Quality And Productivity

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Examen rápido

• Con base en el material de la clase anterior explique tres unidades de análisis empleadas para calcular o definir la productividad.

Se recoge a las 19:10 hrs
Quality and Productivity

- Productivity of a process is the ratio of the value added by the process to the value of the labor and capital consumed.
- Productivity is measured with no reference to customer satisfaction as a result of product quality.
Quality And Productivity

- Productivity = output / input
- Fewer defects increase output
- Quality improvement reduces inputs
Measuring Yield & Productivity

\[ Y = (I)(%G) + (I)(1-%G)(%R) \]

where

Y = yield
I = number units started in production
% G = percentage good units
% R = percentage of defective units reworked
Product Yield Example

Start 100 motors per day

80% are good

50% of poor quality units can be reworked

\[ Y = (I)(%G) + (I)(1-%G)(%R) \]

\[ Y = 100 \times 0.80 + 100 \times (1- 0.80) \times 0.50 = 90 \text{ motors} \]
Product Cost

\[
\text{Product Cost} = \frac{(\text{direct mfg cost})(\text{input}) + (\text{unit rework cost})(\text{reworked units})}{\text{yield}}
\]

\[
= \frac{(K_d)(I) + (K_r)(R)}{Y}
\]

where

- \(K_d\) = direct manufacturing cost
- \(K_r\) = rework cost per unit
- \(I\) = input
- \(R\) = reworked units
- \(Y\) = yield
Product Cost Example

Direct mfg cost = $30, Rework cost = $12
100 motors started, 20% defective
50% of defective motors can be reworked

Product cost = \( \frac{(K_d)(l) + (K_r)(R)}{Y} \)

\[ \frac{($30)(100) + ($12)(10)}{90 \text{ motors}} = $34.67 \text{ per motor} \]
Multistage Product Yield

\[ Y = (I) (%g_1)(%g_2)...(%g_n) \]

Where

\[ I = \text{input batch size} \]
\[ %g_i = \text{percent good at stage } I \]
Multistage Process Yield

Motors produced in four-stage process
Start with 100 motors

<table>
<thead>
<tr>
<th>Stage</th>
<th>% Good quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.93</td>
</tr>
<tr>
<td>2</td>
<td>0.95</td>
</tr>
<tr>
<td>3</td>
<td>0.97</td>
</tr>
<tr>
<td>4</td>
<td>0.92</td>
</tr>
</tbody>
</table>

\[ Y = (100) \times (0.93) \times (0.95) \times (0.97) \times (0.92) \]

\[ Y = 78.8 \text{ motors} \]
Input Required For Output Of 100 Good Motors

\[ I = \frac{Y}{(\%g_1)(\%g_2)(\%g_3)(\%g_4)} \]

\[ I = \frac{100}{(0.93)(0.95)(0.97)(0.92)} \]

= 126.8 motors
MOVIE
What Is Quality?

• “The degree of excellence of a thing” (Webster’s Dictionary)

• “The totality of features and characteristics that satisfy needs” (ASQC)

• Fitness for use
What is Quality?

“The quality of a product or service is a customer’s perception of the degree to which the product or service meets his or her expectations.”
Best-In-Class and World-Class

- Customers’ expectations of quality are not the same for different classes of products or services.
- Best-in-class quality means being the best product or service in a particular class of products or services.
- Being a world-class company means that each of its products and services are considered best-in-class by its customers.
Dimensions Of Product Quality (Garvin)

1. Performance
   - basic operating characteristics

2. Features
   - “extra” items added to basic features

3. Reliability
   - probability product will operate over time
4. Conformance
   - meeting pre-established standards

5. Durability
   - life span before replacement

6. Serviceability
   - ease of getting repairs, speed & competence of repairs
7. Aesthetics
   - look, feel, sound, smell or taste

8. Safety
   - freedom from injury or harm

9. Other perceptions
   - subjective perceptions based on brand name, advertising, etc
MOVIE
Service Quality

1. Time & Timeliness
   – customer waiting time, completed on time

2. Completeness
   – customer gets all they asked for

3. Courtesy
   – treatment by employees
4. Consistency
   – same level of service for all customers

5. Accessibility & Convenience
   – ease of obtaining service

6. Accuracy
   – performed right every time

7. Responsiveness
   – reactions to unusual situations
Determinants of Quality

- **Quality of design** – products/service designed based on customers’ expectations and desires
- **Quality capability of production processes** – processes must be capable of producing the products designed for the customers
- **Quality of conformance** – capable processes can produce inferior product if not operated properly
- **Quality of customer service** – a superior product does not mean success; must have quality service also
- **Organization quality culture** – superior product and service requires organization-wide focus on quality
Quality Of Conformance

• Ensuring product or service produced according to design

• Depends on
  – design of production process
  – performance of machinery
  – materials
  – training
The Meaning of Quality

Producer’s Perspective
- Quality of Conformance
  - Conformance to specifications
  - Cost

Consumer’s Perspective
- Quality of Design
  - Quality characteristics
  - Price

Fitness for Consumer Use

Production

Marketing
Quality as an Investment

• To gain approval for a quality improvement effort, quality must be viewed as an investment
  – Accounting vs. Marketing view
• Establishing quality requires expenditures
  – Selling the importance and value
  – Training on quality concepts
  – Stabilizing processes
  – Improving processes
Quality and Time

• Step-by-step doesn’t fit well with American temperament
• Quality takes time and consistency of long-term strategy
• For Japanese, quality improvement is forever, and this is the only attitude to take
MOVIE
Quality Philosophers

- Walter Shewhart
- W. Edwards Deming
- Joseph Juran
- Philip Crosby
- Armand Feigenbaum
Quality Gurus

• W. Edwards Deming
  – Assisted Japan in improving productivity and quality after World War II
  – In 1951 Japan established Deming Prize
  – US was slow in recognizing his contributions
  – Introduced Japanese companies to the Plan-Do-Check-Act (PDCA) cycle (developed by Shewart)
  – Developed 14 Points for managers
Deming’s 14 Points for Managers

1. Create constancy of purpose toward product quality to achieve organizational goals
2. Refuse to allow commonly accepted levels of poor quality
3. Stop depending on inspection to achieve quality
4. Use fewer suppliers, selected based on quality and dependability instead of price
5. Instill programs for continuous improvement of costs, quality, service, and productivity
Deming’s 14 Points for Managers

6. Train all employees on quality concepts
7. Focus supervision on helping people do a better job
8. Eliminate fear, create trust, and encourage two-way communications between workers and management
9. Eliminate barriers between departments and encourage joint problem-solving
10. Eliminate the use of numerical goals and slogans to make workers work harder
Deming’s 14 Points for Managers

11. Use statistical methods for continuous improvement of quality and productivity instead of numerical quotas

12. Remove barriers to pride of workmanship

13. Encourage education and self-improvement

14. Clearly define management’s permanent commitment to quality and productivity
The Deming Wheel
(or P-D-C-A Cycle)

1. Plan
   Identify problem
   Develop plan for improvement

2. Do
   Implement plan on test basis

3. Study / Check
   Is the plan working

4. Act
   Institutionalize improvement
   Continue cycle

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WILLIAM W. SCHERKENBACH
THE DEMING ROUTE TO
QUALITY AND
PRODUCTIVITY
ROAD MAPS AND ROAD BLOCKS
FOREWORD BY W. EDWARDS DEMING

MERCURY BUSINESS BOOKS
Quality Gurus

• Philip B. Crosby
  – Wrote *Quality Is Free* in 1979
  – Company should have the goal of zero defects
  – Cost of poor quality is greatly underestimated
  – Traditional trade-off between costs of improving quality and costs of poor quality is erroneous
Quality Gurus

• Armand V. Feigenbaum
  – Developed concept of total quality control (TQC)
  – Responsibility for quality must rest with the persons who do the work (quality at the source)

• Kaoru Ishikawa
  – Wrote Guide to Quality Control in 1972
  – Credited with the concept of quality circles
  – Suggested the use of fishbone diagrams
Quality Gurus

• Joseph M. Juran
  – Like Deming, discovered late by US companies
  – Played early role in teaching Japan about quality
  – Wrote *Quality Control Handbook*

• Genichi Taguchi
  – Contends that constant adjustment of processes to achieve product quality is not effective
  – Instead, products should be designed to be robust enough to handle process and field variation
Quality Drives the Productivity Machine

• If production does it right the first time and produces products and services that are defect-free, waste is eliminated and costs are reduced.
• Estimated that 20-25% of COGS in the US is spent on finding and correcting errors
• Quality management programs today are viewed by many companies as productivity improvement programs.
Other Aspects of the Quality Picture

- Just-in-time (JIT) and lean manufacturing
- Product standardization
- Automated equipment
- Preventive maintenance
JIT Manufacturing

• “A system of enforced problem solving”
• Lot sizes are cut
• In-process inventories are drastically reduced
• Any interruption causes production to stop
• Quality problems are immediately addressed
• The necessary teamwork contributes to increased pride in quality
Total Quality Management

1. Customer defined quality
2. Top management leadership
3. Quality as a strategic issue
4. All employees responsible for quality
5. Continuous improvement
6. Shared problem solving
7. Statistical quality control
8. Training & education for all employees
TQM Throughout The Organization

- Marketing, sales, R&D
- Engineering
- Purchasing
- Personnel
- Management
- Packing, storing, shipping
- Customer service
Strategic Implications Of TQM

- Quality is key to effective strategy
- Clear strategic goal, vision, mission
- High quality goals
- Operational plans & policies
- Feedback mechanism
- Strong leadership
TQM In Service Companies

• Inputs similar to manufacturing
• Processes & outputs are different
• Services tend to be labor intensive
• Quality measurement is harder
• Timeliness is important measure
• TQM principles apply to services
Cost Of Quality

• Cost of achieving good quality
  – Prevention
  – Appraisal

• Cost of poor quality
  – Internal failure costs
  – External failure costs
Costs of Quality

- Scrap and rework - rescheduling, repairing, retesting
- Defective products in the hands of the customer - recalls, warranty claims, law suits, lost business, …
- Detecting defects - inspection, testing, ….
- Preventing defects - training, charting performance, product/process redesign, supplier development, ….
Traditional View of How Much to Inspect

Annual Cost ($)

Optimal Level of Inspection

Total Quality Control Costs

Cost of Scrap, Rework, and Detecting Defects

Cost of Defective Products to Customers

0

% of Products Inspected
Quality Indexes

- Labor index
  - quality cost / labor hours
- Cost index
  - quality cost / manufacturing cost
- Sales index
  - quality cost / sales
- Production index
  - quality cost / units produced
# Quality Index Example

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Quality Costs</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Prevention</td>
<td>$27,000</td>
<td>41,500</td>
<td>74,600</td>
<td>112,300</td>
</tr>
<tr>
<td>Appraisal</td>
<td>155,000</td>
<td>122,500</td>
<td>113,400</td>
<td>107,000</td>
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<tr>
<td>Internal failure</td>
<td>386,400</td>
<td>469,200</td>
<td>347,800</td>
<td>219,100</td>
</tr>
<tr>
<td>External failure</td>
<td>242,000</td>
<td>196,000</td>
<td>103,500</td>
<td>106,000</td>
</tr>
<tr>
<td>Total</td>
<td>$810,400</td>
<td>829,200</td>
<td>639,300</td>
<td>544,400</td>
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</table>

**Accounting measures**

<table>
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<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$4,360,000</td>
<td>4,450,000</td>
<td>5,050,000</td>
<td>5,190,000</td>
</tr>
<tr>
<td>Mfg costs</td>
<td>1,760,000</td>
<td>1,810,000</td>
<td>1,880,000</td>
<td>1,890,000</td>
</tr>
</tbody>
</table>
Quality Index

Total quality costs * 100 / base
$810,400 * 100 / 4,360,000 = 18.58

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales</th>
<th>Cost</th>
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<tbody>
<tr>
<td>1994</td>
<td>18.58</td>
<td>46.04</td>
</tr>
<tr>
<td>1995</td>
<td>18.63</td>
<td>45.18</td>
</tr>
<tr>
<td>1996</td>
<td>12.66</td>
<td>34.00</td>
</tr>
<tr>
<td>1997</td>
<td>10.49</td>
<td>28.80</td>
</tr>
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</table>
Quality Is...

• An important determinant of business profitability

• Positively & significantly related to higher return on investment
Quality Productivity Ratio (QPR)

Includes productivity & quality costs

Increases
- if processing or rework costs decrease
- if process yield increases

\[
QPR = \frac{\text{Good quality units}}{(\text{input})(\text{proc. cost}) + (\text{def. units})(\text{rework cost})} \times 100
\]
QPR Example

Direct cost = $30/unit Rework cost = $12/unit
Start with 100 motors per day
80% are good, 50% of defective units are reworked

Company studies 4 changes

1. Increase production to 200 units/day
2. Cut processing cost to $26 & rework cost to $10
3. Increase yield to 95%
4. Combine 2 & 3
QPR Example

• Base case QPR = 3.09

\[
QPR = \frac{80 + 10}{(100)(\$30) + (10)(\$12)} = 2.88
\]

• Case 1 - Increasing I has no effect

\[
QPR = \frac{160 + 20}{(200)(\$30) + (20)(\$12)} = 2.88
\]
• Case 2 - Cost decrease increases QPR

$$QPR = \frac{80 + 10}{(100)(\$26) + (10)(\$10)}(100) = 3.33$$

• Case 3 - Increased yield increases QPR

$$QPR = \frac{95 + 2.5}{(100)(\$30) + (2.5)(\$12)}(100) = 3.21$$

• Case 4 - Cut costs & raise yield is best

$$QPR = \frac{95 + 2.5}{(100)(\$26) + (2.5)(\$10)}(100) = 3.71$$
Employees & Quality Improvement

- Quality circles
- Employee suggestions
- Process improvement teams
- Self-managed work teams
The Quality Circle Process

- **Presentation**
  - Implementation
  - Monitoring

- **Organization**
  - 8-10 members
  - Same area
  - Moderator

- **Training**
  - Group processes
  - Data collection
  - Problem analysis

- **Solution**
  - Problem results

- **Problem analysis**
  - Cause & effect
  - Data collection & analysis

- **Problem ID**
  - List alternatives
  - Consensus
  - Brainstorming
Seven Quality Control Tools

1. Pareto analysis
2. Flowcharts
3. Check sheets
4. Histograms
5. Scatter diagrams
6. Control charts
7. Fishbone diagram
A Pareto Chart

Causes of poor quality

Percent from each cause

- Poor Design: (64)
- Wrong dimensions: (13)
- Defective parts: (10)
- Machine calibrations: (6)
- Operator errors: (3)
- Defective materials: (2)
- Surface abrasions: (2)
A Flowchart
# Check Sheet

<table>
<thead>
<tr>
<th>COMPONENTS REPLACED BY LAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIME PERIOD: 22 Feb to 27 Feb 1998</td>
</tr>
<tr>
<td>REPAIR TECHNICIAN: Bob</td>
</tr>
</tbody>
</table>

## TV SET MODEL 1013

<table>
<thead>
<tr>
<th>Component</th>
<th></th>
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<tbody>
<tr>
<td>Integrated Circuits</td>
<td>☑</td>
</tr>
<tr>
<td>Capacitors</td>
<td>☑ ☑ ☑ ☑ ☑</td>
</tr>
<tr>
<td>Resistors</td>
<td>☑</td>
</tr>
<tr>
<td>Transformers</td>
<td>☑</td>
</tr>
<tr>
<td>Commands</td>
<td></td>
</tr>
<tr>
<td>CRT</td>
<td></td>
</tr>
</tbody>
</table>
Scatter Diagram
Control Chart

Number of defects

Sample number

UCL = 23.35

LCL = 1.99

\( \bar{c} = 12.67 \)
Fishbone Diagram

- **Measurement**
  - Faulty testing equipment
  - Incorrect specifications
  - Improper methods

- **Human**
  - Poor supervision
  - Lack of concentration
  - Inadequate training

- **Machines**
  - Out of adjustment
  - Tooling problems
  - Old/worn

- **Environment**
  - Inaccurate temperature control
  - Dust and Dirt

- **Materials**
  - Defective from vendor
  - Not to specifications
  - Material-handling problems

- **Process**
  - Poor process design
  - Ineffective quality management
  - Deficiencies in product design

**Quality Problem**
Japanese Quality Strategy

- Quality improvement cuts cost
- Lower costs allow lower prices
- Lower price brings increased market share
- Increased market share brings benefits of scale
- Scale benefits generate further cost reductions
- Quality of design increases demand
Quality Awards And Certifications

• The Malcolm Baldrige Award
• The Deming Prize
• Industry, regional, and company awards
  – Institute of Industrial Engineers
  – NASA
  – European Quality Award
Malcolm Baldrige National Quality Award

- Awards given annually to US firms
- Nearly all states have quality award programs styled after the Baldrige Award
- Criteria include
  - Leadership
  - Strategic planning
  - Customer and market focus
  - Information and analysis
  - Human resource focus
  - Process management
  - Business results
Human Resources in the Baldrige Award Criteria

The Human Resource Focus Category examines how an organization motivates and enables employees to develop and utilize their full potential in alignment with the organization’s overall objectives and action plans. Also examined are the organization’s efforts to build and maintain a work environment and an employee support climate conducive to performance excellence and to personal and organizational growth.

5.1 Work Systems
5.2 Employee Education, Training, and Development
5.3 Employee Well-Being and Satisfaction
   a. Work Environment
   b. Employee Support and Satisfaction
The Deming Prize

• Awarded by the Union of Japanese Scientists and Engineers
• Recognizes companies that have demonstrated successful quality improvement programs
• All (not just Japanese) firms are eligible
• Four top-management activities recognized
  – Senior management activities
  – Customer satisfaction activity
  – Employee involvement activities
  – Training activity
Premio Nacional de Calidad

Objetivos

• Promover y estimular la adopción de procesos integrales de calidad total con base en el Modelo de Dirección por Calidad, así como reconocer a las empresas industriales, comercializadoras y de servicios, instituciones educativas y dependencias de gobierno que operan en México, que se distinguen por contar con las mejores prácticas de calidad total y mostrarlas como modelos a seguir por la comunidad mexicana.
Premio Nacional de Calidad

Características o descripción

• El Presidente de la República hace entrega de una paloma estilizada en plata sterling, 0.925 ley con una dimensión de 26 cm. de alto por 30 cm. de ancho.

• Asimismo, hace entrega de una placa destacando la labor de los trabajadores de cada organización ganadora.
ISO 9000 Categories

- ISO 9001 ~ Suppliers and Designers
- ISO 9002 ~ Production
- ISO 9003 ~ Inspection and Test
- ISO 9004 ~ Quality Management
Implications Of ISO 9000

• Truly international in scope
• Certification required by many foreign firms
• U.S. firms export > $100 billion/yr to Europe
• Adopted by U.S. Navy, DuPont, 3M, AT&T, & others
ISO Accreditation

• European registration
  – 3rd party registrar assesses quality program
  – European Conformity (CE) mark authorized

• United States 3rd party registrars
  – American National Standards Institute (ANSI)
  – American Society for Quality Control (ASQC)
  – Registrar Accreditation Board (RAB)
ISO 9000 Standards

• Quality management guidelines developed by the International Organization for Standardization
• Companies become certified by applying to third-party providers who assess the level of conformity to the standards
• More than 300,000 companies worldwide are ISO 9000-certified
• The US big three automakers have adopted a similar set of standards called QS-9000
ISO 9000 Standards

• Standards based on 8 quality management principles
  – Customer focused organization
  – Leadership
  – Involvement of people
  – Process approach
  – System approach to management
  – Continual improvement
  – Factual approach to decision making
  – Mutually beneficial supplier relationship
Customer Involvement

• Mechanisms to involve the customer
  – Focus groups
  – Market surveys
  – Customer questionnaires
  – Market research programs

• Quality Function Deployment (QFD)
  – Formal system for identifying customer wants
  – Eliminate wasteful product features and activities that do not contribute
Designing Products for Quality

- **Designing for Robustness**
  Product will perform as intended even if undesirable conditions occur in production or in field.

- **Designing for Manufacturability (DFM)**
  Products typically have fewer parts and can be assembled quickly, easily, and error-free.

- **Designing for Reliability**
  Manufacturing parts to closer tolerances. Using redundant components where necessary.
Designing for Reliability

• Each part of a product is designed for a given level of component reliability

• **Component reliability** is defined as “the probability that a part will not fail in a given time period or number of trials under ordinary conditions of use”

• 3 common measures of component reliability are:
  – Reliability (CR)
  – Failure Rates (FR and FR_n)
  – Mean Time Between Failures (MTBF)
Designing for Reliability

- **Reliability**
  \[ CR = 1 - FR \]

- **Failure Rates**
  \[ FR = \frac{\text{Number of failures}}{\text{Number tested}} \]
  \[ FR_n = \frac{\text{Number of failures}}{\text{Unit-hours of operation}} \]

- **Mean Time Between Failures**
  \[ MTBF = \frac{\text{Unit-hours of operation}}{\text{Number of failures}} = \frac{1}{FR_n} \]
Designing for Reliability

- The combined reliability of all the components in a product forms the basis for system reliability (SR).
- When $n$ independent critical components are combined into a product, the SR is determined by:

$$SR = CR_1 \times CR_2 \times CR_3 \times \ldots \times CR_n$$

- Consider a product with 50 identical critical components:
  - If each component’s CR = 99.5%, then SR = 77.8%
  - If each component’s CR = 98.0%, then SR = 36.4%
  - If each component’s CR = 90.0%, then SR = 0.5%
Example: Allied Switch

• Reliability

Allied Switch has designed a machine having three critical components that interact. The three parts have component reliability of .96, .90, and .98.

What is the system reliability of the machine?

\[ SR = (CR_1) (CR_1) (CR_1) \]
\[ = (.96)(.90)(.98) \]
\[ = .847 \]
Example: Allied Switch

- Reliability

If the machine could be redesigned to allow redundancy for the component that presently has a reliability of .90, what would be the new system reliability of the machine?
Example: Allied Switch

• Reliability

First, compute the CR for the redundant parts.

\[
CR = \text{Probability of primary component working} + \left(\text{Probability of backup component working}\right) \times \text{Probability of needing backup component}
\]

\[
= .90 + \left(\left(\text{.90}\right) \times \left(\text{.10}\right)\right) = .90 + .09 = .99
\]

Now, compute the system reliability.

\[
SR = \left(\text{.96}\right) \times \left(\text{.99}\right) \times \left(\text{.98}\right) = .931
\]
Designing and Controlling Production Processes

- The responsibility of producing products of high quality rests with the workers producing the product
- Two types of factors introduce variation in production processes
  - Controllable factors - can be reduced by workers and management
  - Uncontrollable factors - reduced only by redesigning or replacing existing processes
Process Capability

• Process capability is a production process’ ability to produce products within the desired expectations of customers.

• The process capability index (PCI) is a way of measuring that ability.
Process Capability Index (PCI)

\[
\text{PCI} = \frac{(UL - LL)}{6\sigma}
\]

UL = allowed upper limit of the product characteristic, based on customer expect.
LL = allowed lower limit of the product characteristic, based on customer expect.
\(\sigma\) = standard deviation of the product characteristic from the production process

PCI > 1.00  Process is capable of meeting customer expectations.
PCI < 1.00  Process is not capable.
Process Capability Index (PCI)

- Process is not capable: PCI = 0.8
- Process is capable: PCI = 1.0
- Process is quite capable: PCI = 1.2
Example: Process Capability

In order for a certain molded part to be considered acceptable, the molding process must be conducted within a limited range of temperature. The lower limit is 455° and the upper limit is 465°.

Three molding machines being considered are A, B, and C with standard deviations of $\sigma_A = 2.50$, $\sigma_B = 1.25$, and $\sigma_C = 1.75$.

Which of these machines are capable of producing the part in accordance with the temperature requirements?
Example: Process Capability

\[
\begin{align*}
\text{PCI}_A &= (465 - 455) / (6(2.50)) = 10/15 = 0.67 \\
\text{PCI}_B &= (465 - 455) / (6(1.25)) = 10/7.5 = 1.33 \\
\text{PCI}_C &= (465 - 455) / (6(1.75)) = 10/10.5 = 0.95
\end{align*}
\]

Machine A is not close to being capable, with a PCI well below 1.00. Machine B is more than adequate with a PCI well above 1.00. Machine C falls slightly short of being capable.
Developing Supplier Partnerships

• Supplier becomes part of the customer’s TQM program
• The relationship between the supplier and the customer becomes long-lasting and durable
Customer Service, Distribution, and Installation

- Packaging, shipping, and installation must be included in TQM.
- Warehousing, marketing, and the distribution function must be committed to perfect quality.
- Contact between the customers and the firm’s product must be planned and managed to provide satisfied customers.
Building Teams of Empowered Employees

• Employee training programs
  – Employees at all levels are trained in quality.

• Works teams and empowerment
  – Workers are given the authority to act.

• Quality at the source
  – Workers are responsible for their own work.

• Quality circles
  – Small groups of employees who analyze and solve quality problems and implement improvement programs.
Benchmarking and Continuous Improvement

• Benchmarking
  – The practice of establishing internal standards of performance by looking to how world-class companies run their businesses

• Continuous Improvement
  – The company makes small incremental improvements toward excellence on a continual basis
Quality Management in Services

- Since many services are intangible, it is difficult to determine their quality
- Customers set their own standards for services
- Perceived quality of service affected by the surroundings
- Performance of service employees determines in large part the quality of the services
Wrap-Up: World-Class Practice

• Quality begins when business strategy is formulated
• Quality is the weapon of choice to capture global markets
• Quality drives the productivity machine
• Not depending on inspection to catch defects; concentrating on doing things right the first time
• Committing tremendous resources to put in place TQM programs aimed at continuous improvement