Quality: An Introduction
The Quality Challenge

• Today’s economic reality: Intense global competition for sales, profits, contracts and jobs

• Competition is equally challenging in manufacturing and service organizations

• Emphasis on controlling people has not worked

• The Proven New strategy: Combine Effective Leadership with Total Quality Management
Quality management

• Customer Satisfaction is today’s Engine for Growth

• QM: Assessing, recognizing and meeting the true requirements—needs and expectations—of the ‘customer’

• To win him over, we must delight the customer by fully meeting these needs and expectations
Traditional Management

- Focus on short term profits, stock price
- No clear strategic position in target sectors (poor competitive positioning)
- Clamping down on costs while tolerating high levels of waste
- Take-it-or-leave-it attitude to customers
- Buying at lowest price
- Managers are troubleshooters
In the past, there was often:

• no expectation that the system could be better
• no understanding of how to make it better
• no encouragement for all workers to be involved in the improvement process
• no power to change it
Traditional mgmt works only when…

• Employees do as they are told
• Demand exceeds supply
• Customers’ expectations increase or change slowly
• The world situation does not change
Current Situation Worldwide

• More competitors than ever
• Fiercely competitive strategies in play
• Fluid and unpredictable financial systems
• Customers’ expectations increasing
• Employees’ expectations increasing
• Investors expect more
• Rapid changes in technology
Flaws and Weak Spots

• Doing same things but expecting different results
• Not understanding competitive positioning
• Departments don’t understand needs and expectations of other depts.
• Controlling people by rules and “systems”
• “AQL”—defects and errors are inevitable!”
• Firefighting rather than doing it right the first time
• Person causing problem does not suffer the problem; someone else does
Cost of Mismanaging is Enormous

- 15-30% manufacturing sales revenue goes in
  - Failing to satisfy customers’ needs and expectations
  - Not doing it right the first time
- Up to 40% service effort goes in extra work to fix problems
- Mismanagement pushes away new customers
Effective Leadership and TQM

• A successful strategy combines Effective Leadership and TQM practices

• EL Vision:
  – Capitalize on market opportunities to get competitive advantage

• TQM:
  – Ensure that every job, every process is carried out right, first time and every time

• Together EL + TQM: Company does the right thing, right first time
Competitive Positioning

• Must decide first how you want to compete:
  – Low price or differentiation
  – Target market broad or niche marketing
  – Assess strength of buyers, suppliers, competition

• Determine how valued added will be distributed between suppliers, you and customers

• TQM starts with identifying needs and expectations of targeted potential customers
Meeting the Requirements

- Performance, appearance, availability, delivery, reliability, maintainability and cost effectiveness
- The first task—find out what these requirements are
- Companies must establish a ‘marketing’ activity charged with this task
- Measure needs and expectations
- Measure organization’s ability to meet the requirements
TQM encourages problem solving at all levels

- a different management philosophy
- appropriate organizational structure to put this into effect
- use of the simple and advanced statistical tools
- training at all levels
- power to delegate to those who can make the necessary changes
Quality Chains

• Throughout and beyond the organization a series of quality chains exist
• Quality chains exist within the organization also
• Chain may be broken by
  – One person, or
  – One equipment, not meeting the requirements of the customer—internal or external
The Quality Chain

Source: TQM by John Oakland
Internal Quality Chains

• There exists in each department a series of suppliers and customers

• Many dissatisfactions can be traced to
  – The interface between the organization and its outside customers, or
  – The people who operate at that interface
  – People at the interface experience the ramifications

• Within companies transfer of information regarding requirements is frequently poor or totally absent
To Achieve Quality…

• Each person in the Quality Chain must be trained to interrogate the interface…

• Internal Customers
  – Who are my internal customers, what are their requirements? How do I measure my ability to meet them? What must change to improve my capability? What prevents me from meeting requirements? How do I monitor changes in the requirements?
Internal Suppliers

- Who are my internal suppliers?
- What are my true requirements to do my job right?
- How do I communicate my requirements?
- Do my suppliers have the capability to measure and meet my requirements?
- How do I inform them of changes in the requirements?
Two-way Responsibility in Dealing with your Internal Supplier

- Must respect supplier’s needs and expectations if the supplier is to satisfy your requirements
- Everyone must have his/her customers well-defined
- Quality will not just happen, it has to be managed—the complete Quality Chain must function right
- Many employees are far removed from the company’s external customers
Process Management

• A process is the transformation of inputs to desired outputs to satisfy the customer
• Involves actions, methods and operations
• Output is what is transferred to the customer
• At every supplier-customer interface there resides a transformation process
• Every task is a process and must add value
• Critical process are activities carried out to achieve the company’s mission and objectives
TQM is not a collection of tools and techniques. It is a culture.

TQM is an attitude of mind based on pride in job, teamwork, and management commitment extending to all employees at all levels and in all departments.
Commitment to Quality

• Commitment creates quality interactions between marketing, design, production/operations, purchasing, distribution and service functions
• To be effective TQM must be applied throughout
• Top management must make it unmistakably evident that they are really serious about quality
• Management must ensure that efforts and achievements receive
  – recognition,
  – attention and
  – reward
Commitment is easy to detect

- It shows on the shop floor, in hospital wards, in classrooms...
- Things happen:
  - Material problems are corrected with suppliers,
  - equipment faults are put right by improved maintenance programs or replacement,
  - people are trained,
  - partnerships are built,
  - continuous improvement is observable
TQM is also visible

- Management operates by the assumption that people want to achieve, accomplish, influence their work, and they want to challenge their abilities.
- Focus of control moves from outside the individual to within.
- Ideas for improvement come from those with knowledge and experience of the methods and techniques.
- Focus is on prevention—doing the right things, right first time, every time.
Setting up TQM

Three major components must be set up:

- A quality assurance system
- Quality tools and techniques
- Teamwork
The Quality Assurance System

• Develop the quality policy
• Develop and implement a quality system to accomplish the objectives set out in the quality policy
• Consistency—to be achieved by ensuring that for each task same methods, materials, skills etc. are used every time
• Audit and review
  – People are operating by the documented system, and
  – The system meets the requirements
• Example: ISO 9000 or QS 9000
Quality Tools and Techniques

• Focus is on reducing variability from the targeted performance in meeting customer expectations
• Any process can be monitored and improved by gathering and using its data more effectively
• Tools and techniques are the enablers
• Statistical process control (SPC) is an example
• Use of statistical tools should spread companywide—to make the best use of the data being generated possible
• Besides tools you will need management commitment to resourcing and training, and good organization
Process Studies should be Systematic

- Diagrams, charts, graphs, etc. should become the means of communication concerning the state of process control
- Process studies should answer:
  - Is the process capable of doing the job correctly?
  - Does it continue to do the job correctly?
  - Could it do it more consistently and on target?
Why Teamwork?

• Processes are now complex, beyond the control of one person
• Teams can tackle a greater variety of problems
• Problems are exposed to greater variety of skills
• Working in a team on a quality problem is more satisfying and boosts morale
• Problems that cross boundaries become easier to deal with
• Team recommendations are more likely to be implemented than individual suggestions
Effective Teamwork

• May require expert facilitation
• The culture in the West
  – Independence is valued, with little incentive for sharing of ideas and information
  – Rewards are typically individualized
• Mind-set of individualism must be changed, for quality problems are often complex and involve interdependence
• Open communication and trust facilitates teamwork
How to Manage Quality

• Provide effective leadership
• Quantify incentives for improvement
• Manage by TQM
Providing Effective Leadership

- Express your vision—what you want the company to be
- State clearly what you want to achieve in line with that vision and communicate those throughout the organization
- Develop effective strategies and supporting plans to achieve those goals
- Identify and focus on critical processes
- Empower and encourage participation
Mission and Objectives

• Use them to communicate an inspiring vision of what the company is all about and where it is going

• Address:
  – Target sectors and customers and market or service, and your aimed position
  – Relationships with customers
  – Internal relationships
  – Relationships with suppliers or subcontractors
  – Monitoring of customer satisfaction performance
Empowering Employees

• Authorize employees to act autonomously for quality improvement

• Help develop the attitude: “I want to personally understand who my customers are and what their needs and expectations are”

• Build abilities—Train, train and train. Relate the training to needs and process improvement; review its effectiveness

• Facilitate participation; reward behavior that demonstrates initiative taking
Implementing and Using TQM

- Commit to satisfying customers’ needs and expectations
- Get close fully understand those needs and expectations
- Do all jobs right first time
- Review external/internal customer complaints to initiate quality improvement projects
- Expand involvement to the lowest rank toward satisfying the customer; Recognize and publicize achievements
- Measure cost of quality mismanagement and the level of firefighting
- Demand and lead continuous improvement
- Benchmark your quality performance with competitors’
Getting Started

• Recognize customers and discover their needs and expectations
• Set performance standards consistent with customer requirements
• Control processes and improve their capability
• Establish quality management systems
• Set quality policy, motivate through leadership and equip people to achieve
• Empower everyone to act for quality improvement
Quality Concepts
The Quality Process

- Finance
- Personnel
- Maintenance
- Legal

Corporate

Quality Assurance

Quality Engineering
- Product Design
- Process Design
- Procurement

Quality Control
- Manufacturing
- Packaging
- Distribution
- Field Service

OPRE 6364
The search of efficiency and quality...

- Lean production: from Japan
  - Quality circles

- Teams: from Sweden
  - Use of autonomous work groups
  - Multi-skilled, gain sharing

- Flexible specialization: from Italy
  - Use of flexible technology
  - Job security

- Diversified quality production: from Germany
  - Combining skills and technology
Quality Defined

- What does the term quality mean?
- Quality is the ability of a product or service to consistently meet or exceed customer expectations.
Concepts of Quality

Internally Oriented Definitions
1. degree to which product conforms to a design
2. differences in the quantity of some desired ingredient or attribute from an ideal amount.

Externally Oriented Definitions
1. fitness for use (including for the next worker)
2. capacity to satisfy wants.
Quality Gurus

Edward Deming
- Plan - Do- Check - Act
- Fourteen Points for Transformation Management

J M Juran
- Managerial Breakthroughs, Training, Cost of Quality

Armand Feigenbaum
- Total Quality Control (all stages)

Kaoru Ishikawa
- Quality Circles, 7 Tools

Philip Crosby
- Zero defects, Quality is free

Genichi Taguchi
- Simplified design of experiments
- Quality loss functions
- Robust design
Components of TQM

• Focus on the Customer
• Everyone responsible for quality
• Team Problem Solving
• Employee Training
• Fact-based Management
• A philosophy of Continuous Improvement
“TQM is a culture not a program.”
Cost of Quality

• **Internal Failure Costs**  (rework, scrap, and other costs of correcting errors before they reach the customer)

• **External Failure Costs**  (warranty repairs, replacements, complaints, legal expenses)

• **Appraisal Costs**  (measuring quality, inspections, tests, surveys, etc.)

• **Prevention Costs**  (training, redesigns, inspection procedures, etc.)
Quality Costs

Internal Failure Costs
- Scrap
- Rework

External Failure Costs
- Warranty cost
- Product liability

Appraisal Costs
- Inspection costs

Prevention Costs
- Process improvement
- Product simplification
- Training costs

Continual Improvement

Decline
- Little or no defective work
- No dissatisfied customers
- Very little inspection

Increase
- An ounce of prevention is worth a pound of cure

OPRE 6364
Costs of Quality

- Failure Costs--costs incurred by defective parts/products or faulty services.
- Internal Failure Costs--Costs incurred to fix problems that are detected before the product/service is delivered to the customer.
- External Failure Costs--All costs incurred to fix problems that are detected after the product/service is delivered to the customer.
Costs of Quality (continued)

- Appraisal Costs
  - All product and/or service inspection costs.

- Prevention Costs
  - All TQ training, TQ planning, customer assessment, process control, and quality improvement costs to prevent defects from occurring
Locating Quality Problems
(where do you begin)

• Customer complaints, Warrantees
• Benchmarking
• 7 Tools
• House of Quality
• Taguchi Experiments
• Continuous improvement programs
• Plan-Do-Check-Act
The role of Management in TQM

• Management is an enabler, culture setter, and supporter rather than dictator
TQM—What it Involves

• Quality is the Responsibility of Management
  – Problems are result of the system
  – Unempowered workers have no control over the system

• Customer Concept
  – Focus: maximize value added
  – External
  – Internal
    – Horizontal
    – Supervisors
    – Subordinates
TQM--What it Involves (Contd.)

• Defects are *Treasures*

• Requirements of TQM:
  – Elements
    • Top down commitment (management integrity)
    • Bottom up ideas (cooperative worker attitudes)
  – Two-way *communication* is necessary

• Employee Empowerment
TQM and the Deming Philosophy

• Deming’s 14 Points
  – Suggestions/targets (not commandments?)
  – Not a menu: buy all or none!
  – “Some organizations are not ready” (?)
    • Local employers (empowerment?)
    • Universities (grades?)

• Deming’s 7 Deadly Diseases

• Deming’s Other Obstacles

• What Do Others Gurus Say?
Deming’s 14 Points (Abbreviated)

1 -- Constancy of purpose
2 -- New philosophy
3 -- Price tag awarding of business
4 -- Mass inspection
5 -- Continuous improvement
6 -- Training
7 -- Supervision
8 -- Fear
Deming’s 14 Points (Abbreviated)

9 -- Barriers
10 -- Slogans, etc.
11 -- Quotas
12 -- Pride in workmanship
   • Direct labor
   • Management
13 -- Education
14 -- Structure
Deming’s 7 Deadly Diseases

- Lack of constancy of purpose (flavor-of-the month)
- Emphasis on short-term profits
- Performance evaluations (e.g., MBO)
- Executive mobility
- Emphasis of visible figures alone
- Excessive medical costs
- Excessive warranty costs (fueled by lawyers)
Deming’s “Other Obstacles”

- Neglect of long-range planning
- Search for examples
- Belief that technology alone will transform industry
- Believing problems to be different
- Obsolescence in schools
- Reliance on Q/C departments
- Meeting specifications
- False starts (quality circles, lip service)
- Unmanned computers
What is QUALITY?

• Watch or a Clock:
  – accurate time
  – appearance
  – price
  – durability / reliable

• Food producers (Cafeteria, Processors)
  – Food that is safe
  – meets the FHA guidelines
  – Sells

• Universities or TQM course
  – up to date, relevant, challenging etc
Dimensions of Quality

• *Performance* - main characteristics of the product/service
• *Aesthetics* - appearance, feel, smell, taste
• *Special features* - extra characteristics
• *Conformance* - how well product/service conforms to customer’s expectations
• *Safety* - Risk of injury
• *Reliability* - consistency of performance
Dimensions of Quality (Cont’d)

- *Durability* - useful life of the product/service
- *Perceived Quality* - indirect evaluation of quality (e.g. reputation)
- *Service after sale* - handling of customer complaints or checking on customer satisfaction
# Examples of Inspection Points

<table>
<thead>
<tr>
<th>Type of business</th>
<th>Inspection points</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast Food</td>
<td>Cashier</td>
<td>Accuracy</td>
</tr>
<tr>
<td></td>
<td>Counter area</td>
<td>Appearance, productivity</td>
</tr>
<tr>
<td></td>
<td>Eating area</td>
<td>Cleanliness</td>
</tr>
<tr>
<td></td>
<td>Building</td>
<td>Appearance</td>
</tr>
<tr>
<td></td>
<td>Kitchen</td>
<td>Health regulations</td>
</tr>
<tr>
<td>Hotel/motel</td>
<td>Parking lot</td>
<td>Safe, well lighted</td>
</tr>
<tr>
<td></td>
<td>Accounting</td>
<td>Accuracy, timeliness</td>
</tr>
<tr>
<td></td>
<td>Building</td>
<td>Appearance, safety</td>
</tr>
<tr>
<td></td>
<td>Main desk</td>
<td>Waiting times</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Cashiers</td>
<td>Accuracy, courtesy</td>
</tr>
<tr>
<td></td>
<td>Deliveries</td>
<td>Quality, quantity</td>
</tr>
</tbody>
</table>
Determinants of Quality

- Ease of use
- Conformance to design
- Service

Design
# Examples of Quality Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>(Product) Automobile</th>
<th>(Service) Auto Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Performance</td>
<td>Everything works, fit &amp; finish</td>
<td>All work done, at agreed price</td>
</tr>
<tr>
<td></td>
<td>Ride, handling, grade of materials used</td>
<td>Friendliness, courtesy, Competency, quickness</td>
</tr>
<tr>
<td>2. Aesthetics</td>
<td>Interior design, soft touch</td>
<td>Clean work/waiting area</td>
</tr>
<tr>
<td>3. Special features</td>
<td>Gauge/control placement</td>
<td>Location, call when ready</td>
</tr>
<tr>
<td></td>
<td>Cellular phone, CD player</td>
<td>Computer diagnostics</td>
</tr>
<tr>
<td>4. Safety</td>
<td>Antilock brakes, airbags</td>
<td>Separate waiting area</td>
</tr>
</tbody>
</table>
## Examples of Quality Dimensions Cont’d

<table>
<thead>
<tr>
<th>Dimension (Product)</th>
<th>Automobile</th>
<th>(Service)</th>
<th>Auto Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Reliability</td>
<td>Infrequency of breakdowns</td>
<td>Work done correctly, ready when promised</td>
<td></td>
</tr>
<tr>
<td>6. Durability</td>
<td>Useful life in miles, resistance to rust &amp; corrosion</td>
<td>Work holds up over time</td>
<td></td>
</tr>
<tr>
<td>7. Perceived quality</td>
<td>Top-rated car</td>
<td>Award-winning service department</td>
<td></td>
</tr>
<tr>
<td>8. Service after sale</td>
<td>Handling of complaints and/or handling of complaints requests for information</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Early Defect Detection Saves

Stage: At Source  Next Process  End of Line  Final Inspection  End User

Cost: $  $  $  $  

Impact: • Little  • Minor delay  • Rework  • Reschedule  • Much rework  • Delivery delay  • Inspect more  • Warranty  • Complaints  • Reputation  • Market share

Prevention Saves Even More!

OPRE 6364
Recall Quality...

- The ability of a product or service to consistently meet or exceed customer expectations
- Quality means getting what you pay for

Consequences of Poor Quality

Loss of business:
Poor designs or defective products or services can result in loss of business

Liability:
Damage or injuries resulting from faulty design

Productivity:
Productivity and quality are often closely related

Costs:
Poor quality increases certain costs incurred by the organization
Quality Improvement

- Defect Visibility
- Early Correction
- Defect Prevention
Who is Responsible for Quality?

- Customer Service
- Marketing and Sales
- Packaging and Shipping
- Quality Assurance
- Production/Operations
- Procurement
- Design
- Top Management
• Substandard work
  - Defective products
  - Substandard service
  - Poor designs
  - Shoddy workmanship
  - Substandard parts and materials

Having knowledge of this and failing to correct and report it in a timely manner is unethical.
Quality Awards

Baldrige Award

Deming Prize
Malcolm Baldrige National Quality Award

1.0 Leadership
2.0 Strategic Planning
3.0 Customer and Market Focus
4.0 Information and Analysis
5.0 Human Resource Development and Management
6.0 Process Management
7.0 Business Results
The Deming Prize

• Honoring W. Edwards Deming
• Japan’s highly coveted award
• Main focus is on statistical quality control
Why Measure? Why statistics?

- Without data you are another person with an opinion
- What to measure
- How to report data
- Appropriate use of data
- Benchmarking
Statistical Techniques

Statisticians can do this and teach others

About 30% can do these tasks

EVERYBODY CAN DO THIS!!

Seven Simple Tools

OPRE 6364
Quality Certification

- ISO 9000
- Set of international standards on quality management and Quality assurance, critical to international Business
- ISO 9000 standards require firms to document their quality control systems at every step (incoming raw materials, product design, in-process monitoring and so forth) so that they’ll be able to identify those areas that are causing quality problems and correct them
# ISO 9000 Series

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9000</td>
<td>Helps companies determine which standard of ISO 9001, 9002, and 9003 applies</td>
</tr>
<tr>
<td>ISO 9001</td>
<td>Outlines guidelines for companies that engaged in design, development, production, installation, and servicing of products or service</td>
</tr>
<tr>
<td>ISO 9002</td>
<td>Similar to 9001, but excludes companies engaged in design and development</td>
</tr>
<tr>
<td>ISO 9003</td>
<td>Covers companies engaged in final inspection and testing</td>
</tr>
<tr>
<td>ISO 9004</td>
<td>The guidelines for applying the elements of the Quality Management System</td>
</tr>
</tbody>
</table>
ISO 9000 Registration Process

• The final audit begins with a review of the company's quality manual, which the accredited registrar or third party audit team typically uses as its guide.
• The audit team checks to see that the documented quality system meets the requirement of ISO 9000 and that the organization is practicing what is documented.
ISO 9000 Registration Process

• When the registrar is satisfied with the favorable recommendation of the audit team, it grants registration and issues a registration document to the company.
ISO 14000

• ISO 14000 - A set of international standards for assessing a company’s environmental performance

• Standards in three major areas
  – Management systems
  – Operations
  – Environmental systems
Initiatives in employee involvement

- Locating quality-related decisions at the lowest levels in the organization
- Self-managed teams to form critical part of thinking
- New work structures and new ways of organizing work
- The job of management is to prepare individuals/teams to function in an autonomous manner
- Individuals/teams are given the power, information and knowledge
Total Quality Management (TQM)

- A systematic and coordinated company-wide effort to continuously improve the quality of a firm’s products and services.
- Combination of statistical controls and group problem solving process
- …. 
<table>
<thead>
<tr>
<th>Stage of Knowledge</th>
<th>Description</th>
<th>Quality Improvement Strategy</th>
<th>Managing Production</th>
<th>Relevant Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Total ignorance. Can’t tell good product from bad</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Can tell good from bad but don’t know why</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Can list possibly relevant causes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Can isolate important causes by noting correlation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Can measure key input &amp; output variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Can develop a repeatable recipe which often works</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Can see local behavior around base recipe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Have quantitative model</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Have complete procedural knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage of Knowledge</th>
<th>Description</th>
<th>Relevant Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Total ignorance. Can’t tell good product from bad</td>
<td>Customer complaints report</td>
</tr>
<tr>
<td>1</td>
<td>Can tell good from bad but don’t know why</td>
<td>Customer complaints report</td>
</tr>
<tr>
<td>2</td>
<td>Can list possibly relevant causes</td>
<td>Cause-effect diagrams; Correlation plots</td>
</tr>
<tr>
<td>3</td>
<td>Can isolate important causes by noting correlation</td>
<td>Process log book; Correlation plots</td>
</tr>
<tr>
<td>4</td>
<td>Can measure key input &amp; output variables</td>
<td>Orthogonal array experiments; Trend charts</td>
</tr>
<tr>
<td>5</td>
<td>Can develop a repeatable recipe which often works</td>
<td>Process Control by SPC; Reaction Plan; R&amp;D by DOE</td>
</tr>
<tr>
<td>6</td>
<td>Can see local behavior around base recipe</td>
<td>Regression; Modeling; EVOP procedures</td>
</tr>
<tr>
<td>7</td>
<td>Have quantitative model</td>
<td>Optimization; CNC; Simulation</td>
</tr>
<tr>
<td>8</td>
<td>Have complete procedural knowledge</td>
<td>Automation software</td>
</tr>
</tbody>
</table>
Evolution of QA Methods...

- Six Sigma...
- Quality Mgmt Systems
- DOE
- SPC
- Inspection

Time Line:
- 1930
- 1940
- 1975
- 1985
- 1990
- 1995
- 2000
References

http://erc.msh.org/quality/example/example1.cfm
Santa Rosa Health Center Quality Improvement Case Study

http://www.gslis.utexas.edu/~rpollock/tqm.html
Quality management web resources