's approach to quality is the philosophy that revolutionized Japan after World War II.
- Deming's 14 Principles for transformation of Western culture:
 1. **Create constancy of purpose for improvement of product and service.**
 - Aim to become competitive
 - Quality is not an intermittent priority
 - A long term, strategic approach is required
 - Management is committed to people and jobs.

(continued)

Understanding the Quality Management Concept

2. Adopt the new philosophy.

- Western management must take up the challenge
- Management must learn their responsibilities
- Management must take on leadership for change
- Most easy to get natural resources are depleted
- Inspection and assurance are insufficient
- No longer live with accepted levels of delays, defective materials, and defective workmanship.

3. Cease dependence on mass inspection.

- Build quality into the product/service in the first place
- The problem is in the process, not the product
- Even 100% inspection does not assure quality
- Provide tools and delegate correction of special causes to those closest to the process.

Quality Authorities*Deming's 14 Points (Continued)*

4. End the practice of awarding business on price tag alone.
5. Improve constantly and forever the system of production and service.
6. Institute training.
7. Institute leadership.
8. Drive out fear.

Understanding the Quality Management Concept

4. **End the practice of awarding business on price tag alone.**
 - The fallacy of the "low bid"
 - Purchasing managers must understand "cost of ownership"
 - Share with suppliers knowledge of quality improvement.
5. **Improve constantly and forever the system of production and service.**
 - It will constantly decrease costs
 - Constantly pursue reduction of process variation
 - Management is responsible for the systems
 - Managing quality of the extended process.
6. **Institute training.**
 - TQM and its rewards begins and ends with training
 - Employees must receive in-depth process training
 - All employees need training in statistical methods
 - Trainers must have profound knowledge of process.

(continued)

Understanding the Quality Management Concept

7. Institute leadership.

- Help people and machines do a better job
- Improvement means change, and change requires leadership
- A supervisor should be a coach, not a judge
- A leader determines who is in need of special help.

8. Drive out fear.

- Economic cost of fear
- Employees afraid to ask questions
- Good management solicits recommendations, acts.

Quality Authorities*Deming's 14 Points (Continued)*

9. Break down barriers between staff areas.
10. Eliminate slogans, exhortations, and targets for the workforce.
11. Eliminate numerical quotas.
12. Remove barriers to pride of workmanship.
13. Institute a vigorous program of education and retraining.
14. Take action to accomplish the transformation.

Understanding the Quality Management Concept

9. **Break down barriers between staff areas.**
 - Break down barriers between departments
 - A team can foresee problems of productions and usage
 - Reconcile organizational structure with process
 - Internalize the "customer-supplier" concept
 - Need for vertical and horizontal communication.
10. **Eliminate slogans, exhortations, and targets for the workforce.**
 - The bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force
 - Slogans do not help people do the job better
 - Production rate beyond control of workers
 - Targets without methods are ineffective.

(continued)

Understanding the Quality Management Concept

11. **Eliminate numerical quotas.**
 - Substitute leadership for quotas
 - Numbers are crutches of poor supervision
 - Standards and goals are often determined without knowledge of process capability
 - Management by Objectives (MBO) is often inconsistent with process improvement.
12. **Remove barriers to pride of workmanship.**
 - Measures lack precision and sufficiency
 - Workers perform with a larger system
 - Can have adverse effects on teamwork
 - Management by Objectives (MBO) and annual merit ratings need to be revisited.
13. **Institute a vigorous program of education and retraining.**
 - Process improvement will displace workers – develop a policy of cross training
 - Prepare for changes in process and technology
 - Innovation arises from active minds.
14. **Take action to accomplish the transformation.**
 - The transformation is everybody's job
 - Top management cannot do it alone
 - Do it: "We are all in it together"
 - An organization for quality improvement must be formed.

Quality Authorities

Deming's 7 Deadly Diseases

1. Lack of constancy of purpose.
2. Emphasis on short-term profits.
3. Annual review of performance.
4. Mobility of management.
5. Running a company on visible figures alone.
6. Excessive medical costs.
7. Excessive costs of warranty.

Understanding the Quality Management Concept

Reference:

Deming, W. Edwards. Out of the Crisis. MIT Center for Advanced Engineering Study, Cambridge, MA, 1986.

Quality Authorities



- **Quality Planning**
- **Quality Control**
- **Quality Improvement**

Understanding the Quality Management Concept

- **Dr. Juran's trilogy for successful quality management:**
 - **Quality Planning**
 - **Quality Control**
 - **Quality Improvement.**
- **Quality planning is the process of establishing quality goals and developing the means for meeting those goals. Quality planning consists of a standardized series of steps:**
 - **Identify the customer**
 - **Determine customer needs**
 - **Develop product features to meet customer needs**
 - **Establish product goals**
 - **Develop processes to meet the product goals**
 - **Improve process capability.**

(continued)

Quality Authorities

FUNDAMENTAL CONCEPT

**All improvements take place
project-by-project and in no other
way**

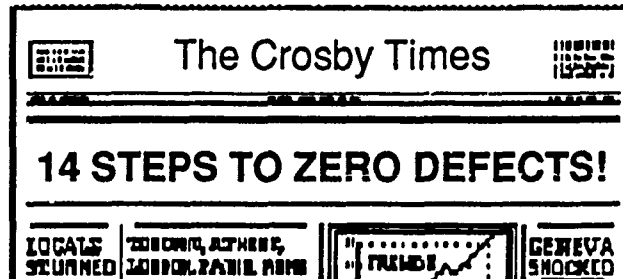
Understanding the Quality Management Concept

- **Quality Control is "staying on course, adhering to standards, and prevention of adverse change."**
- **Quality Control is carried out by the operations work force. Their job is to run the processes and meet the product goals. Their job also includes putting out the "sporadic spike" fires.**
- **Quality Improvement aims at outperforming the past: improving competitiveness in the marketplace and reducing the chronic level of quality deficiencies.**

References:

Juran, J.M., Managerial Breakthrough, McGraw-Hill Book Company; New York NY, 1964, p. 181.

Juran, J.M. and Gryna, F. M., Quality Planning and Analysis, McGraw-Hill Book Company; New York, NY, 1980.

Quality Authorities

- | | |
|-----------------------------|-------------------------|
| 1. Management commitment | 8. Employee education |
| 2. Quality improvement team | 9. Zero Defects Day |
| 3. Measurement | 10. Goal setting |
| 4. Cost of quality | 11. Error-cause removal |
| 5. Quality of awareness | 12. Recognition |
| 6. Corrective action | 13. Quality councils |
| 7. Zero Defects planning | 14. Do it over again |

Understanding the Quality Management Concept

- Philip B. Crosby pinpoints four "absolutes" involved with quality management:
 - Quality has to be defined as conformance to requirements, not as goodness.
 - The system for causing quality is prevention, not appraisal.
 - The performance standard must be zero defects, not "that's close enough."
 - The measurement of quality is the price of nonconformance, not indexes.

Reference:

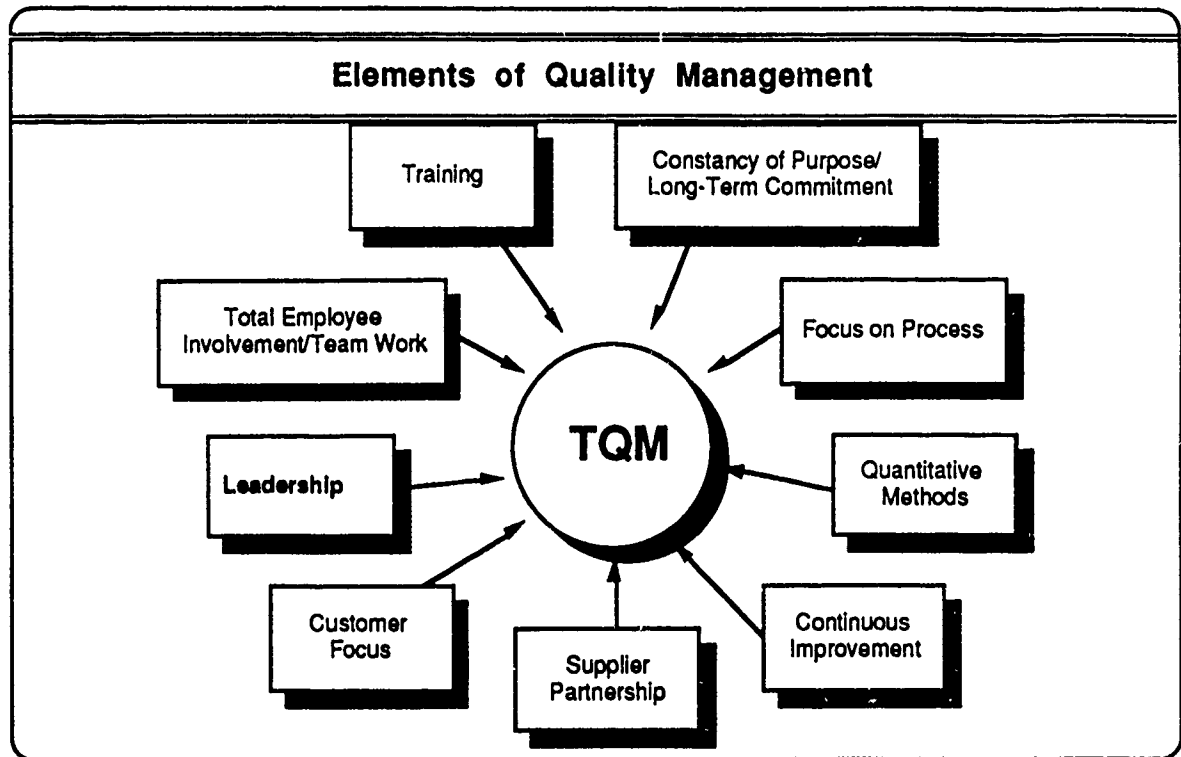
Crosby, Philip B., Quality Without Tears, Mc Graw-Hill Book Company; New York, NY, 1984

Quality Authorities

- Customer defines quality.
- Management creates the quality culture.
- Management provides for system improvements.
- Quality becomes prevention-based.
- Statistical thinking is used to study processes.
- Team approach.
- Continuous improvement.
- Education and training are vital.

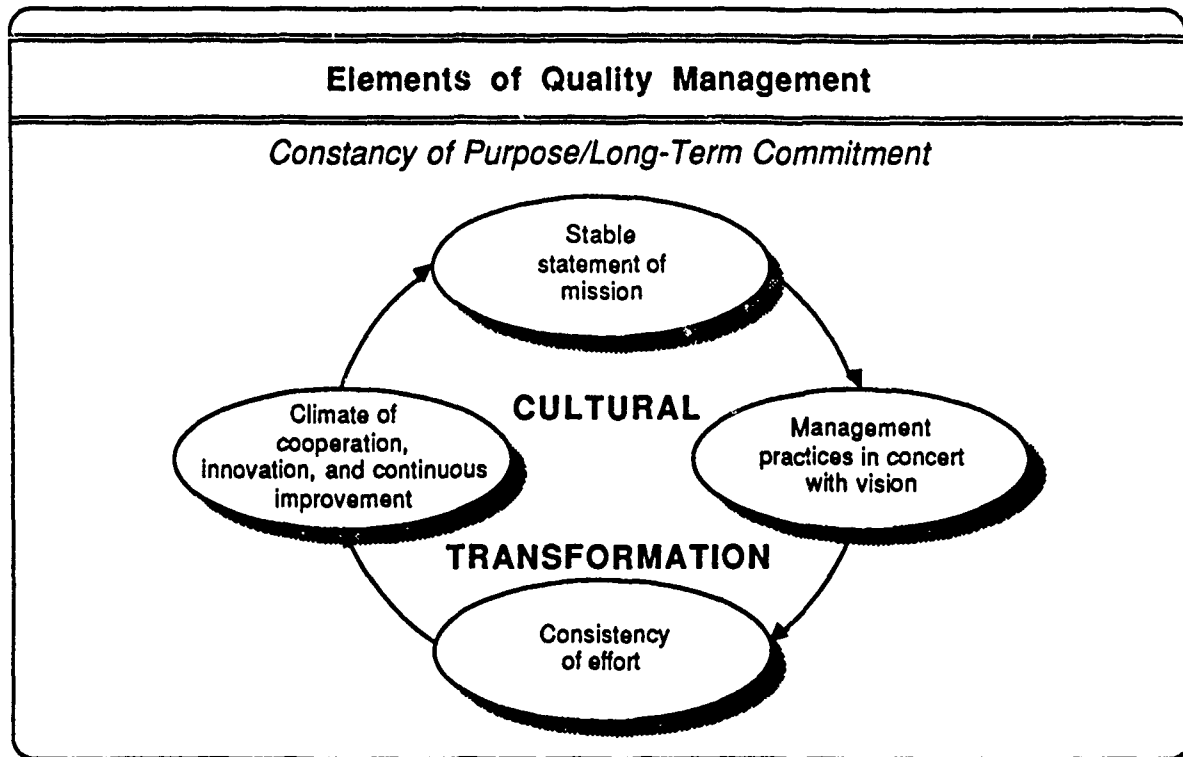
Understanding the Quality Management Concept

- Deming, Juran, and Crosby, though different in approaches, all advocate the quality path to productivity. Common themes among these quality management authorities include:
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 - Statistical thinking is used to study processes and select improvement projects.
 - Team approach to problem-solving.
 - Continuous improvement.
 - Education and training are vital.



Understanding the Quality Management Concept

- Quality management has emerged as a fourth generation management style, to replace the most commonly used management style of today – Management by Results.
- Quality management provides the method, often lacking in management by results, to continuously improve each and every process in an organization. This philosophy combines human resource management techniques and quantitative methods to focus on:
 - Supplier
 - Internal Processes
 - Customer.
- Quality management can be represented by nine basic elements which will be discussed in greater detail in this section.



Understanding the Quality Management Concept

- The mission of the organization must be clearly stated, documented, and known by all employees, suppliers, and customers.
- Clear statement of the mission prevents employees, suppliers, and customers from generating their own notions of the organization's mission and work priorities.
- Management's actions must support the mission at all times to define the commitment and establish the priority and truth of the mission.
- Constancy of purpose focuses work efforts towards common goals, providing unification of effort.
- The result is an environment which fosters cooperation towards common purposes, innovation to continually strive towards the vision, and continuous improvement.

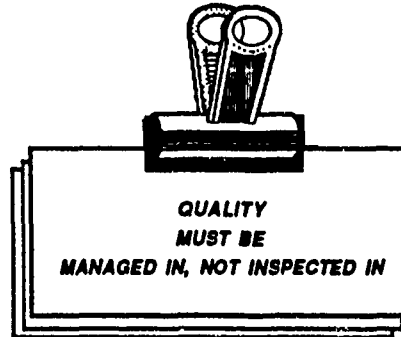
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Understanding the Quality Management Concept

- Quality management requires a cultural transformation, which takes time. Management must make a long-term commitment and provide constancy of purpose towards long range goals.

Elements of Quality Management

Focus on Process



- Quality management focuses on the processes by which work gets done in order to achieve results.
- Quality is continuous process improvement that leads to the continual upgrading of product quality.

Understanding the Quality Management Concept

- Quality management focuses on the processes by which work gets done in order to achieve results.
- With quality management, emphasis is placed on preventing defects through process improvement rather than discovering them through product inspection. "Quality must be managed in, not inspected in."
- Quality is not mere conformance to specifications, but continuous process improvement that leads to the continual upgrading of product quality.
- "Quality begins in the boardroom."

Operational Definition

- Defining Terms
- Establishing Common Language
- Eliminating Unnecessary Jargon
- Exercise: Can We Communicate?
 - Instructions
 - Active Participation

Understanding the Quality Management Concept

- Operational definitions are important internally.
 - Everyone in the process has to clearly understand the process language -- the precise language!
- Operational definitions are important externally.
 - Customer defines the terms of quality.
 - You have to know the customers language.
 - Suppliers have to understand your process language precisely.
 - In short, there has to be a lot of dedicated communication.

Operational Definition*Customer Focus*

- Get details about customer needs, exact details!
- The better you get, the more the customer will expect.
- Trifles make perfection, but perfection is no trifle.

Understanding the Quality Management Concept

- The customer defines quality. Management must adopt a new perspective to consistently and continually focus on the customer.
- Management must continually communicate with the customer to develop operational definitions to ensure that the output of the process meets the customer's current and future needs. Requires management that is very familiar with their processes -- how things get done!
- Operational Definitions are always changing; customers will demand increasing levels of quality. "World Class" customers will demand higher quality from their suppliers.
- Customer satisfaction is essential for continued success of your mission – without a customer, there is no need to exist.

Operational Definition

Supplier Partnership

- **The output of a process depends upon the quality of the input, or the supplier.**
- **Management must open lines of communication with the supplier to operationally define quality.**
 - **Management in role of customer.**
 - **Obligation to demand high quality from suppliers.**

Understanding the Quality Management Concept

- **The output of a process, the product or a service, depends upon the quality of the input, or the supplier.**
- **Management must open the communication channels and establish a working partnership with both customer and supplier to operationally define quality.**

Elements of Quality Management*Leadership*

- **Management is responsible for 100% of the processes.**
- **Only management can facilitate change.**
- **Quality is in the hands of everyone.**
- **Leaders must drive out fear to promote innovation.**

Understanding the Quality Management Concept

- Management is responsible for 100% of the processes. *"At least 85% of the problems are in the systems - fewer than 15% are attributable to some particular individual or set of circumstances."* --Dr. Joseph Juran, about 1955. It is management's responsibility to improve the system.
- Only management can facilitate change. This change must be implemented top-down.
- Quality is in the hands of everyone. Management defines the systems and processes; employees work in them.
- Leaders must drive out fear to promote innovation, risk-taking, pride in workmanship, and continuous improvement.
- The leadership challenge includes commitment and active involvement in speech and action.

Elements of Quality Management*Total Employee Involvement/Teamwork*

- **All employees are involved in the continuous improvement process.**
- **Quality management requires both individual contribution and team effort.**
- **Quality management employs teaming structures in a linking pin arrangement to top management.**
- **Cross-functional management satisfies cross-functional goals.**

Understanding the Quality Management Concept

- Under the leadership of top-level managers, all employees are involved in the continuous improvement process.
- Quality management requires both individual contribution and team effort working toward common goals.
- Employees are the ones actively involved in the processes, and are the ones who are best suited to study and recommend solutions in the processes.
- Quality management employs teaming structures in a linking pin arrangement to top management.

(continued)

Understanding the Quality Management Concept

- **Teamwork:**
 - Builds communication down, through, across, and up the organization
 - Fosters cooperation among individuals and groups
 - Provides consistency of effort
 - Stimulates innovation.
- Quality management demands cross functional management (e.g., cooperation among design, engineering, production) to satisfy cross-functional goals such as quality, cost, schedule, mission need and suitability, and foster a win-win situation.
- Teamwork promotes optimization of the entire system, whereas management by results promotes suboptimization.
- Teamwork builds cooperation which requires trust and risk
 - Teamwork is risky; the person who works to help others may not have as much production to show for the annual rating as the person who worked alone.
 - Management must create a culture of trust that fosters cooperation and optimization of the entire system, rather than 'rugged individualism' and suboptimization commonly found today.
- Quality is built in throughout a system; thus everyone should be involved.
- Quality management requires commitment and involvement throughout the organization, from top-level leaders, to managers and employees.

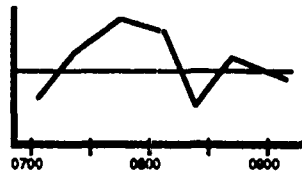
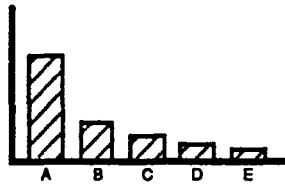
Elements of Quality Management

TQM Training

- **Quality management requires investment in people.**
- **Training should include both quality concepts and techniques:**
 - **Teamwork**
 - **Statistical thinking.**
- **The TQM culture places a high value and priority on training.**

Understanding the Quality Management Concept

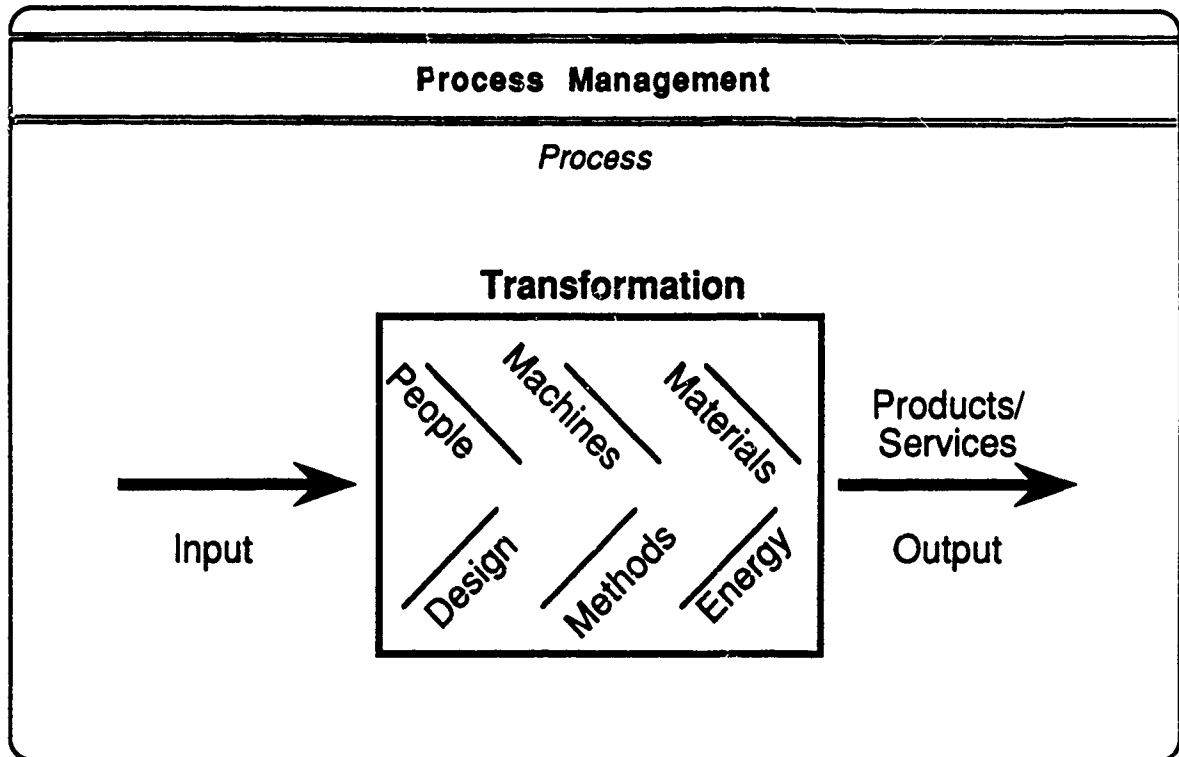
- **Quality management requires investment in people, the largest and most valuable asset in an organization, as they are the most essential component in continuous process improvement.**
- **Training should include both quality concepts and techniques (such as statistical thinking, teambuilding, etc.)**
- **Some training should be accomplished as a work group activity.**

Elements of Quality Management*Quantitative Methods*

- Identify problems
 - Identify solutions
 - Monitor progress
- Data-based decision making

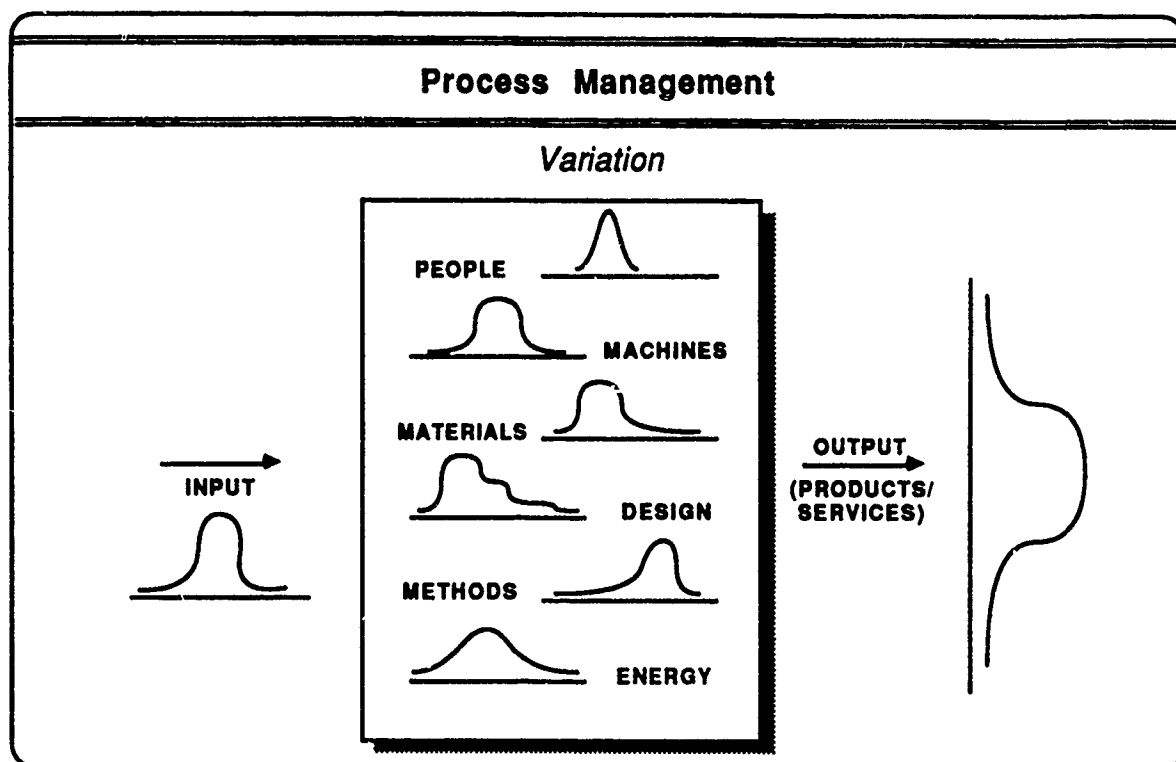
Understanding the Quality Management Concept

- Quality management integrates statistical thinking and management actions and provides managers with the facts necessary for data-based decision making. Managers no longer have to rely on instinct or intuition to make decisions.
- Quantitative methods are used to:
 - Identify problems
 - Identify solutions
 - Monitor progress.
- Managers and employees need to develop the skills to enable them to scientifically study and constantly improve every process by which work is accomplished.



Understanding the Quality Management Concept.

- In a process, some item, information or person is acted upon in order to be changed. The resulting change, or outcome, is the reason the process exists.
 - A series of high level decisions are transformed into policy directives.
 - A candidate is transformed by a placement process into a new hire.
 - A piece of metal is transformed into a device.
- The inputs into a process are transformed through people, machines, materials, design, methods, and energy to produce a product or service.



Understanding the Quality Management Concept

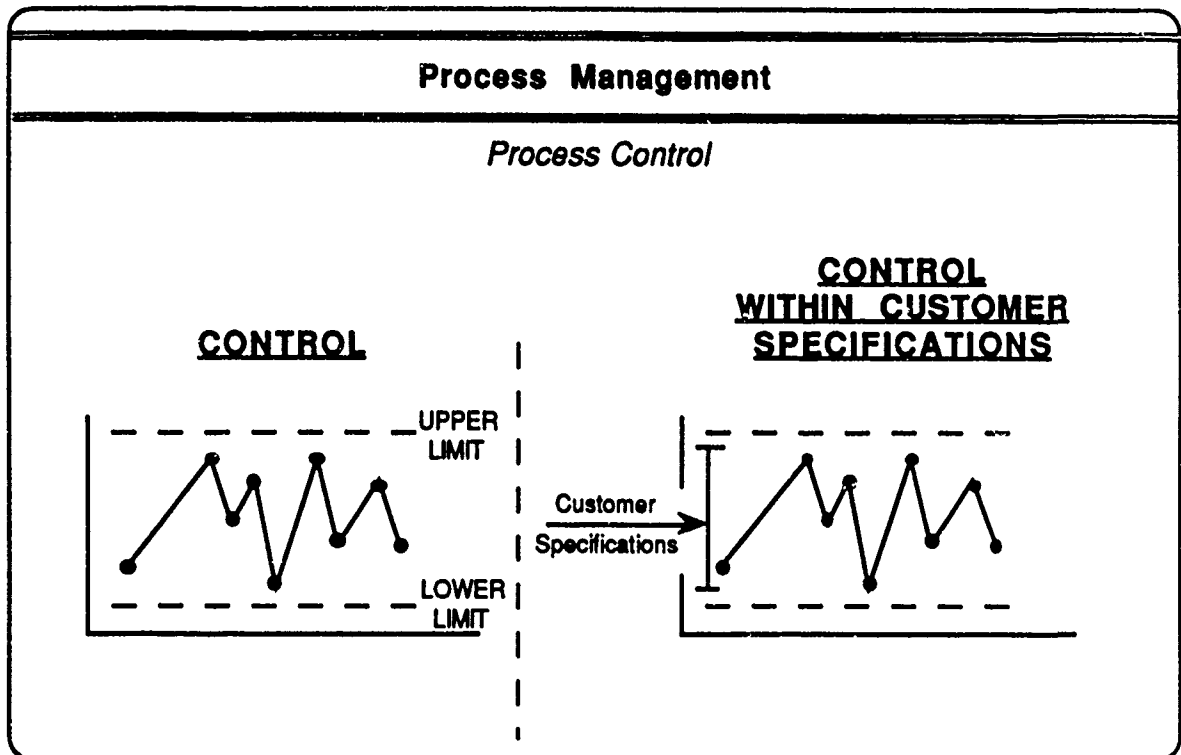
- Each transformation event is not an exact duplicate of the one before or the next one which will occur.
 - There is variation in the materials and information that are brought into the transformation process.
 - The process itself has variation in each component.
 - The outcomes are also not perfectly identical. They are the result of a transformation process with many sources of variation.

Process Management*Variation***Types of variation:**

- Common/random cause
- Special/assignable cause

Understanding the Quality Management Concept

- There will always be variation in people, performance, service and product – the key is to determine the type of variation:
 - Common/random cause, resulting from the system (e.g. design, choice of machine, supply, etc.)
 - Special/assignable cause, the source of which can be determined. (e.g. people errors, accidents, etc.)
- Everyday example of variation:
 - Secretaries go to lunch on a staggered schedule.
 - Record of phone calls shows that calls drop off significantly between 11:45 am and 1:15 pm.
 - Defines the period when lunch breaks should be scheduled.
 - One day phones ring off the hooks from 12 noon to 12:30 pm.



Understanding the Quality Management Concept

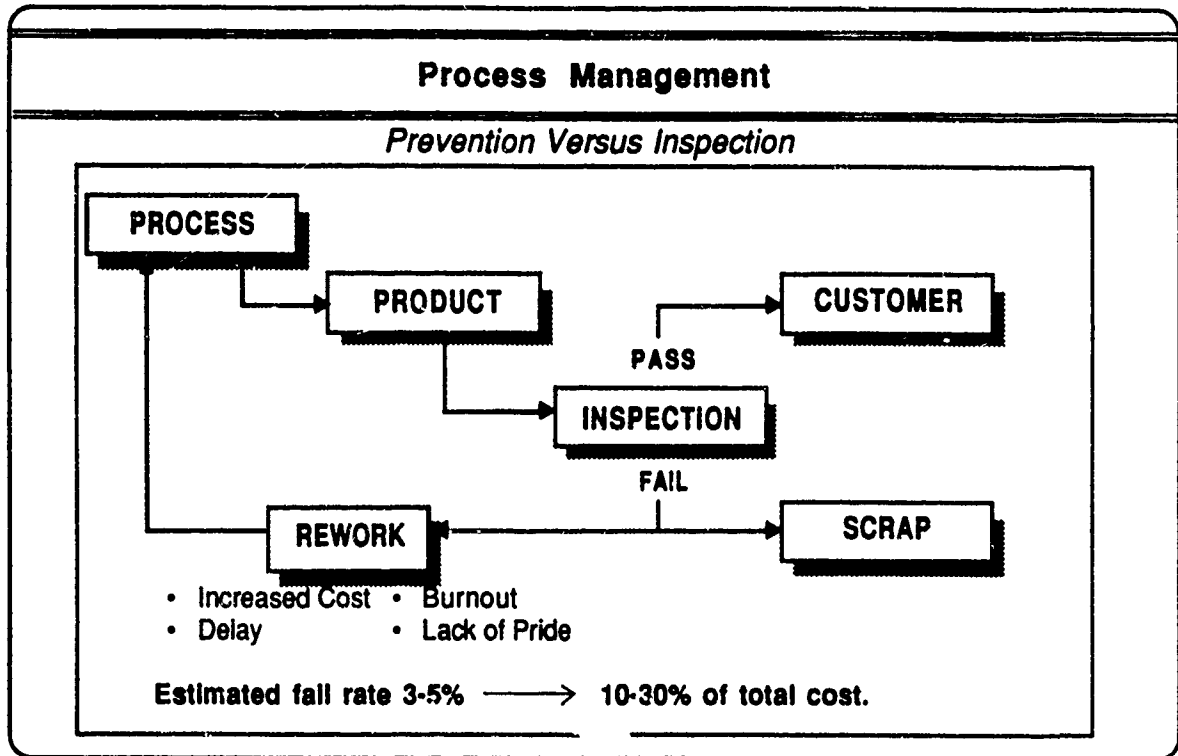
- A process is in **CONTROL** if it is stable or predictable (i.e., there are only common causes of variation, and there is no indication of a special cause of variation).
 - Managers need a stable system as a basis for prediction to manage. With a stable system, managers can plan on an average with a high degree of confidence.
 - A process that is not in control is the responsibility of management. A change in method, operator expertise, or equipment may be needed to stabilize the process.
 - A process can be stable and predictable, but not necessarily acceptable.

Understanding the Quality Management Concept

- In addition to being in control, the process must be able to consistently produce within the customer's specifications. If a process does not produce within the specified requirements, then management has to find a different process or modify the specifications.
- Improvement of a process is to:
 - Reduce variation of critical characteristics (bring it into CONTROL).
 - Move average to a higher or lower level to meet specifications and customer needs.

Reference:

Deming, W. Edwards; Out of the Crisis; MIT Center for Advanced Engineering Study, Cambridge, MA, 1986.



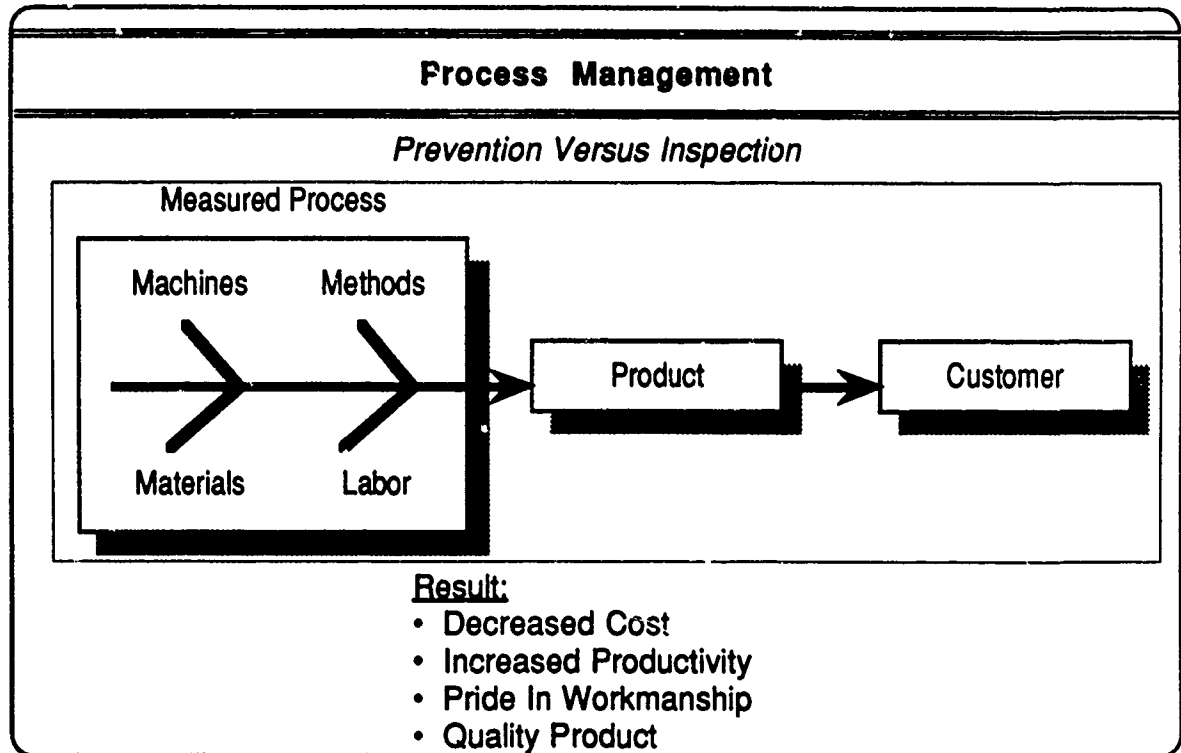
Understanding the Quality Management Concept

- The commonly practiced concept of quality is inspection or detection:
 - All products are subject to an "inspection" to determine if the product is within current specifications.
 - The inspection results in:
 - Pass the product onto the customer
 - Fail the product and rework or scrap the product.
- Rework results in:
 - Extra cost
 - Substantial delay
 - Employee burnout
 - Lack of pride in workmanship.

(continued)

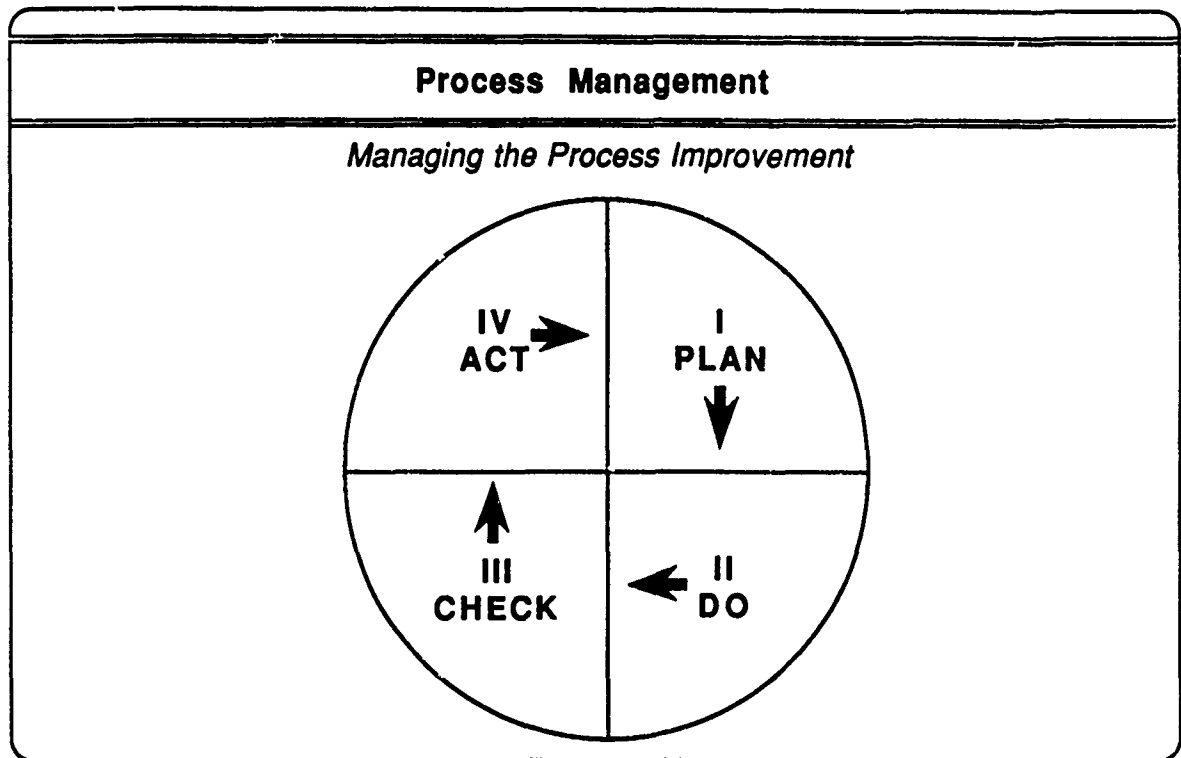
Understanding the Quality Management Concept

- Quotas may contribute to an increase in failed inspections, as employees are held accountable for quantity before quality.
- The inspection method considers quality 'after-the-fact' and not as part of the process.
- In public sector, tendency is to build processes that are "inspection dependent."
 - Policies and procedures are guided by threat of what GAO and the Inspector General may say.
 - GAO and Inspector General are not customers.
 - Inspection threats inhibit creativity and flexibility by placing emphasis on compliance.



Understanding the Quality Management Concept

- Quality management builds in quality throughout the process, with an emphasis on prevention rather than inspection.
- The result is:
 - Lower cost
 - Increased productivity
 - Increased pride in workmanship/quality product.
- "Quality is managed in, not inspected in."



Understanding the Quality Management Concept

The Shewhart Cycle of Learning, or Plan Do Check Act (PDCA) cycle, provides the method to "manage quality into" a process and the resultant outcomes by providing information for planning and prediction purposes.

- The first step is to "Plan" a change. This includes:
 - Definition of the problem
 - Statement of improvement objectives.

This step requires knowledge of the subject matter, the customer needs, and the process.

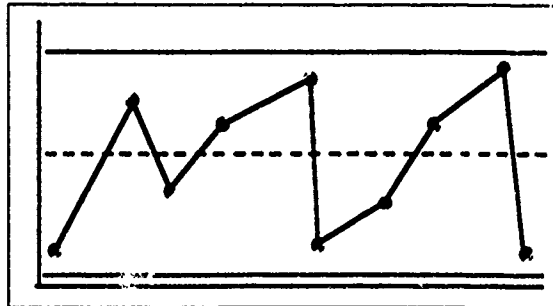
- The next step is to "Do" or test the change, preferably on a small scale. This includes:
 - Identification of possible special causes
 - Establishment of baselines.

Understanding the Quality Management Concept

- The third step is to "Check" or study the results – what did we learn. This information is used for planning and prediction purposes.
- The final step in the Shewhart Learning Cycle is to "Act." Action options include:
 - Adopt the change
 - Abolish the idea
 - Experiment again with different environmental conditions and/or people, to extend the boundary of knowledge.
- The management style commonly practiced today uses a "Plan/Act" or sometimes even "Act" cycle which does not benefit from the learning steps (Do and Check) in the PDCA cycle.

Reference:

Adaptation from
Deming, W. Edwards, Out of the Crisis, MIT Center for Advanced Engineering Study;
Cambridge, MA, 1986.

Process Management*Studying the Process*

- Integration of statistical thinking and management action.
- Data-based decision making.

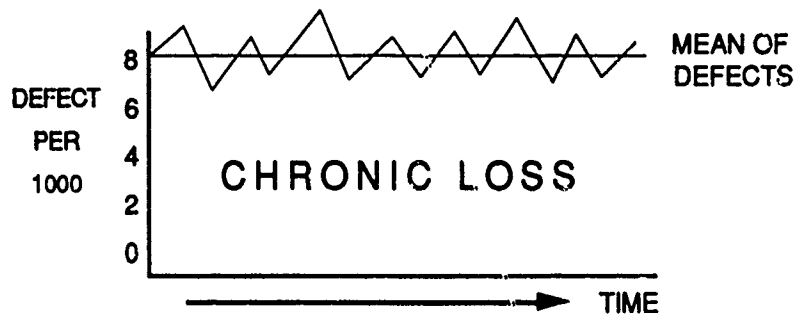
Understanding the Quality Management Concept

- The third Step of the Shewhart Learning Cycle is to check or study the process to gather information for prediction and planning purposes.
- Quality management integrates statistical thinking and management action. Quantitative methods and other problem solving tools are used to study the process and gather information to make data-based decisions.
- Many tools for continuous improvement are described in Module 3.

Process Management

Quality Standard

- Understanding of chronic loss.



Understanding the Quality Management Concept

- Have to change our notion of what is acceptable.

Reference:

Tribus, Myron; Reducing Deming's 14 Points to Practice; MIT Center for Advanced Engineering Study, Cambridge, MA, June 1984.

Process Management

- Acceptable level of quality:
 - Relative, not absolute.
 - Customer will demand higher and higher quality.

- Effects of small errors in sequential processes
 - 95% work on time in each of 11 steps in a sequential process
 - Results in 43% probability final work will not be done on time.

Understanding the Quality Management Concept

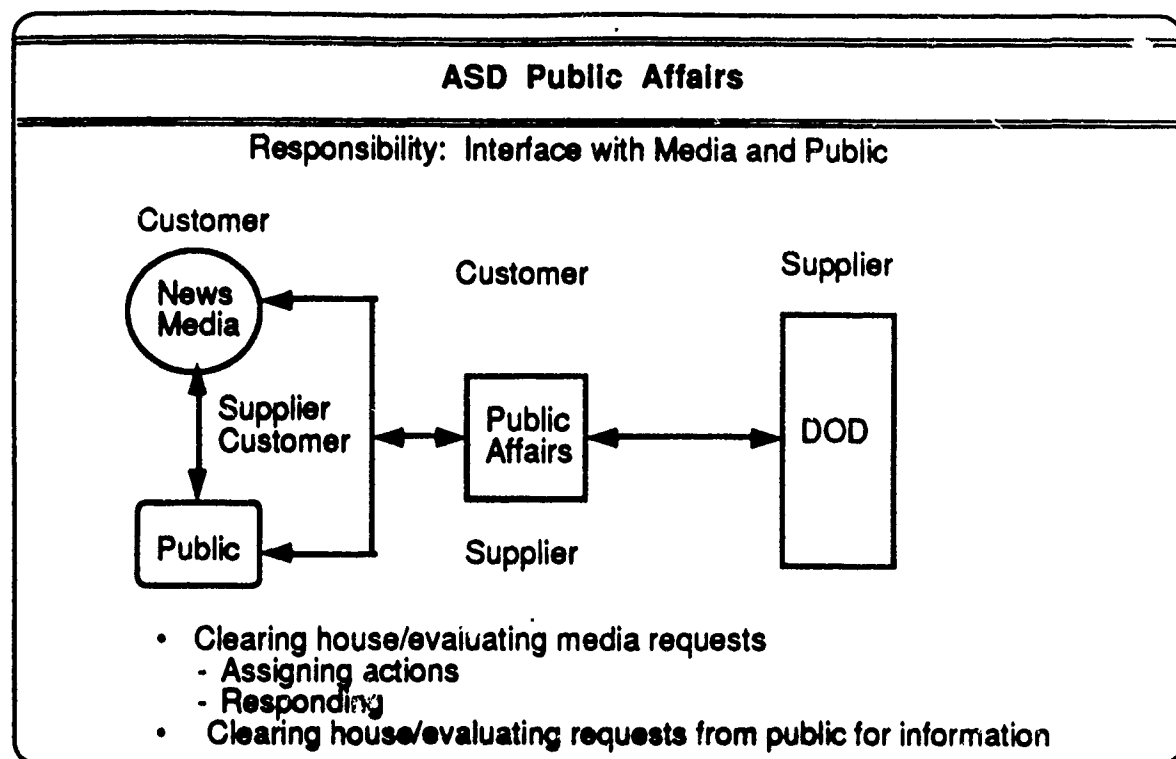
Exercise Assignment

Participant Exercise

Thinking about TQM

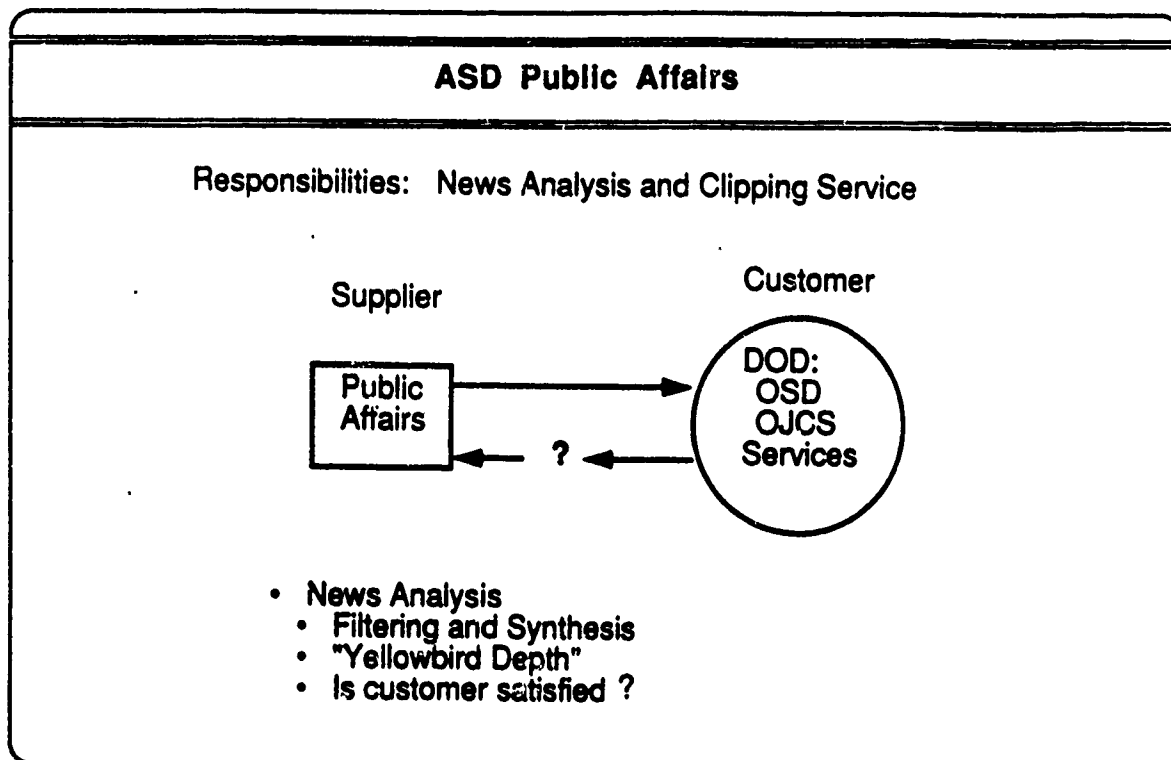
- Individual Preparation
- Group Activity
- Group Presentations
- Special Emphasis Area
 - Client/Customer Relations
 - Policies, Procedures and Processes

Understanding the Quality Management Concept



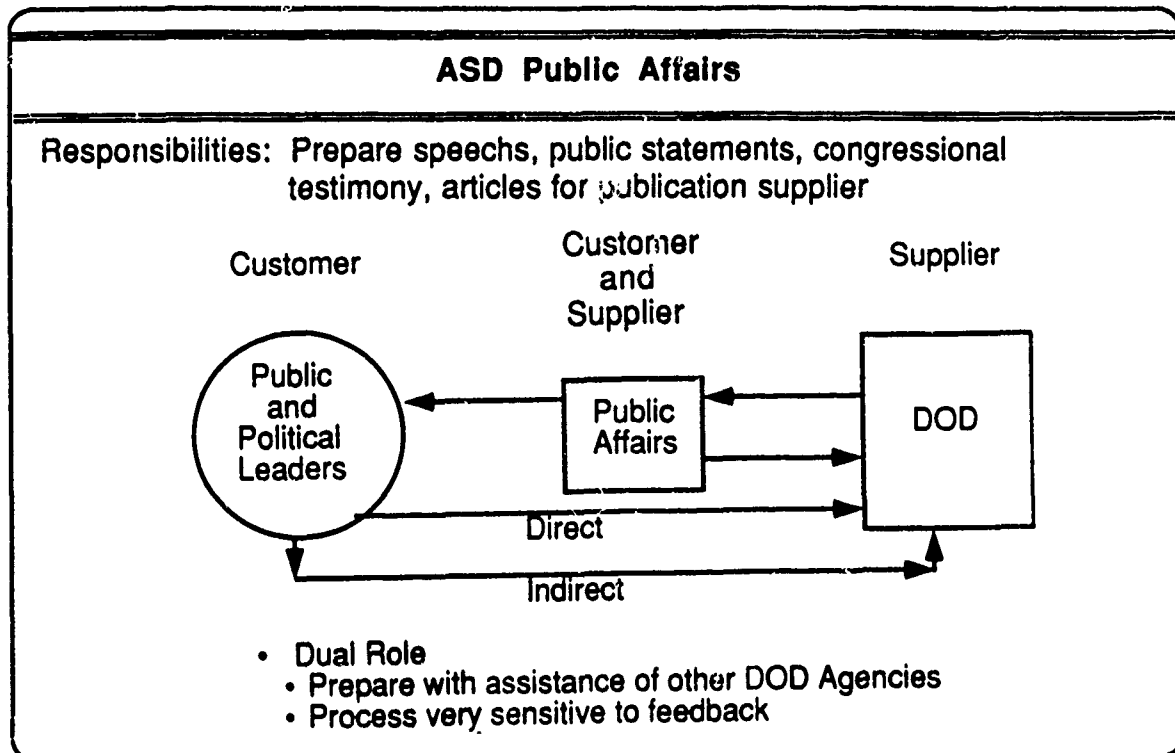
Understanding the Quality Management Concept

- Act as releasing agency for DOD Information and audiovisual materials to news media representatives. Evaluate news media request.
- Receive, analyze, and reply to inquiries regarding DOD policies, programs, and activities received from the public.



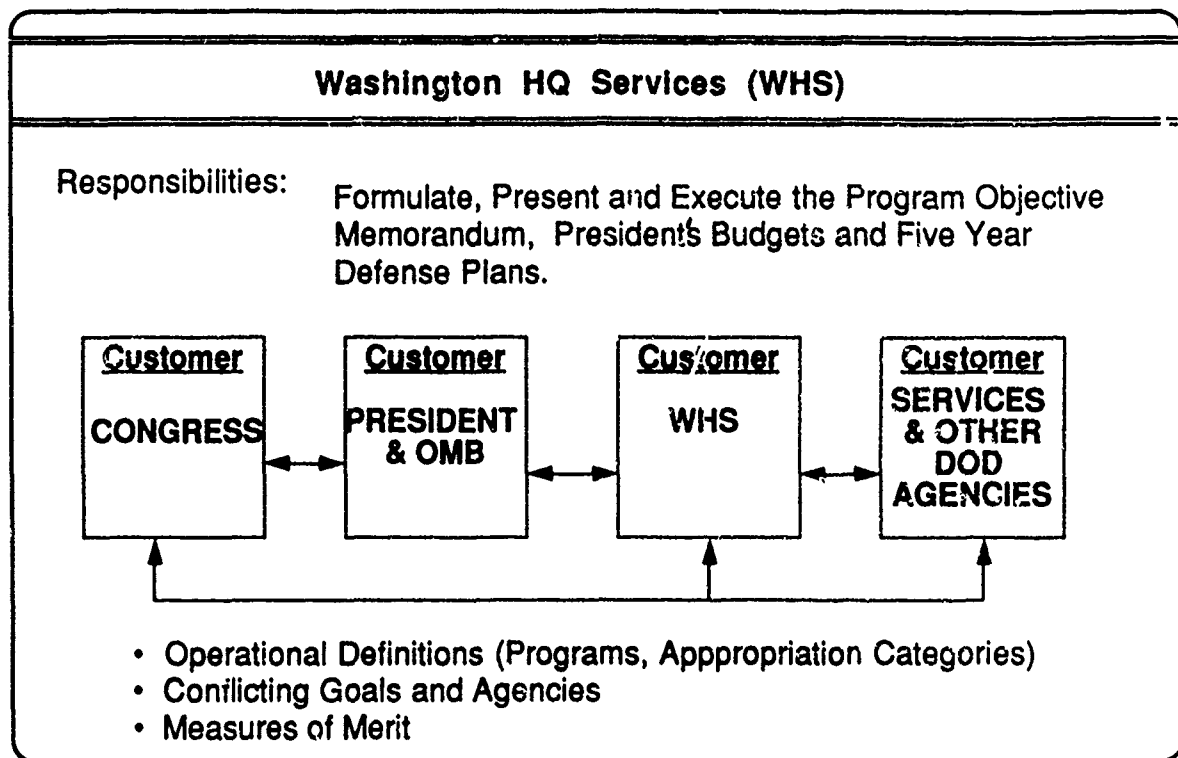
Understanding the Quality Management Concept

- What does customer want from earlybird?
- How many customers are there?
- What would happen if there was no earlybird?

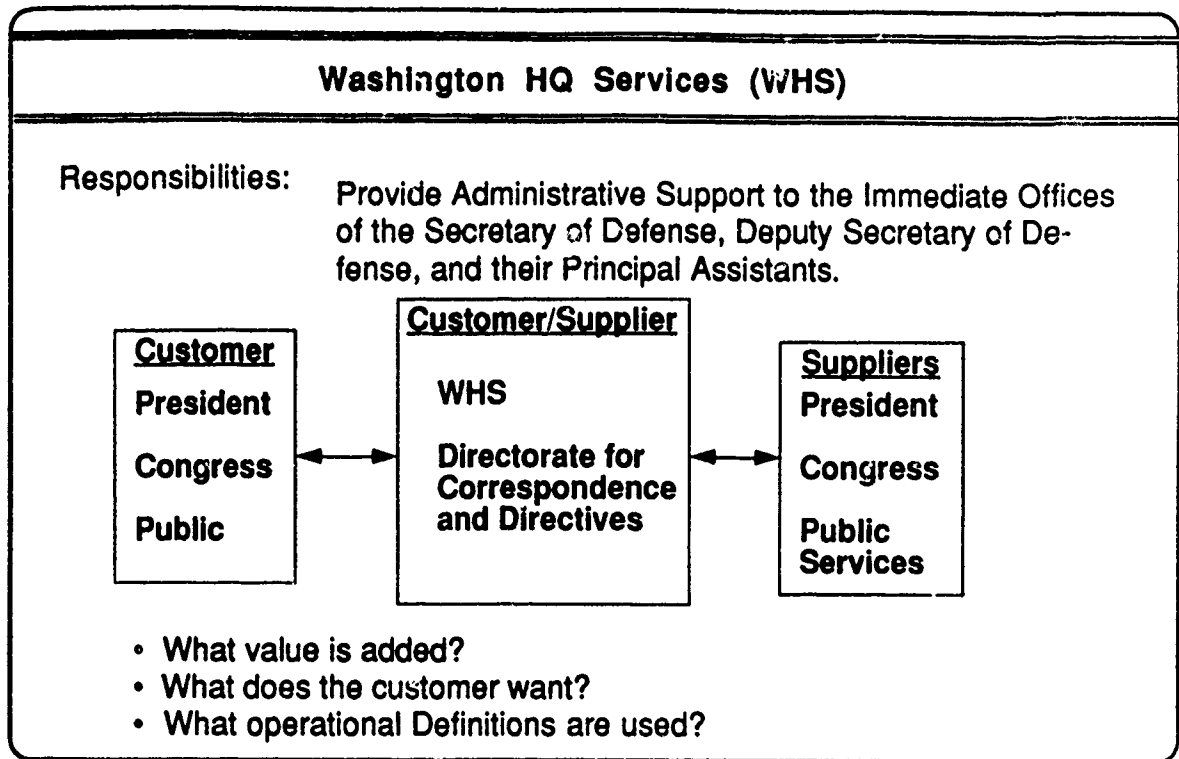


Understanding the Quality Management Concept

- What does customer want?
 - Political leaders
 - Public
- What does DOD provide?

**Understanding the Quality Management Concept****WASHINGTON HEADQUARTERS SERVICE**

- Broad responsibility for all budget activity
- Additional responsibilities in budgeting
 - travel services for DOD officials, military and civilian employees
 - installation level accounting support for appropriation allocated to various DOD components
 - Administer DOD Military Retirement Fund
 - DOD Education Benefits Fund
 - Manage Treasury Index
- Many complex customer, supplier relations and processes

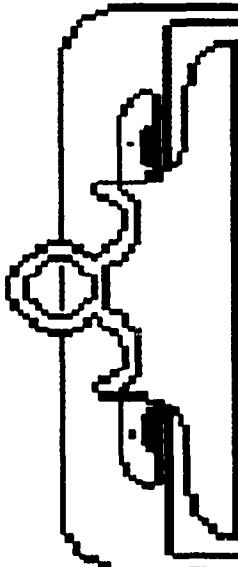
**Understanding the Quality Management Concept****WASHINGTON HEADQUARTERS SERVICE**

- Broad responsibilities for managing correspondence and directives
- Additional responsibilities
 - Electrically transmitted communications for Secretary of Defense
 - Correspondence control
 - Directive System for DOD
 - Records management through life-cycle
 - Historical research
- Very complex customer, supplier relationships
- Measures of merit not well defined
- System and sub--processes probably not in state of control (from a statistical standpoint)

MODULE THREE

UNLEASHING OUR CAPABILITIES:
CHANGING THE WAY WE WORK

Module 3 Objectives



Upon completion of this module, the participants will be able to:

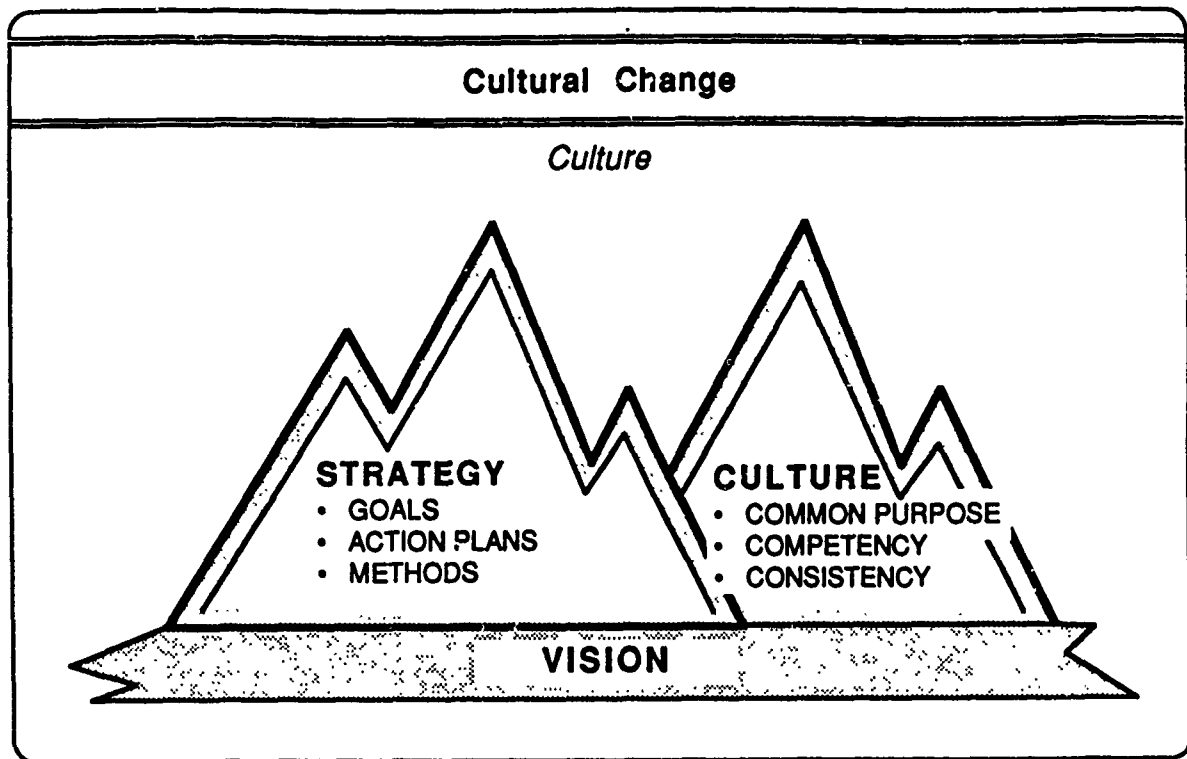
- Describe a TQM culture, the potential barriers, and the critical success factors for implementing a TQM culture.
- Define the skills and processes required for continuous performance improvement at every level.
- Describe the roles and responsibilities required to build and sustain a culture committed to continuous improvement.
- Be familiar with current DOD productivity improvement initiatives, techniques, and tools.

Unleashing Our Capabilities: Changing the Way We Work

Module 3

- Cultural Change
- Skills for Continuous Improvement
- Exercise: Interpreting Control Charts
- Roles and Responsibilities
- Productivity Improvement Initiatives

Unleashing Our Capabilities: Changing the Way We Work



Unleashing Our Capabilities: Changing the Way We Work

- Strategy is the business approach of an organization. It stresses the impact on the bottom line. Strategy includes:
 - Establishing goals
 - Developing time phased action plans to meet goals
 - Identifying and evaluating opportunities and methods for implementation.
- Culture is the attention to organizational and people needs – selecting, training, reworking, retaining and utilizing good employees. Culture includes the norms, work behaviors and communication patterns in an organization.

(continued)

Unleashing Our Capabilities: Changing the Way We Work

- The successful implementation of a strategy requires the nurturing of a culture motivated and dedicated to a vision or constancy of purpose. The nurturing requirements include:
 - Instill a collective commitment to a common purpose.
 - Foster distinctive competence among employees to deliver superior performance
 - Establish consistency that helps recruit, retain, and develop leaders and contributors at all levels.
- The foundation of excellence or quality in an organization is the combination of strategic thinking and culture. The culture must support the vision and vice versa. Vision unites strategy and culture.

Reference:

Hickman, Craig R., and Silva, Michael A., Creating Excellence: Managing Corporate Culture, Strategy and Change in the New Age. New American Library, New York, NY, 1984.

Cultural Change

C U L T U R E

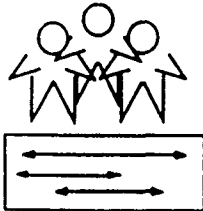
An Operational Definition:

A system of shared values keeping
everyone pulling in the same direction.

Unleashing Our Capabilities: Changing the Way We Work

Cultural Change

The culture of an organization directly affects:

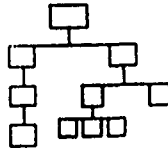


People..... types, numbers

Planning..... short-term, long-term



Control Systems..... what's monitored by whom



Organizational Structure..... reporting relationships,
assignments, sequence
of work

Unleashing Our Capabilities: Changing the Way We Work

- People
 - Not being valued as an asset
 - Prevailing assumption that technology alone can improve agency quality efforts
 - Changing demographics on future workforce
 - Work Force 2000 study.
- Planning for the long term must have priority.
- Control systems have to shift attention to processes not results.
- Organizational structure - flatter with more teaming arrangements.

Cultural Change

DETECTING ORGANIZATIONAL CULTURE

Done to:

Assess readiness for change
Locate systems of support or resistance
Plan the change strategy

Key:



What are the *real rules* (not espoused ones)
for handling!

Attempted Innovations
Decision Making
Communications
Organizing
Appraising
Monitoring
Rewarding

Unleashing Our Capabilities: Changing the Way We Work

- Understanding Commitment
- Survey of American Workforce (1983).
 - Fewer than 25% say they are working at full potential.
 - 50% said they do not put effort into their job beyond what is required to keep it.
 - 75% said that that they could be significantly more effective on their job.
- Find out what rules might be encouraging these kinds of attitudes,

Reference:

Daniel Yankelovich & Associates, Work and Human Values New York: Public Agenda Foundation, 1983), pp. 6-7.

Cultural Change**Two Phases of Leadership Action to Change the Organizational Culture*****PLANNING**

- Examine history and culture
- Identify good & bad strategies
- Promote new vision and values
- Spread the gospel and check for converts

IMPLEMENTING

- Promulgate new values by **real behavior**
 - Associate with exemplars
 - Exemplars visible & elevated
 - Budget applied to new behavior
 - Keep varied pressure applied

* **A strategic purpose needed to make the change**

Unleashing Our Capabilities: Changing the Way We Work

- The key is leadership!
- Invent images, metaphors, and models that create new attention to purpose.
- Relate purpose to shared meanings and interpretations of reality by organization's culture.
- Acceptance of even the "best" idea is only as good as its ability to attract attention in the organization's culture.

Reference:

Warren Bennis and Burt Nanus, Leaders. Strategies for Taking Charge. Harper & Row, Publications Inc., New York, New York, 1985.

Cultural Change			
Role Emphasis Shifts			
CEO			
EARLY	75% Effort 25% Effort	Strategic Thinking Operations	
LATER	50% Effort 25% Effort 25% Effort	Strategic Activity Operations Linking Strategy & Operations (Institutionalizing Values)	

Unleashing Our Capabilities: Changing the Way We Work

Cultural Change

What is the .
Current DOD .
Culture? .

Unleashing Our Capabilities: Changing the Way We Work

- How would you characterize the DOD culture? (List).
- How unique is this list?
- Compare with success stories organizations -- apart from or part of this same culture.

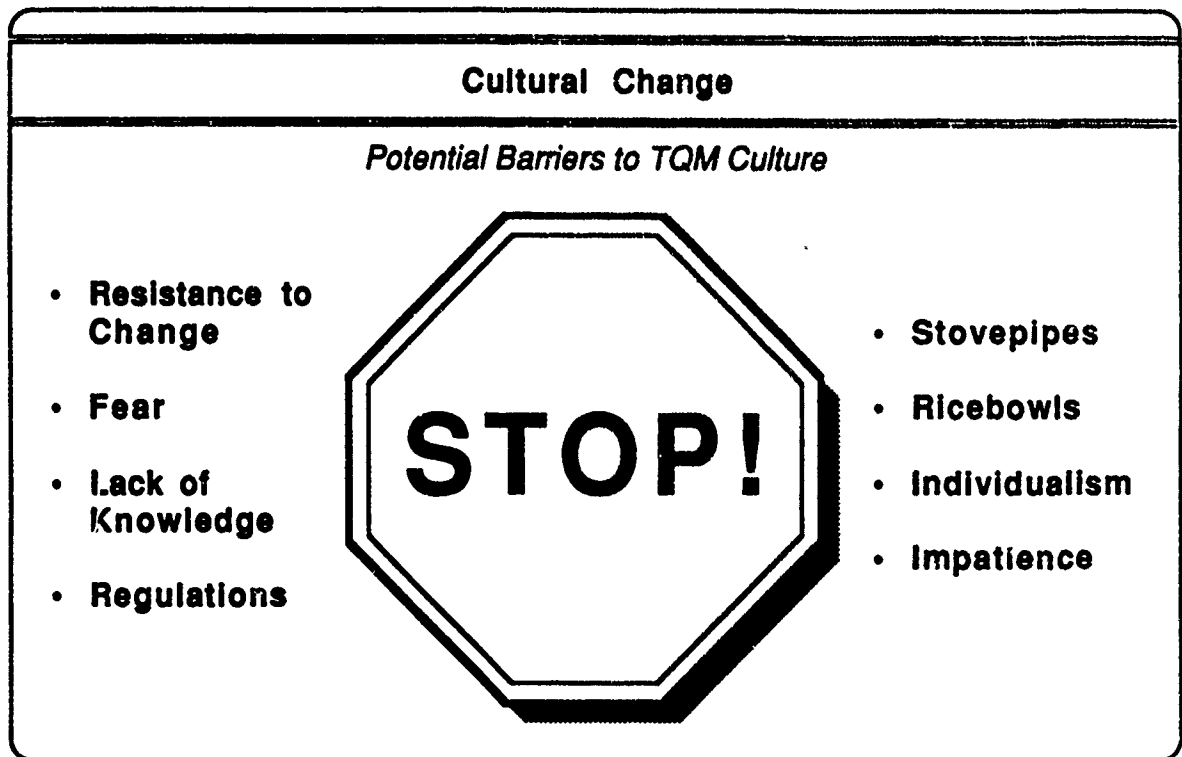
Cultural Change

The Change Process

**Cultural Transformation is
Evolutionary
and Revolutionary**

Unleashing Our Capabilities: Changing the Way We Work

- Cultural change is the process that will facilitate the transformation from the fundamental ways in which we manage and organize our people to a new philosophy – a TQM culture.
- Changing management habits of thought is the revolutionary part.
- The culture change process takes time -- the evolutionary part.
 - It won't happen over night, but will rather take years.
 - The change process begins at the top, with leadership setting the example.
 - The change begins with a few people and will eventually build throughout the organization.
 - A TQM culture will evolve over time.
- As people begin to see the benefits of a TQM approach, the evolution will become natural, rather than forced.



Unleashing Our Capabilities: Changing the Way We Work

The transformation to a TQM culture will involve long-term dedication and effort, with many barriers along the way, including:

- **Resistance to Change.** "People don't resist change, they resist being changed." A TQM culture cannot be created through:
 - Coercion
 - Fear
 - Authoritarian edict.
- **Fear.** Fear of taking a risk will stifle innovation, and fear of individual accountability for random (systemic) causes will hinder cooperation and teamwork.

(continued)

Unleashing Our Capabilities: Changing the Way We Work

- Lack of knowledge. Lack of knowledge about variation, and special and random causes of variation, can hinder management's ability to improve processes, and employee's ability to contribute to the improvement process.
- Regulations. Regulations may create a barrier to TQM culture. For example, regulations may impede innovation by requiring strict adherence to specifications, or loss of communication by restricting access to information.
- Stovepipes. A specialized function with little or no lateral communication.
- Ricebowls. Territorial battles adversely affect cooperation and teamwork by creating suboptimization, and detract from unification of effort towards common goals.
- Individualism. 'Rugged individualism,' like ricebowls, may detract from cooperation towards common goals.
- Impatience. Impatience and the resulting short-cuts and quick fixes, may contribute to short-term results at the expense of long-range goals.

Reference:

Brill, Peter, and Hayes, John; Taming Your Turmoil: Managing the Transitions of Adult Life. Prentice Hall, Inc., Englewood Cliffs, NJ, 1981.

Cultural Change

How Do Successful TQM Implementers Start?

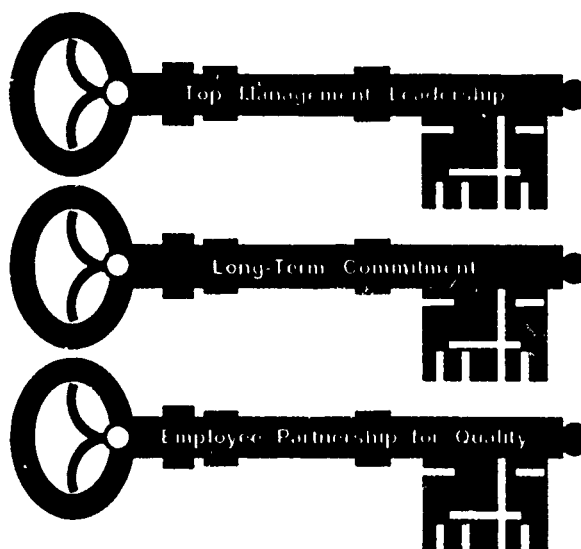
**"ALL IMPROVEMENT
IS MADE
PROJECT BY PROJECT
AND IN NO OTHER WAY"**

-- J. JURAN

Unleashing Our Capabilities: Changing the Way We Work

- Each project will reveal system-oriented issues needing improvement.
- The net result of many teams on projects, guided by quality goals, will be the transformation of the system.
- Incremental change is easier for the system to absorb.
- 70% of the problems that are "blamed" on higher authorities are actually solveable at one's *own level*, with one's own resources.
- "It does not matter when you start, as long as it is now."

-- W.E. Deming

Cultural Change*Critical Success Factors***Unleashing Our Capabilities: Changing the Way We Work**

Successful transformation to a TQM culture requires:

- **Top management leadership.** Top management must take the lead in creating an environment of cooperation and communication, innovation, trust, continuous process improvement, and pride of work. Only top leaders can eliminate fear and provide the constancy of purpose to initiate, promote, and sustain the change. Constancy of purpose will provide the roadmap for change. Managers must demonstrate their commitment to TQM and constancy of purpose in every action and word.
- **Long-Term Commitment.** Transformation to a quality culture takes time. It cannot be dictated but must be built into the organization as a way of life. Managers have the responsibility to provide a vision of the future, remain patient, and avoid short-term fixes. Vision unites TQM strategy and culture.

(continued)

3-15

Unleashing Our Capabilities: Changing the Way We Work

- Employee Partnership for Quality. The cultural change process requires teamwork – teamwork involving managers, supervisors, and employees. Teamwork will provide the vehicle for cooperation and communication, and total employee involvement in continuous process improvement. Employees must be provided with the knowledge of variation and process improvement so they can effectively contribute to the quality process.

Cultural Change

Thinking About Our Work

**IS
YOUR WORK
PRODUCTIVE
ALL THE
TIME?**

Unleashing Our Capabilities: Changing the Way We Work

- If you gauged what percentage of your work is productive, what would your estimate be?

_____ %

Cultural Change

Statistics on Work

10% Needed But Not Value Added

30% Rework

10% Not Needed

25% Not Working

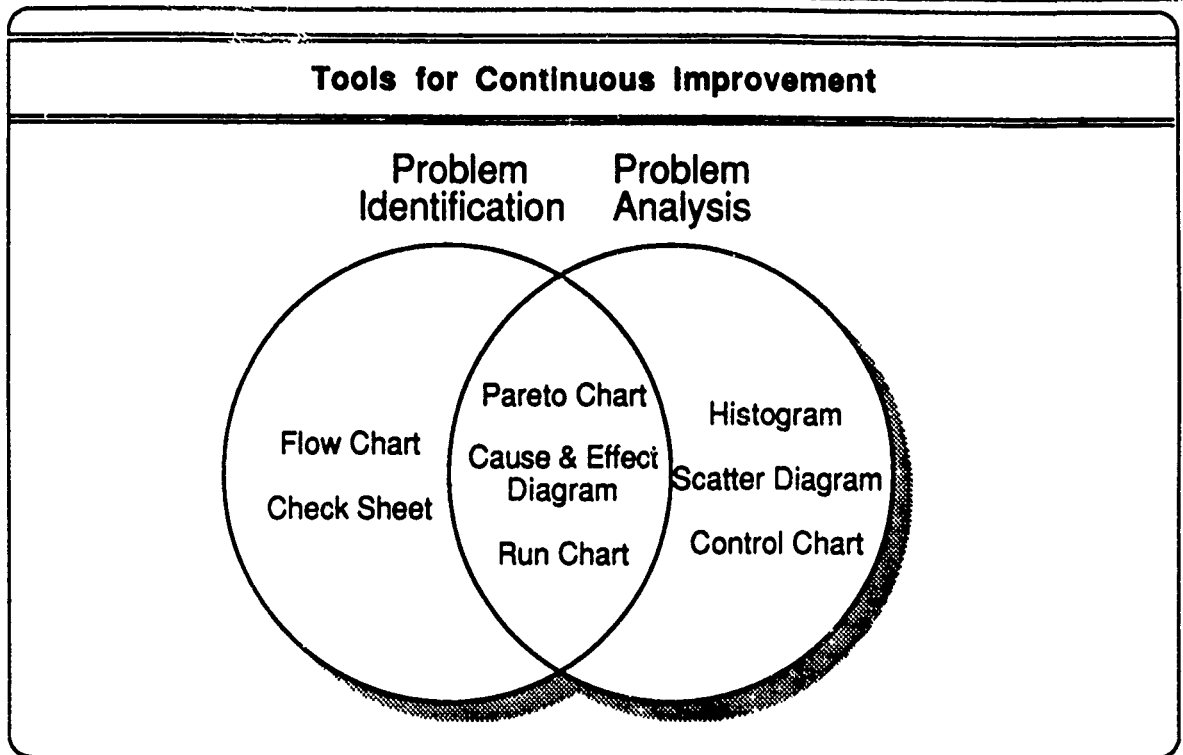
25% Value Added Work

Unleashing Our Capabilities: Changing the Way We Work

- Some of the not-needed work is due to system requirements.
 - Slow decision-making. Undelegated authorities.
 - Over layered organizational structure.
 - Too many reviewing parties.
 - Lack of integrated planning.
 - Multi-functional isolation.
 - Unclear work requirements.
 - Multiple taskers.
 - Poorly trained in work efforts.
 - Obsolete procedures, policies.
 - Serial work, many parties -- backlog.

Reference:

Quarterly Progress, July/Aug. 1989.



Unleashing Our Capabilities: Changing the Way We Work

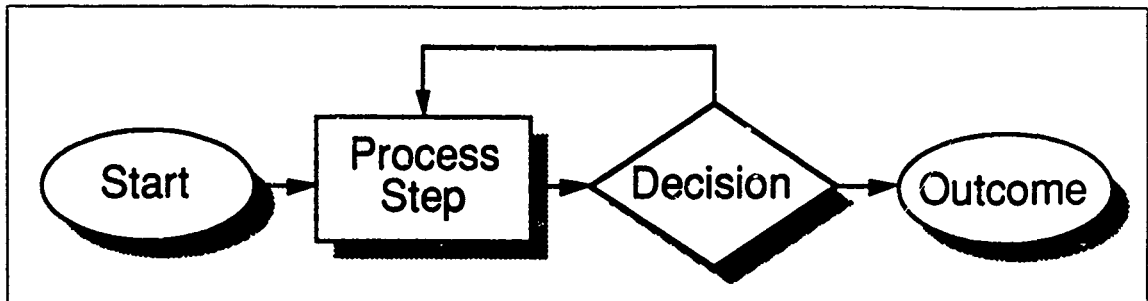
- *"People do not typically think their way into a new way of life; they normally act their way into a new way of thinking. TQM must employ quality tools, techniques, methods, and processes."* — Scott Sink
- TQM employs problem solving techniques which provide a rational, logical and organized way to:
 - Identify problem areas
 - Determine variation in a process
 - Monitor trends
 - Determine relative importance of problems to be solved
 - Monitor process improvements
 - Assess impacts.
- These tools provide the information necessary for data based decision making.

Unleashing Our Capabilities: Changing the Way We Work

- Note that some of the tools can be used for different purposes in the problem solving and continuous improvement process.

Reference:

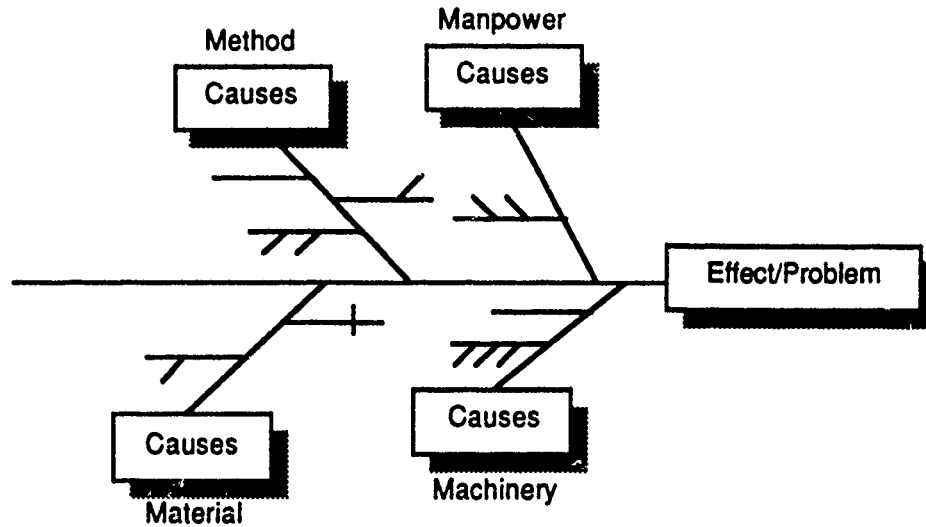
Sink, Scott, "TQM: The Next Frontier or Just Another Bandwagon to Jump On?", Quality Productivity and Management, Vol. 7, No. 2, Virginia Productivity Center, 1989.

Tools for Continuous Improvement*Flow Chart*

- Provides excellent documentation of a process
- Serves as a useful tool to examine relationships among process steps
- Uses recognizable symbols to represent the type of processing performed.

Unleashing Our Capabilities: Changing the Way We Work

- A flow chart is a pictorial representation of all the steps of a process for a product or service. A flow chart:
 - Provides excellent documentation of a process
 - Serves as a useful tool to examine relationships among process steps
 - Uses recognizable symbols to represent the type of processing performed.
- Flow charting is used to:
 - Document the ideal system (steps a process should follow if everything worked right)
 - Compare actual system with ideal system to identify problem areas.

Tools for Continuous Improvement*Cause-and-Effect Diagram***Unleashing Our Capabilities: Changing the Way We Work**

- The Cause and Effect diagram, also called the fishbone diagram, clearly illustrates the relationship between some effect and the possible 'causes' influencing it.
- Causes may be summarized into categories to help organize the analysis, such as:
 - Manpower, machines, methods, materials
 - Policies, procedures, people, plant (for administrative areas)
 - Any major categories that emerge.
- The cause and effect diagram is used to:
 - Define best of all possible causes of a problem
 - Discriminate between causes and symptoms
 - Identify and select causes for further analysis.

Tools for Continuous Improvement

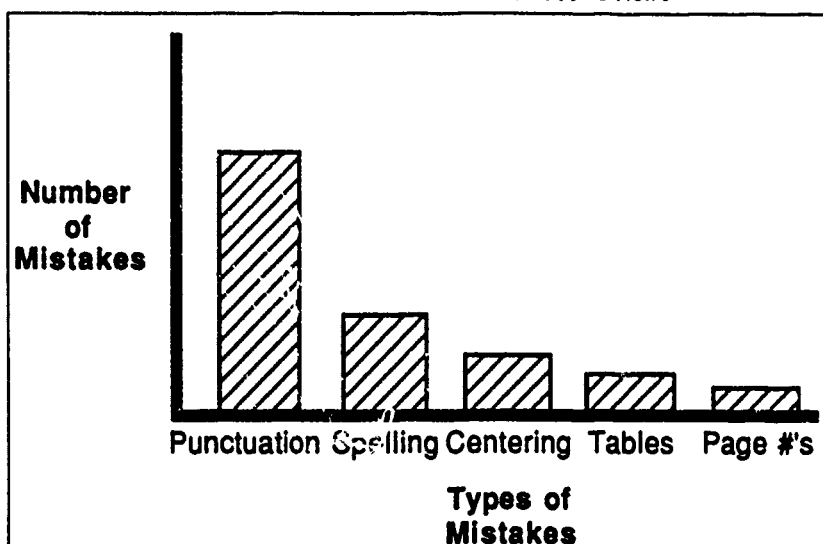
Check Sheet

Mistake	March			Total
	1	2	3	
Centering			≡	9
Spelling	≡	≡ ≡	≡	23
Punctuation	≡ ≡	≡ ≡	≡ ≡	35
	18	25	24	67

Unleashing Our Capabilities: Changing the Way We Work

- Check sheets use a simple form to answer the question:

"How often are certain events occurring?"
- The use of check sheets begins the process of translating opinion/intuition into data/facts, thus providing data for decision making.

Tools for Continuous Improvement*Pareto Chart*

- Prioritize problems
- Analyze different groupings of data
- Measure impact of changes
- Break down broad causes into subcauses

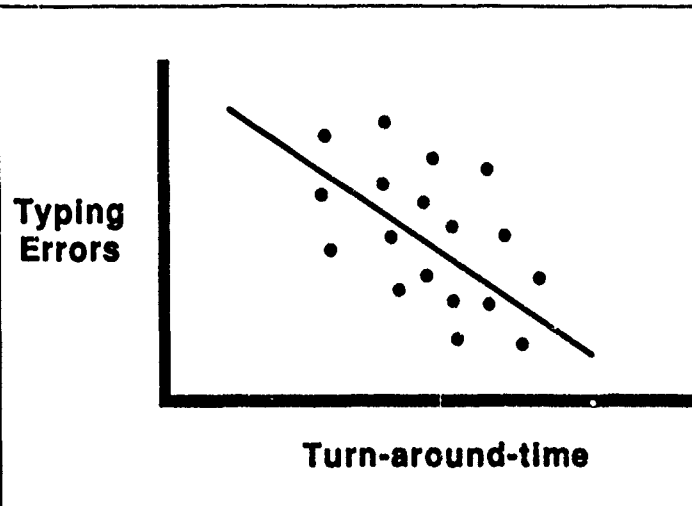
Unleashing Our Capabilities: Changing the Way We Work

- The Pareto Chart is a special form of a vertical bar graph which displays the relative importance of all problems or conditions.
- The chart is constructed using data from a check sheet, brainstorming, or other data collection instrument.
- A Pareto chart is used to:
 - Prioritize problems, i.e. to identify which problems require the most attention through the use of different measurement scales, e.g. frequency, cost, etc. Remember, the most frequent problems are not always the most costly. In our example above, we constructed a Pareto Chart from the data found in the check sheet to prioritize the problems.
 - Analyze different groupings of data (e.g. by product, machine, shift).

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Unleashing Our Capabilities: Changing the Way We Work

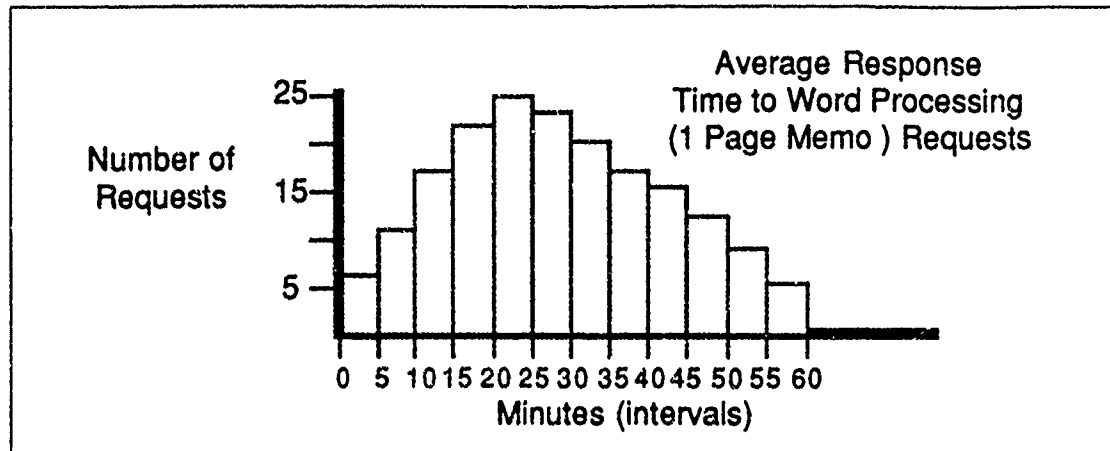
- Measure impact of changes made in a process, i.e. before and after comparisons. After improving our word processing process, we could compare the results with our original chart above.
- Break down broad causes into subcauses. The purpose here is to find the real causes, so you can cure the cause, not the symptom.

Tools for Continuous Improvement*Scatter Diagram*

- Used to study the possible relationship between one variable and another.
- Tests for possible cause and effect relationships.

Unleashing Our Capabilities: Changing the Way We Work

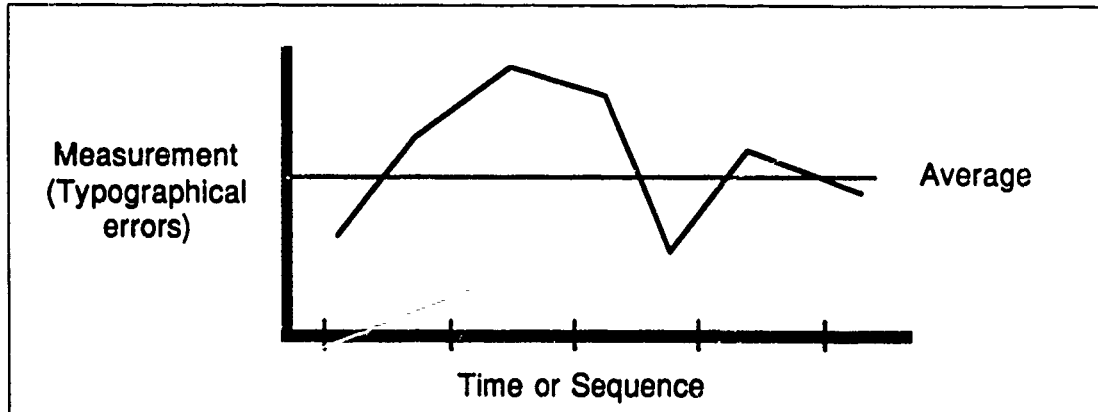
- A Scatter Diagram is used to study the possible relationship between one variable and another.
 - It tests for possible cause and effect relationships.
 - It cannot prove that one variable causes the other, but can demonstrate a relationship, and the strength of the relationship.
- The above example demonstrates a relationship between turn-around-time (cause) and typing errors (effect).

Tools for Continuous Improvement*Histogram*

- Reveals the amount and distribution of variation within a process.

Unleashing Our Capabilities: Changing the Way We Work

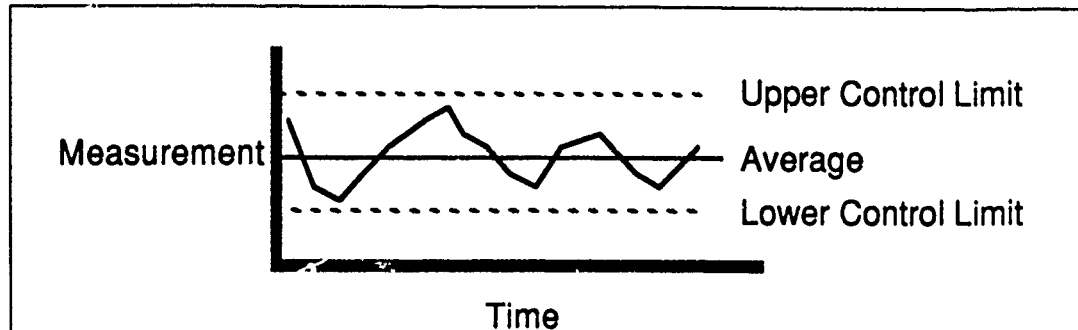
- A Histogram, like the Pareto Chart, is a special form of a bar graph which shows frequency distribution.
 - Pareto Chart deals only with characteristics of a production service (e.g. type of defect, problem, safety hazards, etc.)
 - Histogram displays the distribution of measurement data (e.g. temperature, dimensions, etc.)
- The histogram is used to reveal the amount and distribution of variation within a process.

Tools for Continuous Improvement*Run Chart*

- Illustrate trends over time
- Understand basic characteristics of a process
- Focus attention on truly vital changes in the system.

Unleashing Our Capabilities: Changing the Way We Work

- The Run Chart is a simple chart of process measurements graphed over time, with an average plotted.
- This type of chart is used to:
 - Illustrate trends over time
 - Understand basic characteristics of a process
 - Focus attention on truly vital changes in the system.

Tools for Continuous Improvement*Control Chart*

- Determine sources of variation
 - Common causes
 - Special causes
- Determine control/stability of system.

Unleashing Our Capabilities: Changing the Way We Work

- The Control Chart is a Run Chart with statistically calculated upper and lower control limits plotted (upper control limits (UCL) and lower control limits (LCL)). The limits are calculated by running a process untouched, taking samples, and plugging the sample average into the appropriate formula.
- A Control Chart is used to determine how much variation is in a process, and the causes.
 - Common Causes - the fluctuation of the points within the system (e.g. design, choice of machine, supply, etc.). Common causes can only be affected by changing the system.
 - Special Cause - Points outside the limits (e.g. people errors, accidents, etc.).

(continued)

Unleashing Our Capabilities: Changing the Way We Work

- A system is in statistical process control (SPC) if there are no special causes. Control doesn't necessarily guarantee the desired results, it only means the process is consistent (could be consistently bad).
- if a system is in control, but not capable of meeting specifications limits, then management must:
 - Improve the process
 - Renegotiate the specifications.
- Remember:
 - Control limits are data made (what the process is able to do)
 - Specifications are man made (what the process should do – customer requirements).

Tools for Continuous Improvement

Flow Charts	→ Document actual and ideal path
Cause and Effect Diagram	→ Explore causes
Check Sheet	→ Gather data based on observation
Pareto Chart	→ Display relative importance
Scatter Diagram	→ Test themes of relationships
Histogram	→ Display distribution of data
Run Chart	→ Display simple trends over time
Control Chart	→ Determine common and special variation in a process

Unleashing Our Capabilities: Changing the Way We Work

- The tools provide the information for managers to make data based decisions for continuous improvements.

Exercise 2

***Interpreting Statistical
Process Control Charts***

Exercise 2: Interpreting Statistical Process Control Charts

Objective: Upon completion of this exercise, participants will be able to interpret statistical process control charts.

Time: 15 minutes.

Players: Discussion groups of 2-3 participants.

Materials: Exercise worksheets.

Situation: You are the comptroller of an organization. Customers have been complaining about the time it takes to process purchase authorization requests for non-budgeted items more than \$300. In an effort to meet the needs of your customers, you have decided to improve the purchase request approval process.

You decide to study the process for three months, and then take action accordingly. Consider the following cases:

- Case 1 – Purchase Authorization Requests must be processed within 3 days
- Case 2 – Purchase Authorization Requests must be processed within 2 days
- Case 3 – Purchase Authorization Requests must be processed within 6 days.

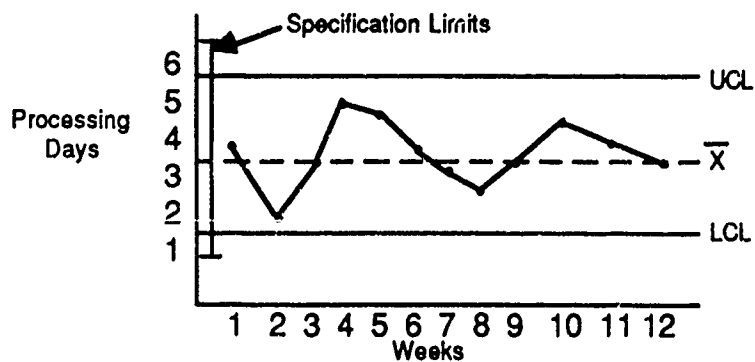
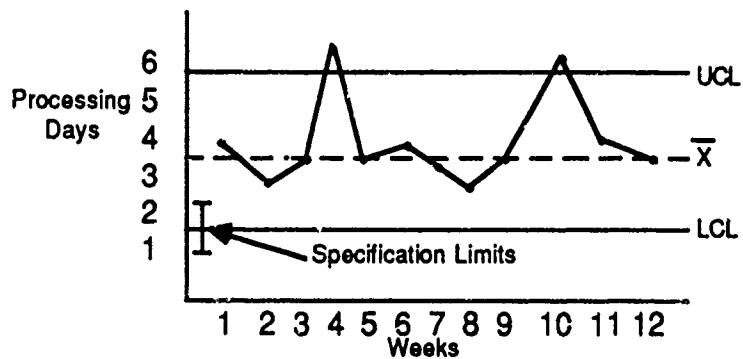
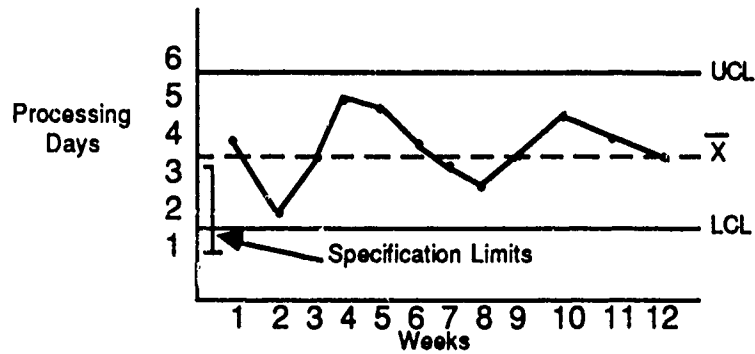
For each case, you work with your employees to develop a control chart which plots the number of days to process a purchase requisition for each week. You calculate the upper and lower control limits for the system. These limits, along with the specification limits (customer requirements), are placed on each chart. It is the end of three months, and you as the comptroller must determine how the performance of the process will be improved.

Exercise 2: Interpreting Statistical Process Control Charts

***Discussion
Questions***

- For each case:
 - What are the types of variation (common, special)?
 - Is the system in control?
 - Is the system capable of meeting the specification?
 - What action should management take?
- What are typical causes of common variation in a paper processing system?

Exercise 2: Interpreting Statistical Process Control Charts Worksheet



Total Quality Management Implementation*Quality Management Boards (QMBs)*

- Include a senior member
- Identify improvement opportunities and issue areas
- Are responsible for changing processes when change is needed
- Remove barriers
- Establish Process Action Teams (PATs) and facilitate progress
- Provide TQM leadership.

Unleashing Our Capabilities: Changing the Way We Work

- Quality Management Boards (QMBs) include a senior member. Members are appointed based on issue area expertise and responsibility.
- The QMBs at each level identify improvement opportunities and issue areas. QMB members have the responsibility and authority to change processes when change is needed.
- The functions of QMBs are:
 - Identify processes in assigned issue area
 - Prioritize processes by improvement potential
 - Analyze and change processes when change is needed
 - Remove barriers
 - Establish Process Action Teams (PATs) when appropriate
 - Facilitate progress of PATs
 - Initiate action on problems referred by PATs
 - Provide TQM leadership.

Total Quality Management Implementation

Process Action Teams (PATs)

- PATs will be formed to deal with specific process problems and to resolve issues.
- Roles of QMBs and PATs are complementary.
- QMBs focus on more permanent and larger issues.
- Involving many people in the improvement process is critical to making the QMB/PAT structure work.

Unleashing Our Capabilities: Changing the Way We Work

- Process Action Teams (PATs) will be formed to deal with specific process problems and to resolve issues.
- The roles of the QMB and PATs are complementary. QMBs are focused on more permanent and larger issues than those addressed by PATs. Involving many people in the improvement process is critical to making the QMB/PAT structure work.

Unleashing Our Capabilities: Changing the Way We Work**QUALITY MANAGEMENT BOARDS (QMBs) AND TQM PRINCIPALS***

- Translate goals to tangible internal initiatives
- Remove barriers
- Establish and facilitate progress of QMBs
- Set guidelines for TQM implementation
- Set reward/recognition guidelines
- Take action on unresolved process problems referred by QMBs
- Serve on QMBs as designated
- Provide TQM leadership:
 - Demonstrate as a group
 - Demonstrate as individuals
- Actively support TQM
- Generate new ideas
- Encourage productivity and quality changes
- Manage the design of TQM
- Oversee the implementation of TQM
- Continue to the whole organization the importance of TQM
- Provide a liaison with labor unions and other interested organization to ensure process success
- Interface with and support middle management
- Help establish and maintain atmosphere for employee participation
- Assume advocacy role in cultural change process.

PROCESS ACTION TEAMS (PATs)

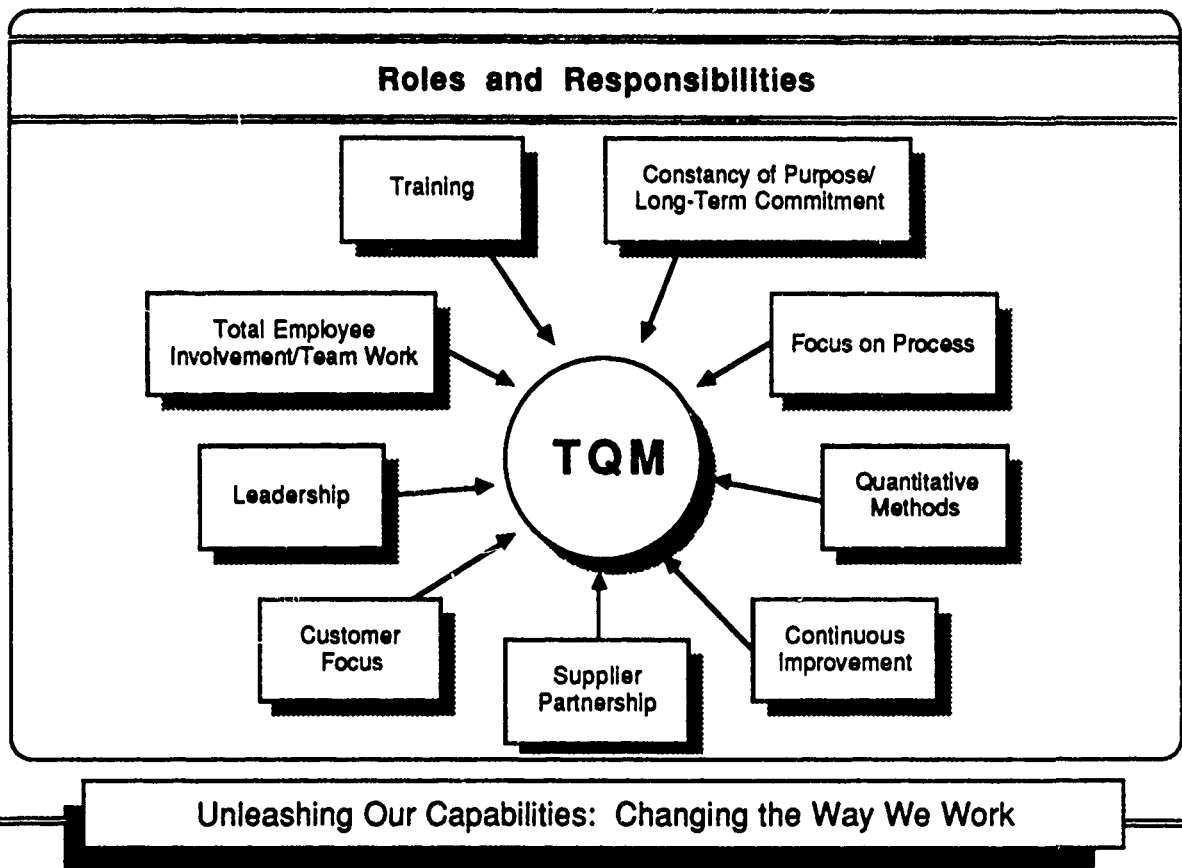
- Identify/remove barriers
- Develop practical process improvements
- Install solutions and measurement systems for process control and feedback to QMB
- Recommend to QMB solutions to problems beyond PAT's ability to implement
- Dissolve upon completion of work
- Play key/leadership role in TQM process
- Recognize and understand role in the continuum of communication from the top and working levels of the organization
- Display visible commitment to the TQM process
- Generate ideas for process improvement to gain improved productivity
- Interface with and support productivity principals
- Work effectively as team member and team leader.

*representative of the Senior Quality Management Board at the Secretariate level.

Unleashing Our Capabilities: Changing the Way We Work

**MIDDLE MANAGEMENT, SUPERVISORS,
AND OTHER MILITARY AND CIVILIAN PERSONNEL**

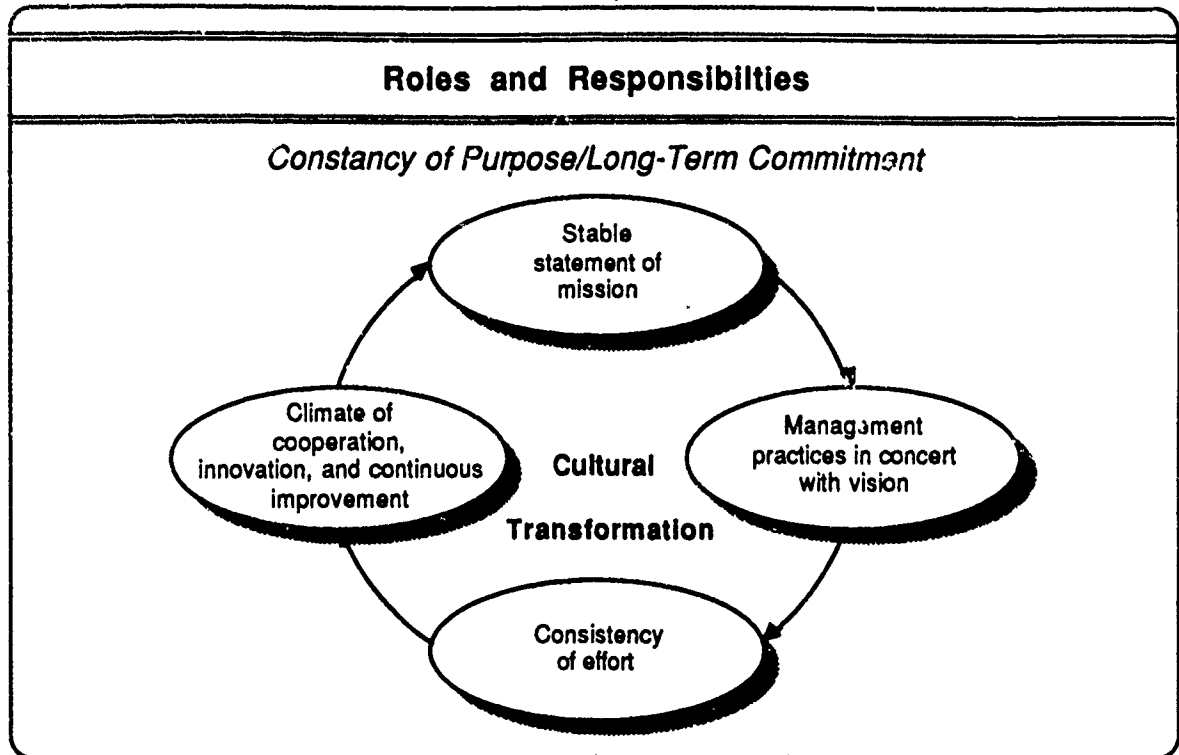
- Play key/leadership role in TQM process
- Recognize and understand role in the continuum of communication from the top and working levels of the organization
- Display visible commitment to the TQM process
- Generate ideas for process improvement to gain improved productivity
- Interface with and support productivity principals
- Work effectively as team member and team leader.



The implementation of all of the elements of TQM in the DOD is a shared responsibility among:

- Executive Steering Group
- Senior managers (at command and facility level)
- Quality Management Boards (QMBs)
- TQM Principals
- Process Action Teams (PATs)
- Middle managers and supervisors
- All employees.

This section describes the roles and responsibilities within each of the TQM elements.



Unleashing Our Capabilities: Changing the Way We Work

The Executive Steering Group and Senior managers are solely responsible for producing, communicating, and maintaining a common purpose.

- Management must clearly communicate the mission of the organization to all employees, suppliers, and customers.
- Management's actions must support the mission at all times to define the commitment and establish the priority and truth of the mission.
- Constancy of purpose focuses work efforts, providing cooperation towards common purposes, innovation to continually strive towards the vision, and continuous improvement.
- It is management's responsibility to ensure a constancy of purpose and a commitment to long term gain through their leadership. They must also be patient, avoiding 'quick-fixes' that provide short-term results at the expense of long-term gain.

Roles and Responsibilities

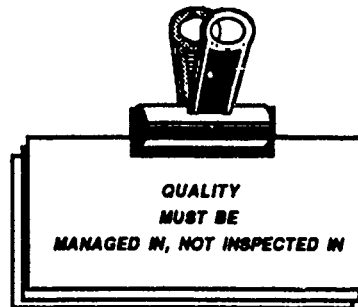
Questions for Leaders

- Do you know **what** will make your customers want your product or service?
- What is the variability of these data?
- Do you know what will make your employees want to work?
- What is the process by which these data were gathered?
- How would you get answers to these questions?

Unleashing Our Capabilities: Changing the Way We Work

Roles and Responsibilities

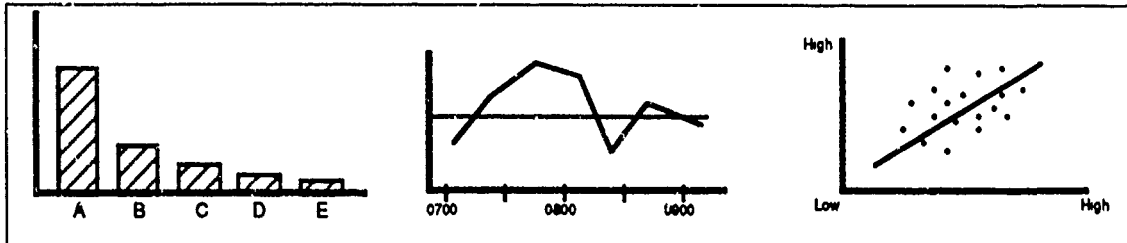
Focus on Process



- Senior management must focus on the processes by which work gets done.
- The mentality of the manager will shift from an emphasis on the "bottom line" to a focus on process improvement.

Unleashing Our Capabilities: Changing the Way We Work

- Senior management must focus on the processes by which work gets done.
- It is the responsibility of senior managers to move away from the management of results philosophy practiced today, to a quality management philosophy.
- The mentality of the manager will shift from an emphasis on the "bottom line" to a focus on process improvement.

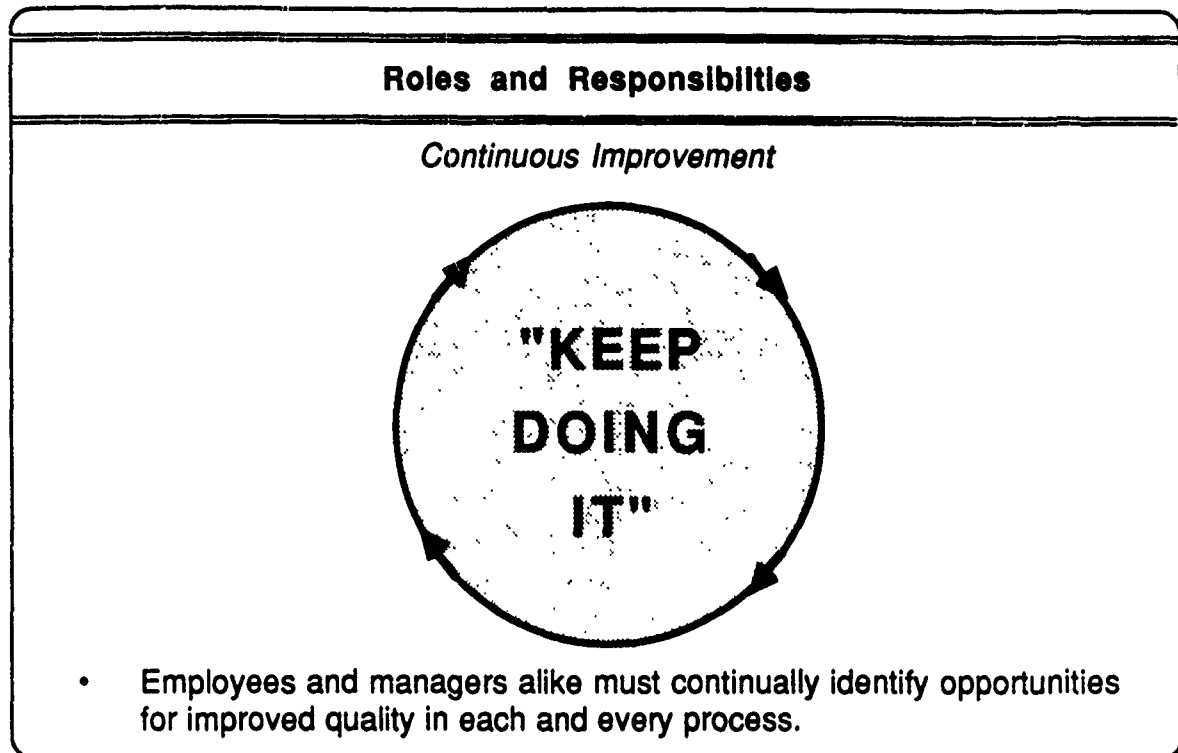
Roles and Responsibilities*Quantitative Methods*

- It is everyone's responsibility to scientifically study and improve work processes.
- Executive Steering Group for TQM is responsible for identification of issue areas. (Executive Steering Group for DOD not yet formed).
- Quality Management Boards are responsible for identification of improvement opportunities.
- Process Action Teams are responsible for process improvement.

Unleashing Our Capabilities: Changing the Way We Work

It is everyone's responsibility to scientifically study and improve work processes. Managers, however, are ultimately responsible for the performance of a process.

- To study and improve a process, both managers and employees must understand:
 - The concept of variation in a process, and the common and special causes of variation.
 - Quantitative methods and how to apply them to control and analyze processes for improvement.
- The Executive Steering Group for TQM is responsible for identification of issue areas.
- Quality Management Boards (QMBs) are responsible for identification of improvement opportunities.
- Process Action Teams (PATs) are responsible for process improvement.



Unleashing Our Capabilities: Changing the Way We Work

Continuous improvement is everybody's responsibility.

- Quality management is the improvement of all of the processes that determine the quality of the product -- the improvement of every requirement process, every design process, every development process, every manufacturing process, every quality assurance process, and every paperwork and administrative process.
- Employees and managers alike must continually identify opportunities for improved quality in each and every process.
- Senior managers must provide the environment for continual improvement.

Roles and Responsibilities*Leadership*

The Executive Steering Group and Senior Management are responsible for providing leadership.

- Creating a quality culture is a result of a long-term commitment.
- Leaders must drive out fear.
- Top-level leaders must accept the challenge.

Unleashing Our Capabilities: Changing the Way We Work

The Executive Steering Group and Senior Management must be responsible for providing leadership to improve the system through effective communication and team building.

- Creating a quality culture is a result of a long-term commitment to TQM, and can be achieved only through leadership towards a long range vision.
- Leaders must drive out fear to promote innovation, risk-taking, pride in workmanship, and continuous improvement.
- Top-level leaders need to accept the challenge and take the lead in establishing a culture for change.
- This leadership challenge includes commitment and active involvement in speech and action. The role of the leader is to lead through example everyday, with more than just "lip service."

Roles and Responsibilities*Total Employee Involvement/Teamwork*

- Quality management requires both individual contribution and team effort.
- Senior Management has the responsibility to establish teaming structures in a linking pin arrangement to top management and establish a climate of trust.
- Senior Management must also establish a culture of trust.
- Senior and Middle Management must work together to achieve cross-functional goals.
- Employees are the ones actively involved in the processes.

Unleashing Our Capabilities: Changing the Way We Work

Under the leadership of senior managers, all employees are involved in the continuous improvement process.

- Employees are the ones actively involved in the processes, and have the responsibility to study and recommend solutions in the processes.
- Senior and Middle Management must work together to achieve cross-functional goals such as quality, cost, schedule, mission need, and suitability, to foster a win-win situation. This is in direct conflict with the functional organization and responsibility found in management by results, which creates suboptimization.
- Senior Management has the responsibility to establish teaming structures in a linking pin arrangement to top management

(continued)

Roles and Responsibilities

Training

- Senior and middle managers are responsible for:
 - Identifying training needs
 - Fostering an environment that values training and education.

Unleashing Our Capabilities: Changing the Way We Work

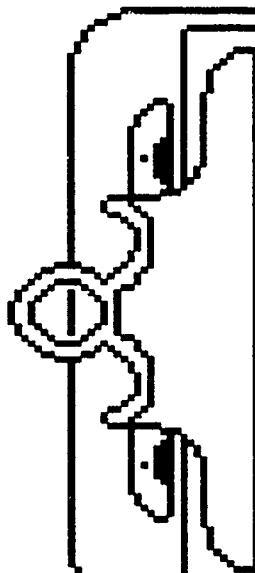
An investment in quality management requires an investment in people.

- Everyone is responsible for educating themselves by reading and seeking training on statistical process control, variation, team building, and other quality concepts and quality management techniques.
- Senior and middle managers are responsible for identifying training needs, providing training opportunities, and supporting employee education and development.

MODULE FOUR

CREATING THE FUTURE:
THE NEW WORK CHALLENGE IN TQM

Module 4 Objectives



Upon completion of this module, the participants will be able to:

- Recognize the challenge of utilizing TQM to build and sustain a culture committed to continuous improvement
- Explain how TQM is the vehicle for guiding the Department of Defense into the future
- Identify sources for continued education on TQM principles and skills.

Creating the Future: The New Work Challenge in TQM

Module 4

- Leadership Challenges
- Exercise
- Course/Instructor Evaluations

Creating the Future: The New Work Challenge in TQM

Leadership Challenges for DOD

- Drive out fear.
- Cultivate passionate commitment to customers.
- Continue education on TQM.
- Foster atmosphere that accepts change.
- Change practices and procedures which impede TQM culture.

Creating the Future: The New Work Challenge in TQM

Recommendations for Change in DOD

Your Top 3!

What needs to be changed?

Why?

Benefits!

- 1 _____
- 2 _____
- 3 _____

Your input will be given to DOD Leadership

Creating the Future: The New Work Challenge in TQM

- Make recommendations substantive! Be specific.
- Give it some thought.
- Compare your recommendations with those of your group and identify top needs for change.

Recommendations for Change in DOD

Recommendations for how you will change things in your area of influence.

Your Top 3!

What needs to be changed?

Why?

Benefits!

- 1 _____
- 2 _____
- 3 _____

Creating the Future: The New Work Challenge in TQM

- Make recommendations substantive! Be specific.
- Give it some thought.
- Compare recommendations within your group and identify the top ten.

Making It Happen

- Start within your area of influence.
- Improve one small project at a time.
- Focus on making your work processes consistent.
- Encourage your people to think process improvement.
- Live in a glass house; provide example.
- Be patient, persuasive, and persistent.
- Advertise successes and share your knowledge.

Creating the Future: The New Work Challenge in TQM

- There is no limit to what can be accomplished if it doesn't matter who gets the credit.

What Next? Initial Personal Steps

- Learn TQM principles, practices, and tools.
- Seek TQM training.
- Seek expert advice on appropriate training resources.
- Follow a top-down approach -- senior-level managers must understand the TQM concepts before directing subordinates to apply specific techniques.
- Develop an implementation strategy -- plan a phased-in approach with timely education and training to avoid false starts.

Creating the Future: The New Work Challenge in TQM

- Incorporate TQM concepts and principles into existing technical and professional development courses.
- Take initiative to implement TQM into your everyday tasks.
 - It increases productivity, builds satisfaction with people you interface with.
- Dialogue with contractors and vendors -- show DOD is serious about TQM.

Making It Happen

A Seven-Step Model
(Adaptation of Florida Power and Light Approach)

Reason for Improvement

Current Situation

Analysis

Countermeasures

Results

Standardization

Future Plans

Creating the Future: The New Work Challenge in TQM

Florida Power and Light (FPL) – winner of the Malcolm Baldrige National Quality Award and the first U.S. company to win Japan's coveted DEMING AWARD for quality improvement.

FPL's GUIDING PRINCIPLES:

- Respect for people
- Customer satisfaction
- Management by facts
- Majority of problems are under management's control
- Process must be stressed
- People doing work can solve problems.

Making It Happen

REASON FOR IMPROVEMENT

- Identify area of emphasis and the reasons for working on it.
- Key activities:
 - Survey internal/external customers.
 - Interview individuals from the work area.
 - Describe the procedure used in the area.
- Techniques:
 - Process flow chart
 - Graphing
 - Control chart
- Level: Executive Steering Committee (ESC)

Creating the Future: The New Work Challenge in TQM

Making it Happen

Current Situation

- Select a specific process within the area of emphasis
- Key Activities
 - Collect detailed data
 - Write a clear problem statement
 - Establish target schedules and goals
 - Establish Process Action Team (PAT)
- Techniques
 - Histograms
 - Checksheets
 - Pareto charts
- Level: Quality Management Board (QMB)

Creating the Future: The New Work Challenge in TQM

Making it Happen

ANALYSIS

- Identify and verify root cause of problem
- Key activities
 - Cause and effect analysis
 - Internal/external factor analysis
- Techniques
 - Flow charting
 - Cause and effect diagram (fishbone)
- Level: Process Action Team (PAT)

Creating the Future: The New Work Challenge in TQM

Making it Happen

COUNTERMEASURES

- Implement test countermeasures to correct problem
- Key Activities
 - Develop test plan
 - Provide process training prior to evaluation
 - Evaluate new process
 - Statistical measures
 - Guard against uniqueness (Hawthorne effect)
 - Encourage feed-back
 - Conduct review
 - Is process better?
 - How does new process interface with other processes in system?
 - Sub-optimizing
 - Cost/benefit
- Techniques
 - Cost/benefit analysis
 - Flowcharting
 - Action planning
- Level: QMB and PAT

Creating the Future: The New Work Challenge in TQM

Making it Happen

Results

- Confirm that new process solves problem and can be implemented
- Key Activities
 - Comparative analysis
 - - old process vs. new
 - Project full-scale implementation
 - Training requirements identified
 - Training before implementation
- Techniques
 - Training needs analysis
 - Implementation schedule
- Level: ESC, QMB, and PAT

Creating the Future: The New Work Challenge in TQM

Making It Happen

Standardization

- Implementation of new process
- Key Activities
 - Conduct training
 - Establish implementation schedule
 - Publish applicable procedures/guidance
 - Provide for feedback
- Techniques
 - Implementation scheduling
 - Evaluation design
- Level: QMB and PAT

Creating the Future: The New Work Challenge in TQM

APPENDIX A

SUCCESS STORIES

Quality Improvement: Top Priority

*Remarks by Thomas J. Murrin
to the Department of Defense
at the Pentagon, June 29, 1989*

*Mr. Murrin is Chairman of the Defense Manufacturing Board
and Deputy Secretary of the U.S. Department of Commerce.*

*In 1987 he retired from Westinghouse Electric Corporation, where he was
President of the Energy and Advanced Technology business group, including Defense Systems.*

My message is simple and specific.

Out of all the things a manager can do — out of all the priorities we set as managers — quality improvement can and should be given top priority. Virtually everything that we need to achieve will benefit greatly from quality improvement.

Several years ago, after I was promoted to a challenging Group President position at Westinghouse, I pondered for some time where I should concentrate my leadership efforts. As you know, a senior manager is faced with a myriad of matters: the need for cost and expense reductions, evaluations of optimum levels of R&D, capital investments, and marketing; people and public relations, mergers, acquisitions, divestitures, and many others — a long list.

Senior managers face many concerns. A 36-year business career teaches that quality improvement can, and should, be the foremost.

I was very mindful of the customer surveys that increasingly put quality as a top demand. I was mindful of the PIMS studies which convincingly indicated that high quality correlated with business success. I had been visiting and studying Japan since 1964 — and I was stimulated by their commitment to world-class quality products and services, and the remarkable progress they were making.

I also was mindful — very frankly — that when I first became responsible for Westinghouse's Defense activities in 1967, I inherited several DoD programs that had serious quality and performance problems. This required that I spend most of the next several years — about 70% of my time, in 100-hour weeks — leading efforts to solve those problems. In addition to being costly, stressful, and very embarrassing, it was almost impossible to find the time and the resources to work on long-range improvements during that period. I vowed never again to suffer through such an experience.

So after all those deliberations, I decided to make quality improvement the top-priority goal for our organization. And I set out to promote it and popularize it.

Quality is sometimes deceptively difficult to define, so we asked a group of our brightest people to propose a definition. They did this wonderfully well. That definition first became a slogan and, over time, a top-priority commitment. It is simply stated as follows:

"Quality is doing the right thing right the first time."

I would ask you to remember — and ponder — the implications of you and your people doing the right thing right the first time. It sounds very simple! But it can have a profoundly positive effect.

With the Monday-morning perspective that a 36-year business career can provide, I am now convinced that quality improvement can and must be the number one priority. It's the only process I've ever been involved in that simultaneously satisfies customers, motivates employees, stimulates suppliers, comforts investors, and — on occasion — even brings favorable media coverage. Therefore, I urge you to play a lead role in quality improvement.

Quality improvement can help make our defense systems affordable — and enable you to do many of the things you need to do, despite budget constraints. Joe Juran, the quality consultant, has said that if DoD put a really effective quality program in place, it would solve many of the Department's budget problems. Of course, one could be skeptical of Dr. Juran's opinion. He makes money selling quality programs.

But I believe Joe is right. So I'm going to show you evidence of tremendous cost savings and performance improvements in defense systems as the result of quality improvement.

- I also know that you want more reliability in your weapons systems — and reliability in the work your people do. So we'll see how quality drives reliability.

- I know that you want innovation, to assure a technology advantage over the enemy. We'll see how quality improvement drives technology improvement — because when the goal is to get better constantly, it forces people to innovate.

- I expect that you like to be spoken of in favorable terms in the press and by the public. The best way to do that is by giving the media good things to say about us. And I'll hopefully show you how quality improvement can help you do that.

Additionally — and most important:

- I know that you want to keep our United States the strongest and most secure nation. Without getting too melodramatic, I want to suggest what's at stake here, before we go on.

The number one power has to play two "Super Bowls" at once: military and economic. So far, no one has been able to win both over the long run. But with quality improvement, you start to do things that couldn't be done.

What is at stake, in my judgment, is the security of our United States. And that security is now being challenged on two fronts: relative to our military capabilities, and relative to our industrial base.

The way I like to put it is that we're engaged in two simultaneous super-Super Bowls: our military competition, particularly with the Soviet Union, and our economic competition with other nations — particularly with Japan.

In his insightful book *The Rise and Fall of the Great Powers*, Professor Paul Kennedy traces 500 years of history — from 1500 AD to the present — to show that these two competitions are interdependent. Kennedy writes:

"All of the major shifts in the world's military-power balances have followed alterations in the productive balances ... [This] has been confirmed by the outcomes of the Great Power wars, where victory has always gone to the side with the greatest material resources."

First the industrial economy rises or falls, then come the military consequences. Professor Kennedy shows the same pattern again and again — with the Habsburgs, the Portuguese, the Spanish, the French, the British Empire — and in the last chapter, speculates about our United States and its future.

It's hard for the number one power to stay on top. That nation has the dual burden of keeping up its lead in productive capacity, as well as honoring a set of security commitments that tend to be more extensive than those of other

nations. In the early years of this century, when we were building up our manufacturing power, we didn't have the security commitments we have now. But now, as I said, we're in two super-Super Bowls at the same time. And so far — as Professor Kennedy points out — no one's been able to play them both and win them both, over an extended period.

Quality improvement can be one way out of this dilemma — for many reasons, including that when you constantly improve quality, you enable yourself to do things that couldn't be done before. You lift yourself and your people to a much higher level of performance.

A second reason is that our main industrial competitor is Japan — and Japan's been beating us largely with quality. Quality products; quality in their work processes. Unless we match them on quality, we cannot compete with them over the long haul.

The issue has gotten more critical lately, because Japan is moving into defense developments in a significant way. In my own contacts with that nation, I saw private business projections several years ago that were based on Japan's devoting up to 3% to 4% of their GNP to defense. That's now being acknowledged in the business press. Some discerning people believe that they may soon go beyond their voluntary 1%-of-GNP cap on defense systems — both for their own use, and for export.

DoD is the key. It is the single largest employer in the country, and the single largest customer of American manufacturers.

It's vital for you to take on the quality challenge, because the Department of Defense is where the two Super Bowls converge. Not only are you in charge of military operations, you are the single largest employer in the country — and the single largest customer of American manufacturers. According to recent data, 11 per cent of U.S. manufacturing output goes to the Department of Defense.

The way that you do business — and the kinds of demands that you place on your suppliers — can greatly improve the productive capacity of this country. It can also ensure a stronger defense.

That's enough preamble. Let me show you a few examples of what's possible with a real commitment to quality improvement.

The examples I'm going to use happen to be from Westinghouse, simply because Westinghouse is what I've been familiar with. They could be — and should be — from any number of aerospace and defense contractors.

Let's start with a brief Corporate overview. Westinghouse Electric today is a profitable, \$12 billion-sales-per-year company. But in the 1970s, they took some big hits to their core businesses — especially in electric power generation, where the demand for new capacity dropped practically to zero. They had to undergo some severe restructuring. Fortunately, though, the company did more than portfolio-shuffling and belt-tightening.

Reshuffling and belt-tightening are not enough. You need to commit to 'doing the right thing right the first time'... and to constantly getting better at it.

In 1979, Westinghouse made a top-level, top-priority corporate commitment to quality improvement. Over the next eight years, several hundred million dollars were invested in quality and productivity improvement. In 1981, for example, Westinghouse formed a corporate Productivity and Quality Center and appointed an Executive VP for Productivity and Quality — both firsts for large U.S. companies.

Results?

CORPORATE PERFORMANCE

WESTINGHOUSE GETS RESPECT AT LAST

The plan was simple: Restructure to create value for shareholders, and make quality your company religion. But carrying it out took more than a decade. ■ by Thomas A. Stewart

HERE'S A TEST of your investment wisdom. You have a choice of buying stock in one of two companies. Do you believe in return on shareholders' equity? For 1988, Company A has an ROE of 22.4%. Company B's is 19.4%. On you had earnings per share? In the past five years, Company A has increased their 12.4% while Company B has gone up 6.4%. You want dividends? In the same period, Company A's dividends has about doubled, while Company B's is up 35%. P/E ratios? Company A's stock has risen from 12 to 17. The said growth is a multiple of just 10%.

from 29 to 34 and trades in a P. C. of 14. So what does he say you buy?

East: Right? Then why did you buy Company B—General Electric—instead of Company A—Westinghouse?

Westinghouse: Tell me any one director of Westinghouse Electric Corp., and before long you'll hear the same complaint. "We can't get no respect, we're the leaders! We're the leaders of 'industrial America.' I've a real good feeling about the members of the Poor Burglars' have put on the board—but 'we' is it hard to sell products?"

unintelligible: "unintelligible"

about returning to core business. We
highest executives refer proudly to the
patience of entrepreneurs—often
years—this range from ad-
technology and market a-
ing. The company's
whispered rumor
a couple

First, I promised I'd suggest how to get respect from the media. And these are headlines from the July 3, 1989 issue of Fortune magazine:

"WESTINGHOUSE GETS RESPECT AT LAST.

The plan was simple: Restructure to create value for shareholders, and make quality your company religion."

Now, I'm not giving you a commercial for Westinghouse — that would be inappropriate. I am trying to point out that quality does make a big difference. Two things that the story praises are worth noting here:

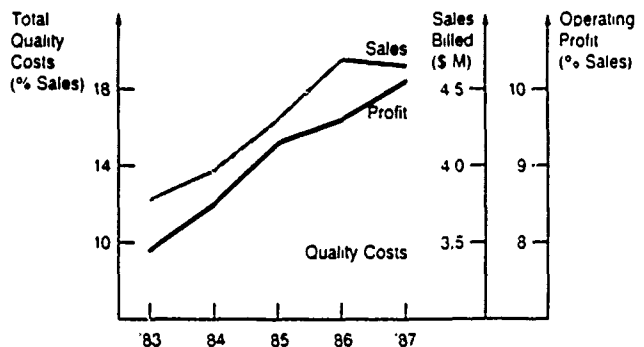
- First, the Westinghouse success at managing a broad portfolio of different kinds of activities — just as DoD must.

- Also, the writer crediting much of the success to quality improvement. He says that even if the business cycles should run against Westinghouse in the future, prospects are good because "The Productivity and Quality Center guarantees a continuing stream of 'work-smart' ideas."

"A continuing stream of work-smart ideas": That's part of the quality imperative. Continuous improvement, generated from within.

Next, consider the track record for the group of businesses for which I was responsible: the Energy and Advanced Technology Group, which at that time included both Energy Systems and Defense Systems.

Energy & Advanced Technology Group Performance 1983-'87



We were able, in just a few years' time, to cut overall quality costs as a percent of sales virtually in half. We increased our sales significantly, by almost 25%. And on the bottom line, we markedly improved our operating profit, from 7.9% of sales to over 10%.

One of the valuable things we did in this process was gather data in a way that we never had before. We learned what the total costs of quality, or un-quality, really are. For decades, we'd believed that un-quality was costing us about 2% to 3% of sales — and that this was due to the warranty costs we were obliged to pay when products didn't work well.

With the help of some outside consultants, we began to look at un-quality costs much more comprehensively. And we found that they were ranging between 20% and 30% of sales. When you think of a large organization wasting that much of its revenue, you begin to see the tremendous burden of un-quality — and on the happier side, you see the incredible opportunity.

One of our Divisions in the Energy and Advanced Technology Group was the Commercial Nuclear Fuel Division, which won the Malcolm Baldrige National Quality Award last year. Let me tell you about these folks briefly.

Commercial Nuclear Fuel Division



This Division makes fuel assemblies for civilian nuclear power plants. A typical 1100-megawatt nuclear plant contains about 50,000 separate fuel rods, which enclose the pellets of uranium dioxide fuel. Once they're loaded into the core of the reactor, they have to perform at maximum efficiency and reliability for several years — in a very tough environment. The temperature inside the fuel rods can reach 1800° F, and the rods are bathed in coolant water at a pressure above 2200 psi.

Commercial Nuclear Fuel: going for 99.9995% perfection in the fuel rods.

Westinghouse nuclear products have always had a good quality record — but until the 1980s, the quality target was largely mandated by U.S. government regulations. Granted, the minimum acceptable level of quality was a high minimum. But the orders for nuclear fuel were coming in as fast as we could fill them, and the name of the game, as far as quality was concerned, was basically to meet the specs.

Then all of that changed.

- Demand went down. Utilities stopped building new power plants, and the nuclear fuel market became strictly a reload market.
- Competition increased — including foreign competition. In the old days, American public utilities would virtually never buy from a foreign supplier. Now they do it all the time.
- And the utilities became much more demanding, because public pressure was on them to perform better, and control costs. That might sound familiar to you.

As a result, in the early 1980s, our people at the Commercial Nuclear Fuel Division made continuous quality improvement their number one objective.

We in top management performed Quality Audits at the

Division and monitored their progress. Typically, we did this in review visits that lasted a couple of days — day and night. We evaluated factors such as:

- Are the managers really committed to quality?
- Do they have techniques for measuring quality?
- Are the commitments — and the techniques — communicated to everyone?
- Are we oriented to really serving the customer?
- Are we making specific changes in processes, to measurably and substantially improve quality?

... and many others. At the same time, we introduced a President's quality recognition process, which rewarded outstanding individual and team accomplishments. This cost very little money, and took relatively little effort, but proved to be a very valuable part of popularizing quality improvement.

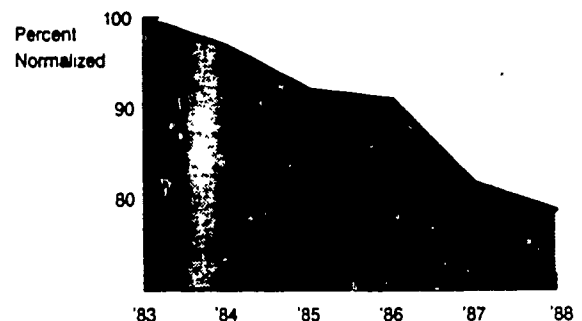
Are the managers really committed to quality? Do they have techniques for measuring it? Are the commitment — and the techniques — communicated to everyone?

The Division published and implemented formal quality improvement Plans. And they set specific goals — to be recognized as the highest quality supplier of commercial nuclear fuel in the world. Their goals essentially had to do with quality performance and serving the customer, rather than with financial returns. The basic idea here was that if we did quality work, the profits would come.

That looked like a considerable gamble at the time, frankly. But that's the way it worked out. Here are some of the results:

CNFD

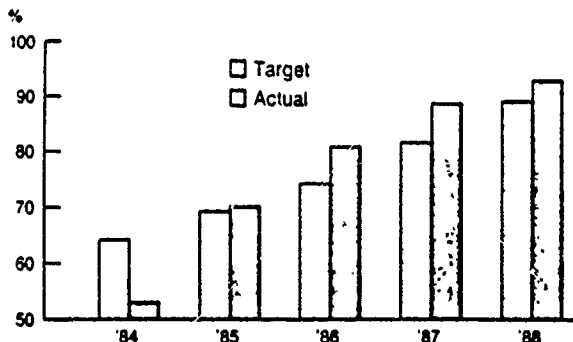
Total Product Costs



We got dramatic reductions, in a few-year period, of total product costs. We got improvement in first-time manufacturing yield. Back in earlier times, we were quite sure — because we visited our competitors — that we had the best manufacturing processes in the world for this product.

CNFD

First-Time Through Yields of Completed Fuel Assemblies



What we didn't appreciate, until we applied rigorous statistics to the process — including some statistically-based design studies — was that we could tremendously improve the yield. Surprisingly little investment was required in new equipment or new plant. A lot of effort was put into gathering and analyzing data, and concentrating improvement efforts where they could pay off.

And most important, the product performed more reliably in the customers' reactors. The y-axis in the Fuel Performance graph is microcuries of radiation per gram of water in the primary cooling system. Even when we started, it was a small amount — but this is a very sensitive measure of merit. And obviously it has improved. Nearly ninety-nine point nine nine nine five percent of our fuel rods now go through their entire service lives without a defect.

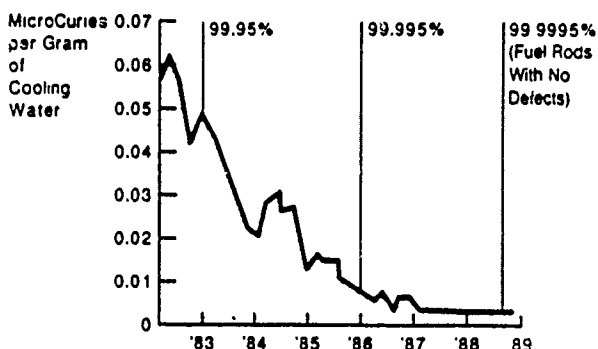
Back in 1983, when all of this started, our people were convinced that nobody could get any better than they then were. They were convinced that nobody *had* to get any better. One of the small contributions I made was to have them visit, more frequently and open-mindedly, our Japanese licensees — and to monitor their performance. To their surprise and embarrassment, they found that the Japanese were ahead of us.

This gave them a strong stimulus to catch up to and surpass our emerging Japanese counterparts. In turn, this led last year to their being recognized by the President of the United States with one of the first annual Malcolm Baldrige National Quality Awards.

Winning awards is nice, but there are additional benefits. As a result of its improvements, this Division recently beat a large number of able and aggressive foreign competitors for

CNFD

Fuel Performance in the Field



a large nuclear fuel tubing contract in South Korea. This is a contract that, in their judgment, they could not have won with their previous quality levels. As I said earlier, that's one bottom line of quality: *Being able to do things you couldn't do before.* In this case, they did something that favorably impacted the nation's economy, the balance of trade ... and therefore national security.

I mentioned that the Group which I was privileged to lead included Defense Systems. So now let's look at two programs from that area.

The first involves printed wiring assemblies. What I want to do here is show you what can happen when DoD and a

contractor work together to make quality improvement a top priority — and put teeth into that commitment, with a contract negotiated to produce quality improvement.

Westinghouse, along with a number of other contractors, makes printed wiring assemblies that go into various kinds of avionics — such as fire-control radar and electronic countermeasures. By the late 1970s it was clear to many of us that there was a need for improvement in

several areas, including the reliability of the product.

- On the radar for the F-4 fighter, the Mean Time Between Maintenance Actions was only about 4 hours. That's all the spec called for. That's all we committed to in our proposal. And that was then considered the state of the art.

- Also, there was room for improvement in the quality of the manufacturing. On Mil Spec printed wiring assemblies, composite yield — that is, the percentage of time that assemblies would make all the way through the process — was between 15% and 20%. Embarrassing, but true.

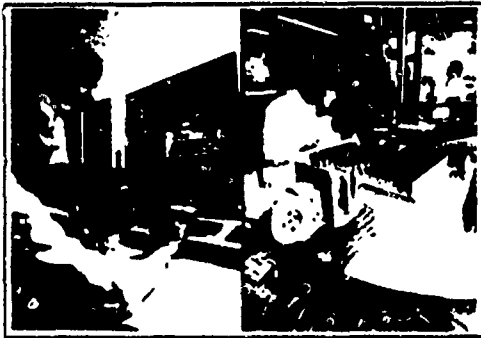
College Station: "We don't want them just pushing a soldering iron all day. We want them to think — about how we can do it better. How we can do it quicker."

Our goal was to improve these figures dramatically. To do that, we decided to invest in an entirely new operation — with new technology, and a workforce trained and committed in a Total Quality approach. ["Total Quality" is the Westinghouse name for its quality effort.]

Now, how do you write the cost of a new plant into a

government contract? We took a risk. The leadership at the Air Force's Electronic Systems Division innovatively — and courageously — adapted existing ManTech and IMIP policies into a motivational customer-contractor agreement called GET PRICE [GET Productivity Realized from Incentivizing Contractors' Efficiency]. Under this program, Westinghouse assumed the risk of building a new assembly plant from scratch — with the contractual agreement that if it paid off for the Air Force, in cost savings on the printed wiring assemblies, we would share in those savings through incentive payments.

Electronic Assembly Plant College Station, Texas



We built our new Electronic Assembly Plant in College Station, Texas, the home of Texas A&M. It has world-class production and test equipment, and about 500 carefully selected, trained and motivated employees who produce about 3400 printed wiring assemblies per month. The plant opened in 1983.

Here are some performance figures for the plant, measured against 1981 benchmarks. The benchmarks come from the parent plant in Baltimore, which at that time was considered first-class.

- I mentioned the 15% to 20% composite yield at Baltimore. When we started up the College Station plant, we ran at about 33%. Recently it went to around 90%; I'm told it's now bumping 95%.

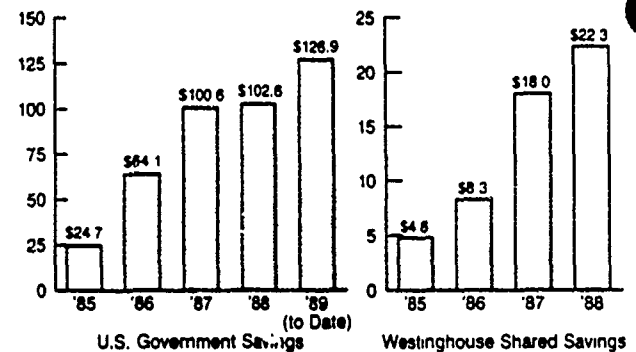
- We reduced the average manufacturing cycle time from 12 weeks to two weeks.

- And the average base cost per printed wiring assembly has been reduced by 70%.

- This has generated almost \$127 million in savings for the Air Force to date. Under the

Electronic Assembly Plant

Cumulative Cost Savings (\$ Millions)



incentivized contract, the corporation's share has been \$22.6 million in additional profit.

That is a lot of money. It has served to get the attention and the support of some people who were a little skeptical about the Defense business. And to the people involved, the symbolic significance of the College Station project was priceless. It demonstrated that our most important customer was assigning top priority to quality and productivity improvement — and was motivating an entire organization to achieve it.

Three hundred twenty-five million dollars.
Extrapolate those savings to the other systems you are involved with.

The total anticipated savings on this program to the Air Force, through 1994, have recently been estimated at about \$325 million. *Three hundred twenty-five million dollars.* Mentally extrapolate these savings to the other systems you are involved with, and perhaps you begin to see what Joe Juran was talking about, when he said that quality improvement could go a long way toward solving DoD's budget problems.

Electronic Assembly Plant Performance Figures

	1981	1983	1985	1986	1987	1989
Process Yield (Cumulative First Time Through)	33%	45%	65%	70%	85%	90%
Cycle Time (Weeks)	12	8	5	4	3	2
Cost Reduction per PWA	Base	8%	44%	48%	55%	70%

One might ask: How did we achieve these savings? One answer, of course, is advanced technology. A new plant; state-of-the-art equipment; robotics and computer systems. But a lot of factories use advanced technology, and they haven't gotten these kinds of results. We have to give credit largely to the Total Quality approach — and to the people at College Station.

I want to show you a videotape that gives you an insight into the attitude and commitment of these people. There were no scripts prepared for this video; nobody was rehearsed ...

[The videotape shown by Mr. Murrin contains interviews with both manufacturing workers and white-collar personnel at the College Station plant. Two quotes — one from a team advisor; one from an engineer — are perhaps the most telling:

"I will have a list of things that I expect accomplished at the end of the week. It's their goal to get there. I don't care how they get there; that's up to them ... These people are the experts. They're the ones we invest all the money on in training. We don't want them just pushing a soldering iron all day. We want them to think about how we can do it better. How we can do it quicker."

— Danny Valenta, Team Advisor

"I've worked with a lot of very talented people at this plant. And the thing that differentiates them from your average talented person is that they care about making things work. They want to do things the right way."

— Marie Sunseri, Manufacturing Engineer]

.. That's the kind of workforce we need for Total Quality. That's the kind of workforce we get when we implement Total Quality. It's a tremendous asset. We can do great things with people like that.

The reasoning was that the APG-68 was going to be more complex, so "naturally" you couldn't expect the same reliability you got with a simpler radar. Fortunately, some key people weren't satisfied.

One of the other great things that's happened, partly as a result of these folks, is that the onboard radar for the F-16 fighter — which uses some of the printed wiring assemblies from College Station — is now achieving MTBMAs of over 100 hours. Remember, we started out at four hours.

You may have heard about the new APG-68 radar, which is the first fire-control radar in the world with triple-digit reliability, as measured in hours between maintenance actions. The APG-68 program is a story in itself — so I'd like to conclude with it.

The APG-68 fire control radar is now going into the F-16C and F-16D. It replaces the APG-66, which was installed in the F-16A and B.

When we first looked at the full spec for the new APG-68, it called for a mature reliability that translated to about 55 hours between maintenance actions in the field. This was

actually *lower* than the Air Force was already getting with the previous generation! The reasoning was that the APG-68 was going to have more capability, and be more complex, so "naturally" you couldn't expect the same reliability you got with a simpler radar.

Fortunately, there were some key customer and key contractor people who were not satisfied with this — including the SPO, who had the foresight to do the right thing. The customer and the contractor agreed on an incentivized contract, based on proven performance in the field.

The SPO calculated a set of curves for four different LRUs [Line Replaceable Units] in the radar. The curves showed what the life-cycle cost savings to the Air Force would be, if the LRUs were able to beat the reliability specs by various amounts. The contract said that reliability for those units would be measured at different periods — and according to how well they performed, Westinghouse would get a percentage of the estimated savings.

"That's combat capability. We know we will be able to get our pilots through the defenses to the target, with equipment that works."

What happened, as a result of this, was that both Westinghouse and the Air Force went beyond their usual ways of working together. The object became to beat the spec, not to meet it. Accordingly, there was an unprecedented degree of communication and cooperation between the contractor and the customer.

They worked together to develop better ways of designing and manufacturing the radar. Better ways of testing it. Better ways to get feedback from the pilots and the maintenance crews in the field. And better ways to incorporate the feedback.

These are some of the results:

- In the final performance measurement period under the APG-68 contract — which ran from late 1988 to early '89 — the radar showed an overall Mean Flight Time Between Maintenance Actions of 115 hours. For the entire calendar year 1988, the average was even better: 125 hours.
- The base price per unit for the APG-68 has gone from over \$2 million per unit in 1985 to about \$750,000 today.
- The F-16 SPO estimates that the Air Force will save in excess of \$60 million over the next few years on the APG-68 program.

At a ceremony recently, the Air Force presented Westinghouse with a check for \$6.7 million, as the final incentive payment under the contract. During this ceremony, General Robert Eaglet laid down a challenge for Westinghouse. He

said: Now that we've got the world's first 100-hour radar, I'd like to see a 200-hour radar in time for the delivery of the new Block 50 aircraft in March 1991. Westinghouse accepted the challenge.

Also at the ceremony, Westinghouse heard from General Henry Viccellio, Jr, deputy chief of staff for logistics at TAC headquarters. The General said that his goal was to someday virtually eliminate the "fixers" on ground crews, by making systems that don't break. He also said, very eloquently, what quality and reliability do for the forces in the field — as you will hear in this final tape ...

[General Viccellio's comments, in part:

"Last summer, a squadron of F-16s at Shaw Air Force Base was celebrating their unit's 70th anniversary. This is one of our oldest fighter squadrons in existence in the Air Force today, born in the days of World War I. That squadron decided to take its new F-16s and fly a maximum surge in one day. And using their 24 jets, in 12 hours they flew 160 combat missions.

"They went and dropped bombs on a tactical target. The average miss distance, for some of you old fighter pilots — the average miss distance of all bombs dropped on those sorties was 29 feet. And 30% of those bombs were direct 'shacks,' as we call them: bull's eyes.

"The best news of all was, out of 160 sorties, 150 returned Code One: airplane fully ready for the next mission. And the 10 breaks we had were fixed within an average of two hours.

"That's combat capability. That's what reliability does for us. When we have reliability like that, we know we will be able to get our pilots through the defenses to the target, with equipment that works.

"Folks, that is not a Tactical Air Command success story. That is not a United States Air Force success story. That is a national success story — and it is your success story. I'm here to say thanks from a satisfied customer."

Well, that's what quality improvement is all about. Getting products and systems that will do the job better — and really serve the customer, at less cost.

In closing, I'd like to make a few simple suggestions:

- Please ponder the profound implications of Professor Kennedy's insights on "The Rise and Fall of the Great Powers" — and the crucial challenges now facing our nation.
- Please ponder the key role that DoD — and you — play in maintaining our pre-eminence in the world.
- ... and, in turn, the extraordinary potential of all of us "doing the right thing right the first time."
- Please consider open-mindedly the early and extensive application of proven DoD procedures to improve quality and reliability — such as those I've noted in my comments.
- Please get familiar with other proven quality improvement procedures, such as Motorola's Six Sigma methodology.
- Please apply such know-how — and the Malcolm Baldrige National Quality Award process — to your DoD organizations. Aim to be a model for all government agencies.
- And please develop DoD policies and procedures so that all aerospace and defense contractors commit, on a top-priority basis, to quality improvement. Make DoD a world-class customer — thereby contributing greatly to our national security, and to our industrial pre-eminence.

I thank you very much for your attention!



Malcolm Baldrige
National
Quality
Award

1988 AWARD WINNER

COMMERCIAL NUCLEAR FUEL DIVISION WESTINGHOUSE ELECTRIC CORPORATION

When electric utilities operating nuclear power plants install fuel-rod assemblies made by the Westinghouse Commercial Nuclear Fuel Division (CNFD), they can be 99.995 percent certain that each of the thousands of rods supplied will perform flawlessly. Realizing that future business depends on continued excellence in product performance, CNFD is pushing its all-important



dependability rating even higher.

Prior to the early 1980's, the CNFD quality goals were geared toward satisfying regulatory requirements for fuel-rod assemblies. Then, motivated by stiff competition and demanding customer requirements, it raised its sights with the objective of being recognized as the world's highest-quality supplier of commercial nuclear fuel.

The Commercial Nuclear Fuel Division of Westinghouse is building a quality culture that

asks employees to do "the right things right the first time." This philosophy makes every action by every employee a quality initiative. Customer satisfaction is the guiding principle, whether it is the ultimate customer or the next person in the process.

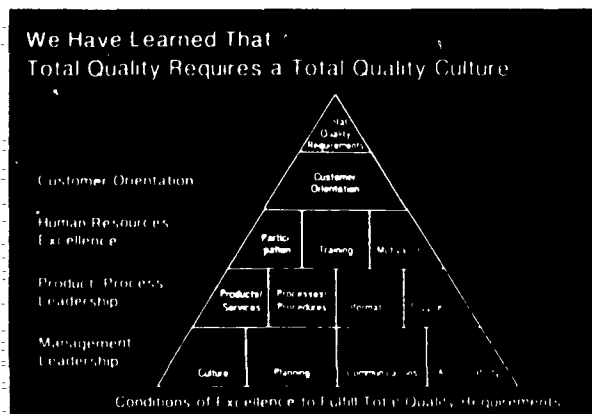
CNFD uses a "Total Quality" approach built upon four imperatives for continuous quality improvement: management leadership, product and process leadership, human resource excellence, and customer satisfaction. Progress is measured by a unique system called "Pulse Points." The system tracks improvements in over 60 key performance areas identified with statistical techniques and other evaluative tools, and it helps set measurable goals within each unit of CNFD, down to the jobs of hourly workers.

Product and service improvements attributable to the seven-year old program have paid business dividends. The value of new orders in 1987 was the highest in the decade.

CNFD AT A GLANCE

Begun in 1969 and now part of the Westinghouse Nuclear Fuel Business Unit, one of 26 such units in the company, CNFD currently employs nearly 2,000 people at three sites. The Specialty Metals Plant, near Pittsburgh, produces the zircalloy tubes that encase pellets of uranium dioxide fuel processed at CNFD's Columbia, South Carolina plant. Final fabrication of fuel-rod assemblies is also done at the Columbia Plant. Headquarters Operations and Nuclear Engineering activities are located in Monroeville, Pennsylvania.

The CNFD currently supplies about 40 percent of the U.S. market for fuel-rod assemblies and about 20 percent of the world market. Fuel assemblies supplied by the Columbia Plant accounted for nearly seven percent of U.S. electrical needs in 1987.



"TOTAL QUALITY"

CNFD uses state-of-the-art technology, such as robotics and other automated processing equipment, supercomputer simulations, expert systems and laser-diagnostics, and laser welding. It estimates that quality-related decisions have dictated 75 percent of its capital allocations during recent years. Management, however, attributes CNFD's substantial improvements in quality and efficiency not so much to advanced technology as it does to a "turned on" work force and to CNFD's Total Quality approach to operations.

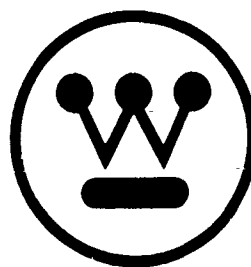
Rather than having a chief quality officer, CNFD assigns responsibility for directing and coordinating quality improvements to the general manager and his various staff functions. These managers form the CNFD's Quality Council, which sets policies, plans and strategies, and directs the quality improvement process. Management's rationale is that quality concerns must be fully integrated into all design, production, and customer service activities.

In strategic planning, top management develops formal quality initiatives and Pulse Points that are deemed most critical to improving performance and customer satisfaction. Supporting, measurable goals, all aimed at accomplishing divisional objectives, are developed in each of the departments and then for each worker. Progress is monitored through an extensive data-collection and trend-analysis system. Pulse Point trends are reviewed each month in a teleconference that includes top management at each division site.

Workers directly address quality improvement opportunities and help devise initiatives through their participation in project-oriented teams. Nearly 1,400 employees were members of 175 such teams in 1987. About 90 percent of all workers have undergone quality awareness or quality-related training during the past three years.

CNFD maintains close — usually daily — contact with its utility customers and regularly collects technical data to evaluate the performance of its fuel assemblies. Customer service plans are created for each client and are jointly reviewed each quarter. A customer's Fuel Users Group meets twice a year to share information and discuss needs for new products. Consistently high scores in surveys and customer-conducted audits reflect high levels of satisfaction. A more telling indicator, however, is repeat business. Existing customers accounted for more than 90 percent of the orders placed in 1987.

Although its eye is on the bottom line, CNFD management deliberately did not include cost concerns in its quality improvement program, believing that gains in quality would spawn cost-reductions through increases in efficiency. Results achieved between 1984 and 1987 confirm this belief. For example, first time through yields in the manufacture of fuel rods increased from less than 50 percent to 87 percent, substantially reducing scrap, product reworking, and manufacturing cycle time. This helped CNFD achieve over three years of 100 percent on-time delivery of high-quality products.



For more information contact:
James A. Fici
Manager, Total Quality Planning
Commercial Nuclear Fuel Division
Westinghouse Electric Corporation
P.O. Box 3912
Pittsburgh, PA 15230-3912



1988 AWARD WINNER

MOTOROLA INC.

Like an olympic athlete seeking to score better than determined world rivals, Motorola Inc. seeks sales victories in world markets for electronic components and equipment by improving the quality of its own performance. For Motorola, quality improvement leading to total customer satisfaction is the key.

In 1981, Motorola launched an ambitious drive for a tenfold improvement in the quality of its products and services. Motorola succeeded. Now, the company has evidence that many of its products are the best in their class. Looking ahead, Motorola intends to top its achievements — further gains in quality for 1989, yet another leap in 1991, and near perfection a year later. The company's quality goal is simply stated: "Zero defects in everything we do."

Motorola's managers literally carry with them the corporate objective of "total customer satisfaction." It's on a printed card in their pockets. Corporate officials and business managers wear pagers to make themselves available to customers, and they regularly visit customers' businesses to find out their likes and dislikes about Motorola products and services. The information, along with data gathered through an extensive network of customer surveys, complaint hotlines, field audits, and other customer feedback measures, guides planning for quality improvement and product development.

COMPANY AT A GLANCE

Employing 99,000 workers at 53 major facilities worldwide and based in Schaumburg, Illinois, 60-year old Motorola is an integrated company that produces an array of products, distributing most through direct sales and service operations. Communication systems — primarily two-way ra-



dios and pagers — account for 36 percent of annual sales, and semiconductors account for 32 percent. The remaining revenues come from sales of cellular telephones and equipment for defense and aerospace applications, data communications, information processing, and automotive and industrial uses. Sales in 1987 totalled \$6.7 billion.

Responding to the rapid rise of Japanese firms in world markets for electronics, Motorola's management began an almost evangelical crusade for quality improvement; addressing it as a company issue and, through speeches and full-page ads in major publications, as a national issue.

The company's most persuasive messages, however, are the results of its quest for quality. Most products have increased their market share here and abroad. In Japan, for example, Motorola pagers, supplied to Nippon Telephone and Telegraph, were introduced in 1982 and now claim a major share of that market. Over the past two years alone, Motorola has received

nearly 50 quality awards and certified supplier citations, tops among the 600 electronics firms responding to a survey published in March 1987.

KEY QUALITY INITIATIVES

To accomplish its quality and total customer satisfaction goals, Motorola concentrates on several key operational initiatives. At the top of the list is "Six Sigma Quality," a statistical measure of variation from a desired result. In concrete terms, Six Sigma translates into a target of no more than 3.4 defects per million products, customer services included. At the manufacturing end, this requires designs that accommodate reasonable variation in component parts but production processes that yield consistently uniform final products. Motorola employees record the defects



found in every function of the business, and statistical technologies are increasingly made a part of each and every employee's job.

Reducing the "total cycle time" — the time from when a Motorola customer places an order until it is delivered — is another vital part of the company's quality initiatives. In fact, in the case of new products, Motorola's cycle-time reduction is even more ambitious; the clock starts ticking the moment the product is conceived. This calls for an examination of the total system, including design, manufacturing, marketing, and administration.

Motorola management demonstrates its quality leadership in a variety of ways, including top-level meetings to review quality programs with re-

sults passed on through the organization. But all levels of the company are involved. Nonexecutive employees contribute directly through Motorola's Participative Management Program (PMP). Composed of employees who work in the same area or are assigned to achieve a specific aim, PMP teams meet often to assess progress toward meeting quality goals, identify new initiatives, and work on problems. To reward high-quality work, savings that stem from team recommendations are shared. PMP bonuses over the past four years have averaged about 3 percent of Motorola's payroll.

To ensure that employees have the skills necessary to achieve company objectives, Motorola has set up its own training center and spent in excess of \$170 million on worker education between 1983 and 1987. About 40 percent of the worker training the company provided last year was devoted to quality matters, ranging from general principles of quality improvement to designing for manufacturability.

Motorola knows what levels of quality its products must achieve to top its competitors. Each of the firm's six major groups and sectors have "benchmarking" programs that analyze all aspects of a competitor's products to assess their manufacturability, reliability, manufacturing cost, and performance. Motorola has measured the products of some 125 companies against its own standards, verifying that many Motorola products rank as best in their class.



MOTOROLA INC.

For more information contact:

Jack Germain

Senior Vice President and

Director of Quality

Motorola Inc.

1303 East Algonquin Road

Schaumburg, IL 60196

1988 AWARD WINNER

GLOBE METALLURGICAL INC.

In a tailspin like most other firms in the nation's "smokestack industries," Globe Metallurgical Inc. refused to retreat from the rising tide of imported cheap, commodity-grade metals. While



many U.S. makers of ferroalloys (iron-based metals) were closing plants, the Ohio-based company stated its refusal in the most convincing of terms. It initiated a quality-improvement program that has made its products the standards of excellence in the metals industry.

Globe set out in 1985 to become the lowest-cost, highest-quality producer of ferroalloys and silicon metal in the United States. At the same

time, the firm shifted its focus from commodity markets, such as steel manufacturing, to the higher value-added markets represented by the foundry and chemical industries and certain segments of the aluminum industry.

Three years later, Globe occupies a quality niche above the competition. Not coincidentally, its share of the U.S. market for high-quality foundry alloys has risen dramatically, sales in Canada and Europe have increased significantly, and profitability has returned.

In quality audits by General Motors, Ford, Intermet, John Deere, and other customers, the firm's scores have set records, resulting in certified supplier status for Globe. Foreign buyers also recognize Globe's commitment to quality. When many European traders place an order for magnesium ferrosilicon alloy they specify that the material must be "Globe quality," a standard that other suppliers must match.

COMPANY HISTORY

A privately held company since 1987, when Moore McCormick Resources sold all of its metal-related businesses, Globe employs 210 people at plants in Beverly, Ohio, and Selma, Alabama. The plants produce about 100,000 tons of alloys annually for more than 300 customers. Annual sales totalled less than \$100 million in 1987, but are projected to increase by approximately 30 percent in 1988.

The firm's drive for quality began two years before the leveraged buy out of Globe's current management. In 1985, Globe's managerial staff was trained in statistical process control and, by the year's end, the foundation of a company-wide quality-improvement system — termed Quality, Efficiency, and Cost (QEC) — was laid.

ELEMENTS OF QEC

Globe's QEC program permeates the entire company, and goals for quality improvement are integrated into strategic planning and research and development activities. Quality committees exist at every level within the company, and rapid communication scales the distance between top officials, who make up Globe's QEC steering committee, and workers, who participate in "quality circles" that meet weekly. In between in each plant is the QEC committee, composed of the plant manager and department heads, that assembles each morning to review the previous day's performance.

The QEC committee assesses the causes of out of control conditions, reviews corrective measures, evaluates suggestions made by quality circles, and addresses broader quality issues that might be raised by the steering committee.

Now three years into its QEC program, Globe has found no surfeit of good ideas for improving product quality and reducing cost, many of them originating with workers. Improvement measures are carefully tracked, and the results — successes and failures — are published monthly.

In fact, Globe attempts to monitor and quantify every factor that influences product quality, making extensive use of computer-controlled systems that continually advise workers on whether target values for important processing variables are being met. Key variables are identified through a number of means, including failure mode effects analyses, statistical evaluations that identify production steps that are most prone to failure. Color control charts derived from a system developed in-house document each product's processing history. The charts provide workers, who are trained in statistical process control, with a performance appraisal and customers with important information for their manufacturing processes.

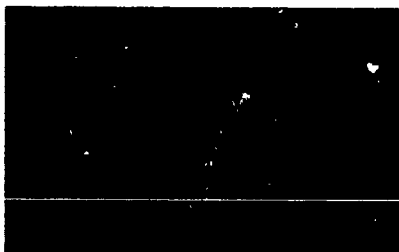
Significant improvements in achieving the targeted grade of metal have been realized since the implementation of the computer-controlled systems, with corresponding reductions in the amount of scrap or reclassified product produced. Today, only about 3 percent of the heats — including initial batches of new products — require reclassification. Similarly, greater consistency in final products, achieving specifications that fall within ranges more demanding than those imposed by customers, has significantly lowered the chance of an out-of-specification shipment. The improved consistency of the operation has increased the production rates on the furnaces, while significantly reducing energy consumption,

a major cost item for Globe. At the same time Globe has realized improvements in manpower efficiency of over 50% in certain areas.

Customer complaints have decreased by 91 percent, from 44 in 1985, when 49,000 pounds of product were returned for replacement, to 4 in 1987, when no product was returned.



Among workers, who have flexible job assignments and whose quality-improvement efforts are recognized through personal letters from management and small gifts, Globe's QEC program is paying dividends. The accident rate, near the average for the ferroalloy industry in 1985, has fallen, while the industry average has risen. The Globe absenteeism rate has also decreased since 1985.



For more information contact:
Kenneth E. Leach
Vice President, Administration
Globe Metallurgical Inc.
P.O. Box 157
Beverly, OH 45715

Quality Focus Results in Federal Sector

Norfolk Naval Shipyard
Norfolk, VA
C. Lopresti (804) 396-9047

Pre-TQM Situation: (1986)

Competitive Challenge for Overhaul/Repair Work Dramatically Increasing
Projected Budget Cuts

TQM Action:

Commitment:	Senior Management chose quality to gain competitive edge Development of Strategic Operations Plan with TQM focus
Education:	Sr. Management: TQM Seminars 1/2-day and 2 1/2 Days 1 Week Seminar All Supervisors: 2-day TQM awareness
Customer Focus:	Customer Briefings, meetings, feedback and critique systems established. Post-Repair Assessments. Supervisors identify all internal and external customers and follow up to confirm satisfaction and suggestions
Team Work:	Union Officers Co-chair QWL Council; Process Action Teams. Union Support involved all levels
Improvement Structure:	Quality and Productivity Improvement Council; Shipyard Strategy Board Quality Management Boards Performance Action Teams TQM Advocate TQM Training Teams
Communications:	Supervisory and Managerial Roles: Check with Customers Union participation in quality planning Monthly meetings with unions
Rewards/Incentives:	Quality awards for improvements designed

Quality Focus Results in Federal Sector

Naval Publications and Forms Center
Philadelphia, PA
Janice Hopkins (TQE Division) (215) 697-2227

Pre-TQM Situation: (1987)

Budget Reductions
Staff Reductions
Difficulty processing 200,000 customer requests monthly
Difficulty providing accounting services for 30 other federal agencies
Historical problems in processing huge amounts of incoming inventory

Quality Action:

Commitment:	Senior Management adopted quality management philosophy Development of Quality Management Plan
Education:	Sr. Management committed to learn how to change from production-oriented management style to quality-oriented styles of management. Course of studies: Management based-on-facts. 1/3rd of workforce trained in quality concepts. All employees: competency-based certification system. All process improvement teams trained in quality skills and tools. Continuous training in quality management and supervision.
Customer Focus:	Internal and external customers identified; needs defined; standards and measures established.
Team Work:	Employee participation using quality improvement teams.
Improvement Structure:	Quarterly All Hands meetings. Quality Council, Quality Design and Review Committee, Quality Division. Quality and Productivity Improvement Teams.
Communications:	Reorganization for increased quality and communications. All Hands meetings.
Quality Measures:	Identified quality indicators and baselines. Identified internal customer satisfaction measures. Use of SPC techniques adopted throughout organization.
Equipment:	Automated telephone sequencer for customer calls. Warehouse Modernization. Navy and Technical Print on Demand Systems.
Environment:	Improved habitability. Civic involvement.
Typical Projects:	Receipt processing team; timecard processing team, classified receipts team, forms bin replenishment team, customer service team, invoice exception team, internal mail room routing team.

Quality Focus Results in Federal Sector
Ogden Service Center
Ogden, Utah
Grant B. Higgs - (801) 625-6832

PRE-TQM SITUATION: (1984)

"Cut costs at any cost" attitude and trend.
Internal competition based on productivity measures.
Inadequate staffing; High turnover; High rates of correspondence errors with taxpayers.
Unacceptable error rates in "non-pipeline" functions.

QUALITY ACTION:

Commitment: Juran's concepts selected as roadmap for quality improvement.
Used consultant service to crystalize support for quality improvement.
Formulated "Core Values" and an "Organizational Goal" for the Service Center.
Involved all managers, especially mid-level managers.

Education: All Management trained in "Towards Excellence" by Tom Peters and Zenger-Miller.
Management trained on interrelationships of computer systems to entire service center.
Onsite visitations to other companies and organizations for quality approach.
Managers research quality philosophies of Juran, Deming, and Crosby.
All managers and supervisors trained in Quality Leadership.
Quality improvement process training for all project managers prior to projects. Quality training team (Quality Improvement Staff)

Customer Focus: Director's Advisory Committee; Customer Outreach
Tax Practitioner Priority Service Program

Team Work: Project Teams;
Joint agreement between Union and IRS for QIP

Recognition: Quality Champions selected;
Letters to employees praised for noteworthy customer service

Improvement Structure: Quality Councils; Quality Assurance Branch;
Quality Improvement Teams

Communications: In-House Newsletter

Environment: Habitability Improvements; Child Care Facilities

Equipment: Quality routines in computer systems--prevent errors;
Centralized Telephone Referral System;
New computer system for responding to taxpayer correspondence

Typical Projects: Erroneous Credit Transfers; Improper Input of Payment Documents;
Undeliverable Mail; Taxpayer Correspondence

Results: \$1.5 million in rework eliminated; Decreased undelivered mail;
Improved accounting and claim referral procedures;
Fewer taxpayer inquiries; Reduced misapplied payments;
\$2 million in improved systems for handling work

APPENDIX B

**SUPPORTING DOD'S
TOTAL QUALITY MANAGEMENT
EFFORT**

MAJOR INITIATIVES

Supporting Department of Defense's Total Quality Emphasis

EXAMPLES:

- Concurrent Engineering.
- Acquisition Streamlining.
- Could Cost.
- Development to Production Transition.
- Industrial Modernization Incentive Program.
- Contractor Performance Certification Program.

Total Quality Management in the DOD

- Different initiatives can be used as way of pursuing a dimension of quality.
- The next series of examples are related to the acquisition process.
- These structural approaches are only a part of TQM -- they can be *part* of senior management's total pursuit of the quality culture.

Concurrent Engineering

A collective of engineering disciplines that require early consideration of:

- Product Manufacturing
- Support During Product Life-Cycle
- User Requirements

Value of Concurrent Engineering:

- Higher quality design at lower production costs.
- High front end investment before benefits realized.
- Requires high involvement of all parties involved.
- Reduced product development cycle time (40% - 60%)

Total Quality Management in the DOD

According to IDA Report R-338,

- Better design results in 50% reduction in change orders during the acquisition process.
- Manufacturing costs reduced by 30% - 40% by having multi-functional teams integrate product and process designs.
- Scrap and rework reduced by 75% through product and process design optimization.
- Concurrent Engineering can be used to improve the DOD acquisition process.

Reference:

Winner, Robert I, et. al., "The Role of Concurrent Engineering in Weapons System Acquisition", [IDA Report R-338] Institute for Defense Analysis, Arlington, VA, December, 1988.

DOD's Objectives for Concurrent Engineering

- High Quality.
 - product performance levels
 - utility and reliability in field
- Low Cost.
 - purchase price
 - product usage
 - product maintenance
 - product disposal
- Short Time
 - Developing product designs and manufacturing
 - Delivery of current products

Total Quality Management in the DOD

- Communications infrastructure needed to ensure continuous improvement.
- Timing is critical -- **early efforts, early dialogues.**
- Early and unambiguous knowledge of all user requirements and priorities by all parties is needed.
- Timely assessment of requirements and tradeoffs needs to be frozen.
- Problem prevention vs. detection-and-response is needed.
- The voice of the customer would be heard by early translation of requirements into specific characteristics and features of the product.
- All requirements of the life cycle are considered and evaluated.
- Critical risks are addressed early.
- Early involvement of manufacturer in specifications and manufacturability assessments.
- Current FAR practices would need amending to pursue CE routinely.

Concurrent Engineering***OTHER FINDINGS OF THE 1988 STUDY***

- Cultural change is needed.
- Multi-function teams are needed.
- DOD is theoretically capable of using CE.
 - It will require tremendous DOD participation
 - DOD would play a major enablement role among parties

**Total Quality Management in the DOD**

- Significant cultural change needed for CE.
- Top down leadership needed to succeed.
- Continued training, backing, interest, and dialogue needed throughout the total acquisition process.
- CE is a still-emerging set of engineering disciplines -- what is available currently (1988) will work.
- DOD should be capable of implementing CE in the DOD acquisition environment.
- DOD will have to participate heavily to enable the methods and technologies to be applied to weapons system procurements.

Pitfalls in CE Implementation

- Failure if top management
 - does not *learn* CE
 - does not *understand* CE
 - does not *lead* CE
- Statistical capability absolutely needed.
- Quality improvement techniques must be involved in the larger systems which only management controls.



Total Quality Management in the DOD

- Examples of larger systems.
 - Policy
 - Training
 - Management Actions
 - Divisional Barriers
 - Purchasing Policy
 - Short Term Profit/Benefit Orientation
- Concurrent Engineering is a management philosophy.

Acquisition Streamlining

- Specify requirements in terms of results.
- Eliminate conflicting guidance.
- Promote innovation.

Total Quality Management in the DOD

References:

DOD Directive 5000.43 "Acquisition Streamlining."

MIL-HDBK-248 "Acquisition Streamlining."

Defense Acquisition Circular, 1 November 1988, Number 88-1.

Federal Acquisition Circular, September 2, 1988, Number 84-39.

Department of Navy Handbook, Implementation of Non-Developmental Item Acquisitions, 6 June 1988.

Could Cost

- Elimination of unnecessary procurement regulations.
- All DOD imposed rules, regulations and conventions subject to challenge.
- Method of challenge streamlined; easier to get attention.

Total Quality Management in the DOD

Reference:

Memorandum for the Secretaries of the Military Departments and the Directors of the Defense Agencies, 1 May 1988.

**U.S. REGISTERED CIVIL AIRCRAFT
BY MANUFACTURER AND MODEL—NUMBER OF SEATS
AMATEUR/PISTON
AS OF DECEMBER 31, 1989**

Model	Designation			Air Carrier	General Aviation	Total Aircraft
	Places	Aircraft/ Engine Type	No. Engines			
FDEMXQ	2	41	1	0	1	1
FHU CORSAIR	1	41	1	0	1	1
FH1-SUPER TWIN	2	51	2	0	1	1
FI-156-C1	2	41	1	0	2	2
FIAT G-46-B	2	41	1	0	1	1
FIBAIR 109	1	41	1	0	1	1
FIBERBIRD XP1	2	41	1	0	1	1
FIELDS STEEN SKYBOLT	2	41	1	0	1	1
FIKE	1	41	1	0	1	1
FIKE D	2	41	1	0	1	1
FIN-1	1	41	1	0	1	1
FIREBOLT	2	41	1	0	1	1
FIREBOLT MODEL C	2	41	1	0	1	1
FIREFLY	1	41	1	0	3	3
FIRESTAR	1	41	1	0	2	2
FIRST STRIKE	1	41	1	0	1	1
FISHER	1	41	1	0	1	1
FISHER CLASSIC	2	41	1	0	1	1
FISHER FP 202 KOALA	1	41	1	0	1	1
FISHER FP 404	1	41	1	0	1	1
FISHER FP-404M	1	41	1	0	1	1
FISHER FP101	1	41	1	0	2	2
FISHER SUPER KOALA	1	41	1	0	1	1
FISHER 1985	2	51	2	0	1	1
FISHER 303	1	41	1	0	1	1
FISHER 404	1	41	1	0	1	1
FK 1 STOL	2	41	1	0	1	1
FK2	1	41	1	0	1	1
FL	1	41	1	0	1	1
FLAC WITH TAIL	1	41	1	0	1	1
FLAGLOR SCOOTER	1	41	1	0	6	6
FLAGLOR SCOOTER DSA	1	41	1	0	1	1
FLAGLOR SCOOTER 57	1	41	1	0	1	1
FLAGLOR-SCOOTER	1	41	1	0	1	1
FLEET 16B	2	41	1	0	1	1
FLEET 2	2	41	1	0	1	1
FLEET-BOLLINGER	2	41	1	0	1	1
FLEET-7	2	41	1	0	1	1
FLIGHTSTAR	1	41	1	0	1	1
FLIGHTSTAR MC	1	41	1	0	1	1
FLIGHTSTER 2 PLACE	2	41	1	0	1	1
FLUT-R-BUG SA5A	2	41	1	0	1	1
FLUT-R-BUG SA6B	2	41	1	0	2	2
FLUTER BUG SA6B	1	41	1	0	1	1
FLY BABY	1	41	1	0	20	20
FLY BABY I	1	41	1	0	2	2
FLY BABY 1	1	41	1	0	1	1
FLY BABY 1-A	1	41	1	0	10	10
FLY BABY 1A	1	41	1	0	13	13
FLY BABY 1B	1	41	1	0	3	3

Development to Production Transition

- Risk reduction methods.
 - Templates (expert system).
- Emphasis on technical **process**.
 - Less on management events.
- Best practices manual.
 - Emphasis on Process.

Total Quality Management in the DOD

References:

DODD 4245.6, **Defense Production Management.**

DODD 4245.7, **Transition from Development to Production.**

DOD 4245.7-M, **Transition from Development to Production.**

NAVSCO P-6071, **Best Practices.**

Industrial Modernization Incentive Program (IMIP)

- Elimination of barriers to industrial modernization.
- Government sharing of capital improvement costs.
- Government sharing in long-term savings.

Total Quality Management in the DOD

Reference:

Stimson, R.A. and Reeves, A.D., **Tri-Service DOD Program Provides Incentives for Factory Modernization**, Industrial Engineering, Feb. 1984, Vol. 16, No. 2, pp. 54-61.

DOD 5000.44G, **Industrial Productivity Incentive Program**.

Contractor Performance Certification Program (Army)

- Contractor with proven products.
- Emphasis on building quality in, not trying to inspect it in.

REDUCED OVERSIGHT

Total Quality Management in the DOD

- Defense Logistics Agency (DLA) and Defense Contract Administration (DCAS) have similar program called *In-Plant Quality Evaluation (IQUE)*.
- IQUE focuses on measuring and continuously improving the process.

APPENDIX C

SUGGESTED READINGS

- *CONSULTANT ADVICE TO U.S. SENIOR EXECUTIVES*
- *BIBLIOGRAPHY AND OTHER RESOURCES FOR TQM STUDY*

BOOZ•ALLEN & HAMILTON **ON** **QUALITY**

Hayer, Steven J., Marcus, Daniel H., and Van Lee, Reginald, **Booz•Allen & Hamilton, Inc.**, "Making Strategy Work: The TEAM Approach", OUTLOOK, (XII), 1988, p. 17-23.

THE BEST STRATEGY CAN FAIL ATTEMPTING TO BE IMPLEMENTED.

Chief Executive Officers who adopt strategic efforts to innovate can be frustrated with trying to implement the chosen strategy.

Implementation infrastructures are often the Achilles heel.

Strategy managers need an implementation *tool kit*.

- Tools to link individual accomplishment to collective goals.
- Tools to get people past interpreting all strategy in terms of organizational structure and functions.

TEAM APPROACH -- WILL WORK IF CEO WORKS.

Four Steps:

- **Translate** strategy into concrete objectives for specific transaction groups.
- **Enlist** commitment of all people on whom the execution of the strategy depends.
- **Activate** behavioral changes that will allow implementation to happen.
- **Monitor** and reinforce the behavior until it is embedded culturally.

BOOZ·ALLEN & HAMILTON ON QUALITY

Exhibit 1 **The CEO Toolkit**

Objective	Tool	Output
Translate	• Business strategy and direction • Demystification of underlying economics • Organization blueprint/transaction flow	• What is important? • Why is it important? • What is controllable?
Enlist	• TEAM creation and definition • Key performance indices and objectives	• How do I fit in? • Who owns the problem? • Who is my support team?
Activate	• Measurement system • Reward system • Decision support system	• Are pay and performance linked? • Is personal optimization in synch with corporate optimization?
Monitor/ reinforce	• TEAM enfranchisement • TEAM meetings • Communication program • Education and training	• Are organization actions and culture consistent with team concept? • How will team performance be recognized?

Source: Booz·Allen & Hamilton

BOOZ•ALLEN & HAMILTON

ON QUALITY

Exhibit 1 **The CEO Toolkit**

Objective	Tool	Output
Translate	• Business strategy and direction • Demystification of underlying economics • Organization blueprint/transaction flow	• What is important? • Why is it important? • What is controllable?
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Source: Booz•Allen & Hamilton

BOOZ-ALLEN & HAMILTON
ON
QUALITY

Exhibit 2
Monitoring Change

Institutionalized monitoring

- Install and maintain a tracking system to monitor and reward performance
- Develop ongoing corporate communications (publications, manuals, videotapes, etc.) to reinforce change
- Create in-house training and development programs to institutionalize change
- Establish periodic reviews of each team's plans and performance with the CEO

Ad hoc monitoring

- Promote self-motivated team meetings to plan, coordinate, and evaluate
- Motivate informal cost, quality, and revenue reviews for self-monitoring or performance
- Encourage the sharing of information across team boundaries, as appropriate
- Encourage senior management to lead by example, by communicating and operating cross-functionally

Source: Booz-Allen & Hamilton

BOOZ·ALLEN & HAMILTON
ON
QUALITY

McGrath, John E., Lucier, Charles E., and Silva, Brian A., **Booz·Allen & Hamilton, Inc.**, "Special Report on Industrial Companies: the Path to Competitiveness", OUTLOOK, (X), 1987.

Quick-fix solutions will not work for U.S. industries.

Long-term health of the advanced economies depends on a robust manufacturing base.

- revamping of manufacturing strategies
- reduce cost disadvantages
- long-term cost management a part of strategies

Competitive Advantage is based on products with superior performance, customizing, bundled service, at price affordable to customer.

U.S.A.'s high costs are due to management action and inaction -- managers can change it by making fundamental breaks with past management practices.

Sequence of priorities:

1. A long-term commitment to cost management.
2. Selective adaptation of new technologies.
3. Global strategies.
4. Capital allocations focused to build advantaged business.
5. Broadened management skills to **change** the organization.

BOOZ·ALLEN & HAMILTON ON QUALITY

Sequence sub-activities:

- Cost Management -- use competitive cost analysis.
 - It is a continuous effort -- very aggressive in nature. Assess competitors' costs and products and the competitors' processes.
 - Commitment to low cost, high quality, constant product innovation, constant cost improvements, and control systems on critical processes.
- Adopt Technologies Selectively to **create competitive processes**, not a panacea for weak manufacturing.
- Global Marketing needs changes in views and structures.
 - Organizational structure changes needed to develop an effective global strategy. The executive's need to think in global scale economics. They also need to examine every segment of the value-added chain.
- Capital Allocation
 - Build competitive position and don't assume you will be staying in the same business.
 - Use **competitive** cost analysis always -- it is the only analysis with a future.
- Revitalize Management Skills at all levels.

Rx: No narrow functional specialties -- cross-training

Rx: More operations training and manufacturing

Rx: More recognition of employee role in managing resources

BOOZ-ALLEN & HAMILTON
ON
QUALITY

Jones, Thomas C., **Booz-Allen & Hamilton, Inc.**, "Launching the World-Class Factory of Today", OUTLOOK, (X), 1987, p. 52-57.

The major threat is not off-shore Japanese plants -- it is new world-class facilities here in North America.

- Their demand for quality components brings in foreign-owned component producers that **can meet** the quality requirements.
- In Japanese automotive operations in USA, 35 new foreign-owned component suppliers have entered U.S. market.
- The trend is growing -- today 35, in the next few years 200.

World Class involves deceptively simple principles applied rigorously and constantly to tighten variances, shorten feedback loops, reduce production time.

- design for manufacturing
- balanced capacity and materials flow
- engineered minimum setups/changeovers
- quality at the source
- preventative maintenance
- employee involvement

The cost advantage of the Japanese and Koreans is not due to wages, proprietary processes, economics of scale -- they are due to integrated systems of these principles. The use of the principles this way **CHANGES the basic economics of manufacturing.**

BOOZ•ALLEN & HAMILTON

ON QUALITY

Top management can take the 1st survival step --

- Develop a clear vision of the facilities' optimum performance potential.
 - Consider world-class constraints.
 - plant age
 - work force skill and training
 - investment capital available
- View facilities as if they were new --
 - Heavy up-front costs for training, new techniques, cultural dynamics.
 - Don't underestimate quality processes and employee involvement payoffs -- often far greater than technological improvements in hardware.
 - Timetable program benefits (mix short and long range). Prioritize tangible projects with interim results. Include a facility-wide communications program to employees to focus, motivate and monitor progress in achieving world-class status.
- Recognize your own barriers for what they are -- life threatening.
 - organizational
 - management/labor
 - manufacturing/marketing interfaces
 - Some which fall into one of the above 3 classes are:
 - too many management layers
 - outdated policies and practices
 - hidden costs in processes used
 - organization's structure-based transactions and reporting relationship

SUGGESTED READING - BOOKS

Rev. September 5, 1989

Bold entries are considered core readings for TQM

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Argyris, Chris. Integrating the Individual and the Organization, John Wiley & Sons, Inc., New York, NY. 1964

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**U.S. REGISTERED CIVIL AIRCRAFT
BY MANUFACTURER AND MODEL—NUMBER OF SEATS
AMATEUR/PISTON
AS OF DECEMBER 31, 1989**

Model	Designation			Air Carrier	General Aviation	Total Aircraft
	Places	Aircraft/ Engine Type	No. Engines			
KITFOX MODEL 1	2	41	1	0	8	8
KITFOX MODEL 2	2	41	1	0	6	6
KITFOX 1	2	41	1	0	3	3
KITFOX 2	2	41	1	0	5	5
KITFOX 2 MB	2	41	1	0	1	1
KITFOX 532	2	41	1	0	1	1
KITTY HAWK	1	41	1	0	1	1
KLEBS FLYBABY	1	41	1	0	1	1
KLEBS PIETENPOL	2	41	1	0	1	1
KM MARK V 100-200	1	41	1	0	1	1
KM-2	2	41	1	0	1	1
KM1	1	41	1	0	1	1
KNIGHT TWISTER	1	41	1	0	3	3
KOHLER MUSTANG M-II	2	41	1	0	1	1
KOLB	2	41	1	0	1	1
KOLB FIRESTAR	1	41	1	0	2	2
KOLB FIRESTAR AK-1	1	41	1	0	1	1
KOLB FLYER	1	41	1	0	1	1
KOLB MARK II	2	41	1	0	3	3
KOLB MARK 2	2	41	1	0	1	1
KOLB MK II TWINSTAR	2	41	1	0	1	1
KOLB TWIN STAR	2	41	1	0	3	3
KOLB TWINSTAR	2	41	1	0	39	39
KOLB TWINSTAR MK II	2	41	1	0	17	17
KOLB TWINSTAR TSP-1	2	1	1	0	1	1
KOLB ULTRA STAR	1	41	1	0	1	1
KOLB ULTRA/FIRESTAR	1	41	1	0	1	1
KOLB ULTRASTAR	1	41	1	0	1	1
KOMET MODEL 163	2	51	2	0	1	1
KOOKABURRA 320	4	41	1	0	1	1
KORNS CAPER	2	41	1	0	1	1
KOSAN #39	1	41	1	0	1	1
KOSTOOM-3	2	41	1	0	1	1
KR	1	41	1	0	1	1
KR II	2	41	1	0	2	2
KR P-51J	1	41	1	0	1	1
KR 1	1	41	1	0	3	3
KR 1 1/2	1	41	1	0	1	1
KR 1 5	1	41	1	0	1	1
KR 2	2	41	1	0	23	23
KR 2M	2	41	1	0	1	1
KR-I	2	41	1	0	1	1
KR-II	2	41	1	0	18	18
KR-II MODIFIED	2	41	1	0	1	1
KR-TWO	2	41	1	0	1	1
KR-1	1	41	1	0	81	81
KR-1B	1	41	1	0	2	2
KR-100	2	41	1	0	1	1
KR-2	2	41	1	0	315	315
KR-2 PS SPECIAL	2	41	1	0	1	1

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"On the Line," Tape, 37 Min., **King Arthur Productions** for **National Semiconductor**. (Productivity Improvement)

"Plato," Computer Based Learning Problem, 6 Hours, **Intertek**, Rolling Hills, Ca. (SPC)

"Quality Control Circles," Slides, W.S. Reiker. (Team Problem Solving)

"Type Z: An Alternative Management Style," Film, 105 Min., Professor William Ouchi.

"If Japan Can, Why Can't We?", Tape, 90 Min., **NBC White Paper** 1981

VIDEOTAPES, FILMS, AND SLIDE PRESENTATIONS

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Encyclopedia Britannica Educational Corp
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Lake Orion, Mich. 48035
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ABCs of SQC: Statistical Methods for Quality Improvement
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77 Massachusetts Ave, Rm 9-234
Cambridge, Mass. 02139
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The Deming Videotapes: What American Managers Must Do to Improve Quality, Productivity, and Competitive Position
14 Videocassettes @ 50 minutes.

Action Plans for Implementing Quality and Productivity (3 video cassettes--30 minutes each)

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Curing the Deadly and Destructive Diseases of Management

From the:

American Statistical Association
806 15th St. N. W.
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1-202-393-3253

The Teaching of Statistics in the Industrial Crisis that Confronts the Western World.
(60 Minutes) Presentation by W. Edwards Deming, 1981

Deming and Statistics in Industry for Statisticians and for Statistical Education (60 minutes) W.E. Deming with panel discussants, 1981

From the:

FORD Motor Company
Dearborn, Mich.
1-313-322-4618

Nashua Conference (30 minutes--excerpts from a presentation by William Conway, CEO of Nashua Corporation, to Ford executives.

The Task Before Us (10 minutes)--A review of Ford's commitment to the statistical methods of Dr. W. E. Deming.

From the:

DOD Total Quality Management Series
U.S. Army Visual Information Center
Room 5A470 PENTAGON Wash., DC 20310-4812
Project ID: 7VA-0702199-000:-SF89

Quality Improvement; Mr. Thomas Murrin, ASD & Westinghouse (1:30 hrs)

Total Quality Management; Mr. William W. Scherkenbach (Ford) PIN 505245 (1:45)

Total Quality Management Briefing: Mr. Wayland Hicks (XEROX) (22 May 89) (1:29)

Total Quality Management: Mr. Christopher Galvin, Motorola (19 April 89)
VIRIN A2306-89-UTC-158

From the:
Department of Commerce

The Malcom Baldrige National Quality Award Winners
Excerpts from the 1988 Award Ceremony and Background (12:41 minutes)

From the:

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John W. Gardner's 10 Papers on Leadership (\$1.00 ea.)

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 - Start over at reason for improvement step
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 - Flowcharting
 - Cause and effect diagram
- Level: ESC and QMB

Creating the Future: The New Work Challenge in TQM

**U.S. REGISTERED CIVIL AIRCRAFT
BY MANUFACTURER AND MODEL—NUMBER OF SEATS
AMATEUR/PISTON
AS OF DECEMBER 31, 1989**

Model	Designation			Air Carrier	General Aviation	Total Aircraft
	Places	Aircraft/ Engine Type	No. Engines			
MURRAY KR-2	2	41	1	0	1	1
MUSTANG	1	41	1	0	2	2
MUSTANG .75	2	41	1	0	1	1
MUSTANG F-51D	1	41	1	0	1	1
MUSTANG I	1	41	1	0	1	1
MUSTANG II	1	41	1	0	41	41
MUSTANG II GLA	2	41	1	0	1	1
MUSTANG II MOD	2	41	1	0	1	1
MUSTANG II/M-II	1	41	1	0	1	1
MUSTANG M II	2	41	1	0	2	2
MUSTANG M-II	2	41	1	0	1	1
MUSTANG M-1	1	41	1	0	1	1
MUSTANG MM-1-10	1	41	1	0	1	1
MUSTANG MM-1-12	1	41	1	0	1	1
MUSTANG MOD. II	2	41	1	0	1	1
MUSTANG P51A	2	41	1	0	1	1
MUSTANG P51D	1	41	1	0	2	2
MUSTANG-II	2	41	1	0	10	10
MW-1	1	41	1	0	1	1
MWP	2	41	1	0	1	1
MX	2	41	1	0	1	1
MX II	2	41	1	0	8	8
MX II EIPPER	2	41	1	0	1	1
MX SPRINT II	2	41	1	0	1	1
MX SUPER	1	41	1	0	12	12
MX 11	2	41	1	0	1	1
MX-2	2	41	1	0	2	2
MX-7-180	5	41	1	0	3	3
MX-7-235	5	41	1	0	10	10
MXII	2	41	1	0	2	2
MXL II	2	41	1	0	10	10
MXL II H P	2	41	1	0	1	1
MXL II HP	2	41	1	0	1	1
MXL SUPER	1	41	1	0	3	3
MXL-II	2	41	1	0	4	4
MXL-2	2	41	1	0	1	1
MXLII	2	41	1	0	1	1
MX2	2	41	1	0	1	1
MY PATSY	2	41	1	0	1	1
MYERS GLASAIR	2	41	1	0	1	1
MYSTERY SHIP 2	3	41	1	0	1	1
M10C	1	51	2	0	1	1
M103	2	41	1	0	1	1
M20L	4	41	1	0	29	29
M305	1	41	1	0	1	1
N 3 PUP	1	41	1	0	2	2
N. DUNBAR VARIEZE	2	41	1	0	1	1
N-1	1	41	1	0	1	1
N-3 PUP	1	41	1	0	1	1
N-3 SUPER PUP	1	41	1	0	1	1

SAYINGS . . .

- The same system that brought you the top 10% also brought you the bottom 10%.
- Don't shoot the person standing next to the "improvement opportunity."
- TQM requires "Follow Me!" leadership.
- Leadership, real leadership, sees the danger and is acting already to change the way business is done.
- The 1:10:100 Rule: The defect prevented for \$1 at the design stage, will cost \$10 to detect and correct after production and \$100 to fix if it gets in the field.
- If you are not working for the customer, you better be working for someone who is.
- Quality Focus is revolutionary and evolutionary. The revolution is in the mind of the innovator. The evolution is in the systems and networks that will be changed by the Quality Focus.
- Dinosaurs, like normal ways of doing business, are locked in stone, very big, very old and very dead.
- The Quality Organization will need more management time invested than fiscal investment.
- At Budget Time: Fund strategies, not projects.
- Surrender nothing except your old way of doing business, otherwise you will be unable to believe in, commit to, or drive toward world class quality.
- If you have to choose between investing time in hardware or softside improvements -- choose the softside improvements of quality at the source, employee involvement, and streamlined processes which are under statistical control.

GLOSSARY

GLOSSARY

- Abnormal Variation** ----- Changes in process performance that cannot be accounted for by typical day-to-day variation. Also referred to as nonrandom variation.
- Conformance** ----- Affirmative indication or judgement that a product or service has met specified requirements, contract, or regulation. The state of meeting the requirements.
- Continuous Improvement** ----- The idea that quality management and improvement is necessarily a continuous activity to ensure ongoing customer satisfaction and improved efficiency.
- Control** ----- The state of stability, normal variation, and predictability. Process of regulating and guiding operations and processes using quantitative data. Control mechanisms are also used to detect and avoid potential adverse effects of change.
- Corrective Action** ----- The implementation of effective solutions that result in the elimination of identified product, service, and process problems.
- Customer** ----- The recipient or beneficiary of the outputs of your work efforts or the purchaser of your products and services. May be either internal or external to the company.
- Customer/Supplier Model** ----- The model is generally represented using three interconnected triangles to depict inputs flowing into a work process that, in turn, adds value and produces outputs that are delivered to a customer. Throughout the process, requirements and feedback are fed from the customer to the supplier to ensure that customer quality requirements are met.
- Effectiveness** ----- The state of having produced a decided or desired effect; the state of achieving customer satisfaction.
- Efficiency** ----- A measure of performance that compares output production with cost of resource utilization (as in number of units per employee per hour or per dollar).
- Functional Organization** ----- An organization responsible for one of the major corporate business functions such as marketing, sales, design, manufacturing, and distribution.

GLOSSARY

(continued)

Implementer	An individual working within the process and who is responsible for carrying out specific job tasks.
Inputs	Products or services obtained from others (suppliers) in order to perform job tasks.
Measurements	The act or process of measuring to compare results to requirements. A quantitative estimate of performance.
Outputs	Materials or information provided to others (internal or external customers).
Process	A set of interrelated work activities that are characterized by a set of specific inputs and value-added tasks that produce a set of specific outputs.
Process Capability	Long-term performance level after the process has been brought under control.
Process Owner	Coordinates the various functions and work activities at all levels of a process, has the authority or ability to make changes in the process as required, and manages the process end-to-end so as to ensure optimal overall performance.
Process Performance	A measure of how effectively and efficiently a process satisfies customer requirements.
Process Review	An objective assessment of how well the methodology has been applied to your process. Emphasizes the potential for long-term process results rather than the actual results achieved.
Quality	The ability of a product or service to meet the expectations of customers.
Quality Improvement Team ...	A group of individuals charged with the task of planning and implementing process quality improvement. The three major roles in this task force are team leader, team facilitator, and team member.
Quality Management	The management of a process to maximize customer satisfaction at the lowest overall cost to the company.

G L O S S A R Y

(continued)

- Quality Management System**— The collective plans, activities, and events that are established to ensure that a product, process, or service will satisfy given needs. The infrastructure supporting the operational process management and improvement methodology.
- Quality Tool** ----- Instrument or technique that supports the activities of process quality management and improvement.
- Requirements** ----- What is expected in providing a product or service. The "it" in "do it right the first time". Specific and measurable customer needs with an associated performance standard.
- Root Cause** ----- Original reason for nonconformance within a process. When the root cause is removed or corrected, the nonconformance will be eliminated.
- Statistical Process** ----- The application of statistical methods to analyze data, study, and monitor process capability and performance. Through the use of SPC methods such as control charts, you can determine if a process is in control and then keep it in control while working to achieve a new level of process performance.
- Subprocesses** ----- The internal processes that make up a process.
- Suppliers** ----- Individuals or groups who provide inputs to you. Suppliers can be internal or external to a company, group, or organization.

SUPPLEMENTARY

INFORMATION

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