Just-in-time, TQC, TQM, Quality Assurance

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What is Quality?

“ Mutu dari suatu jasa atau produk adalah suatu persepsi pelanggan menyangkut tingkat derajat produk atau jasa yang bertemu dengan ekspektasinya.”

Mutu adalah kemampuan suatu produk atau jasa secara konsisten temu atau melebihi harapan pelanggan.

Quality

- Continuous Improvement in quality
  - Never-ending improvement (*kaizen* in Japan)
  - Quality must built into a product
- Quality; customer satisfaction →customer amazement
- Dr. Deming(1900-1993) in Japan, 1954
- Total Quality Management, TQC

Key Contributors to Quality Management

Contributor	Known for
Deming	14 points; special & common causes of variation
Juran	Quality is fitness for use; quality trilogy
Feignbaum	Quality is a total field
Crosby	Quality is free; zero defects
Ishikawa	Cause-and effect diagrams; quality circles
Taguchi	Taguchi loss function
Ohno and Shingo	Continuous improvenment

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
- *Reliability* - consistency of performance
- *Durability* - useful life of the product/service
- *Perceived Quality* - indirect evaluation of quality (e.g. reputation)
- *Serviceability - service after sale*

Examples of Quality Dimensions

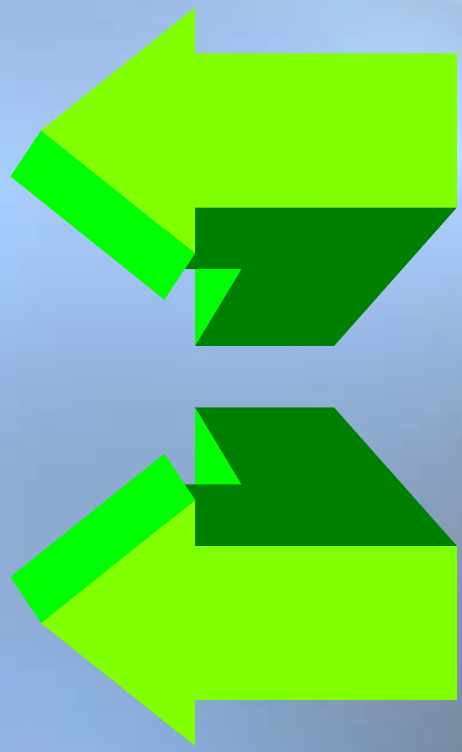
Dimension	(Product) Automobile	(Service) Auto Repair
1. Performance	Everything works, fit & finish	All work done, at agreed price
	Ride, handling, grade of materials used	Friendliness, courtesy, Competency, quickness
2. Aesthetics	Interior design, soft touch	Clean work/waiting area
3. Special features	Gauge/control placement	Location, call when ready
	Cellular phone, CD player	Computer diagnostics

Examples of Quality Dimensions (Cont'd)

Dimension	(Product) Automobile	(Service) Auto Repair
5. Reliability	Infrequency of breakdowns	Work done correctly, ready when promised
6. Durability	Useful life in miles, resistance to rust & corrosion	Work holds up over time
7. Perceived quality	Top-rated car	Award-winning service department
8. Serviceability	Handling of complaints and/or requests for information	Handling of complaints

Service Quality

- Convenience
- Reliability
- Responsiveness
- Time
- Assurance
- Courtesy
- Tangibles



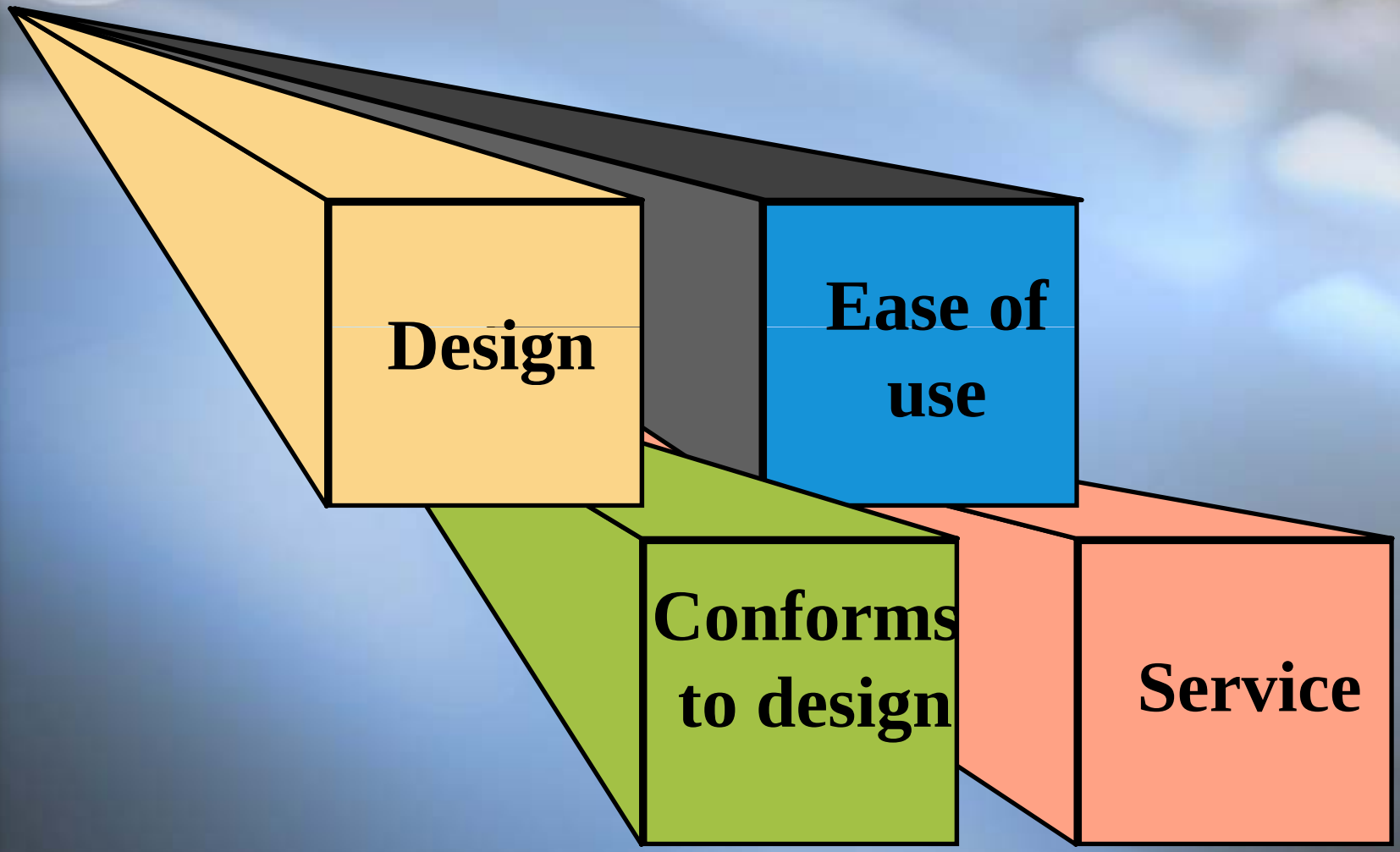
Examples of Service Quality

Dimension	Examples
1. Convenience	Was the service center conveniently located?
2. Reliability	Was the problem fixed?
3. Responsiveness	Were customer service personnel willing and able to answer questions?
4. Time	How long did the customer wait?
5. Assurance	Did the customer service personnel seem knowledgeable about the repair?
6. Courtesy	Were customer service personnel and the cashier friendly and courteous?
7. Tangibles	Were the facilities clean, personnel neat?

Challenges with Service Quality

- Customer expectations often change
- Different customers have different expectations
- Each customer contact is a “moment of truth”
- Customer participation can affect perception of quality
- Fail-safing must be designed into the system

Determinants of Quality

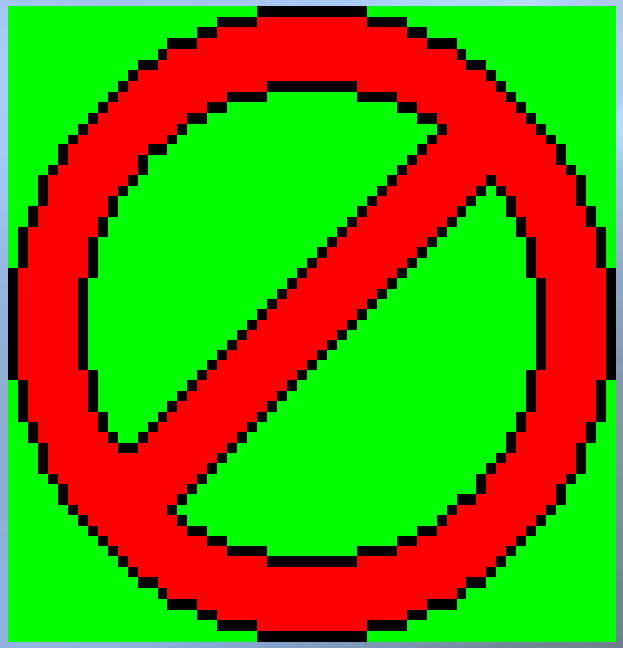


Determinants of Quality (cont'd)

- Quality of design
  - Intension of designers to include or exclude features in a product or service
- Quality of conformance
  - The degree to which goods or services conform to the intent of the designers

The Consequences of Poor Quality

- Loss of business
- Liability
- Productivity
- Costs



Responsibility for Quality

- Top management
- Design
- Procurement
- Production/operations
- Quality assurance
- Packaging and shipping
- Marketing and sales
- Customer service

Evolution of Quality Management

- 1924 - Statistical process control charts
- 1930 - Tables for acceptance sampling
- 1940’s - Statistical sampling techniques
- 1950’s - Quality assurance/TQC
- 1960’s - Zero defects
- 1970’s - Quality assurance in services
- 1980’s – TQM
- 1990’s – Benchmarking, Business Excellence

Sumber Kualitas

- Dimensions of Quality
- Determinants of Quality
- Costs of Quality

Terbaik di kelasnya dan kelas dunia

- Harapan pelanggan adalah mutu tidak sama untuk kelas jasa atau produk yang berbeda.
- Terbaik dalam mutu kelas berarti produk yang terbaik atau dalam kelas produk atau jasa tertentu
- Menjadi perusahaan kelas dunia berarti bahwa masing-masing tentang produk dan jasanya dipertimbangkan terbaik dalam kelasnya oleh pelanggan

Beberapa Dimensi Kelas Produk

- Pencapaian – berkaitan dengan penggunaan pelanggan
- Corak – karakteristik khusus
- Keandalan – kemungkinan gangguan, kegagalan pemakaian
- Kemampuan melayani – kecepatan/biaya/kenyamanan pemeliharaan
- Ketahanan – jumlah waktu yang digunakan sebelum pembetulan pekerjaan
- Penampilan – mempengaruhi pekerjaan
- Layanan pelanggan – perawatan sebelum/selama/setelah penjualan
- Keselamatan – perlindungan pemakai sebelum,/selama/setelah penggunaan

Determinan Kualitas

- **Disain mutu –** baramg atau jasa, yang dirancang pelanggan berdasarkan pada' harapan dan keinginan
- **Kemampuan kwalitas proses produksi –** proses harus mampu memproduksi produk yang dirancang untuk pelanggan
- **Mutu conformance –** proses tidak mampu produk lebih rendah jika dioperasikan dengan baik
- **Mutu layanan pelanggan –** suatu produk yang baik tidak berarti sukses; harus mempunyai mutu melayani juga
- **Kultur organisasi berkwalitas –** produk dan jasa memerlukan organization- memusatkan atas kualitas

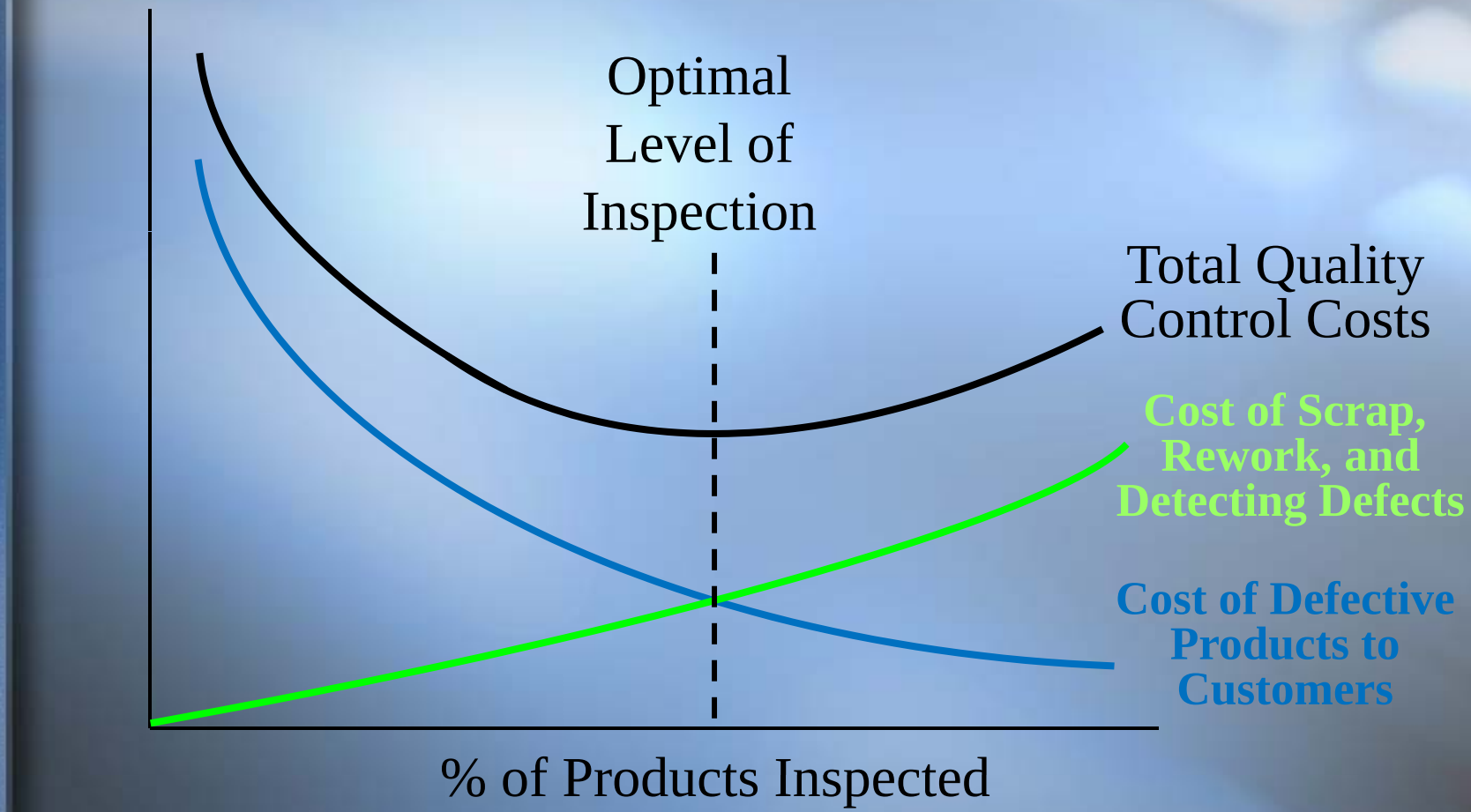
Biaya Kualitas

- Sisa dan pengolahan kembali - rescheduling, memperbaiki, menguji kembali
- Produk cacat di tangan pelanggan - daya ingat, jaminan keabsahan, perkara pengadilan, bisnis yang hilang,…
- Pendeteksian cacat - pemeriksaan, pengujian,….
- Pencegahan cacat - pelatihan, tabel capaian, disain produk kembali, pengembangan penyalur,….

Manajemen Kualitas Tradisional

- Sistem pemeriksaan ketat
- Produk cacat akan diidentifikasi dan dibuang
- Mutu dapat dilihat ke dalam produk
- Keputusan utama adalah berapa banyak produk yang diperiksa

Gambaran Tradisional Berapa Banyak Diperiksa



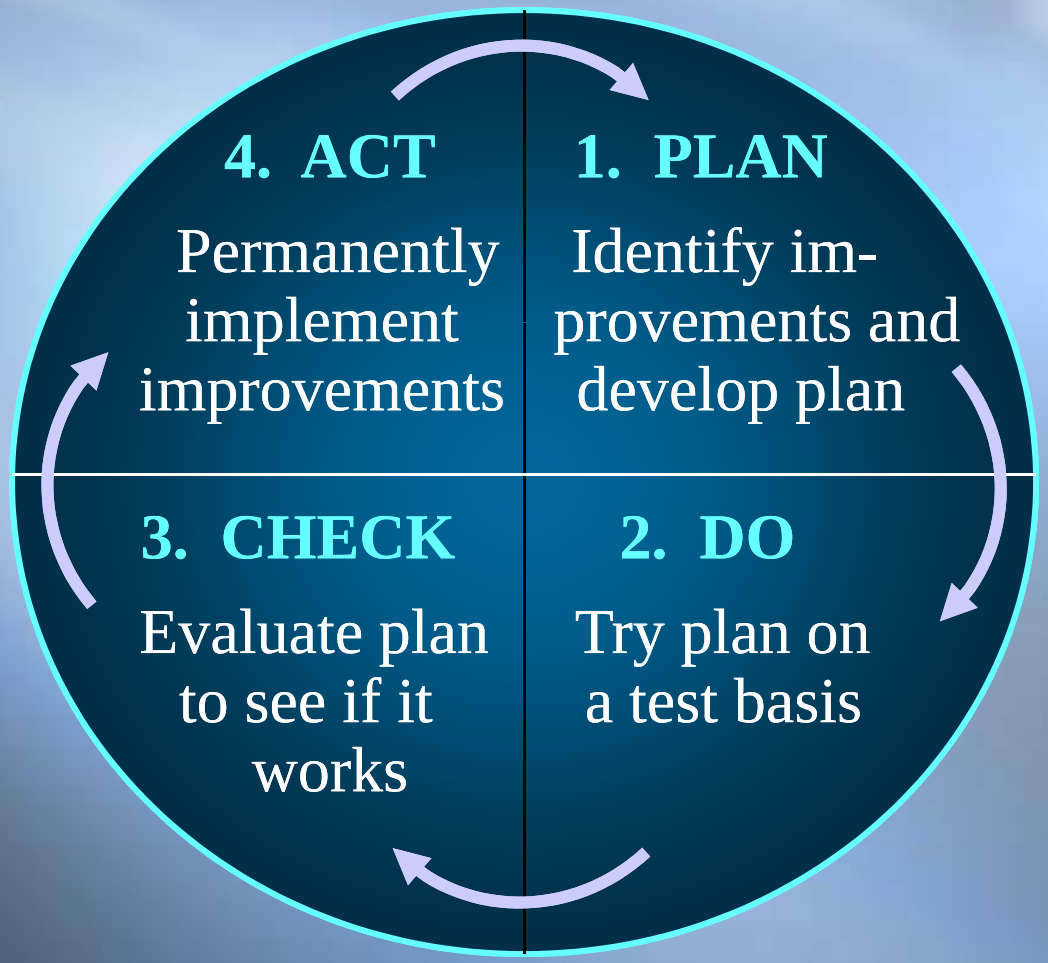
Manajemen Kualitas Modern

- Quality Gurus
- Quality Drives the Productivity Machine
- Other Aspects of the Quality Picture

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

PDCA Cycle


4. ACT
Permanently implement improvements
1. PLAN
Identify improvements and develop plan
3. CHECK
Evaluate plan to see if it works
2. DO
Try plan on a test basis

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 numer. 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

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

Quality Management Recognition

- Malcolm Baldrige National Quality Award
- Deming Prize
- ISO 9000 Standards

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

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

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

Total Quality Management (TQM) Programs

- Motorola - *Six Sigma*
- Xerox - *Leadership through Quality*
- Intel - *$(PDQ)^2$* or *Perfect Design Quality, Pretty Darn Quick*
- Hewlett-Packard - *Total Quality Control*

Elements of TQM

- Top management commitment and involvement
- Customer involvement
- Design products for quality
- Design production processes for quality
- Control production processes for quality
- Developing supplier partnerships
- Customer service, distribution, and installation
- Building teams of empowered employees
- Benchmarking and continuous improvement

Top Management Commitment and Involvement

- Support must be genuine or TQM will be seen as just another passing fad
- Fundamental changes must occur in the culture of the organization
- Such fundamental changes are not easy, but are impossible without top management's commitment and involvement

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 infield.

- 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 = Probability of primary component working + [(Probability of backup component working) x (Probability of needing backup component)]

  = .90 + [(.90) x (.10)] = .90 + .09 = .99

  Now, compute the system reliability.

  SR = (.96) (.99) (.98) = .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)

PCI = (UL - LL) / (6s)

UL = allowed upper limit of the product characteristic, based on customer expect.

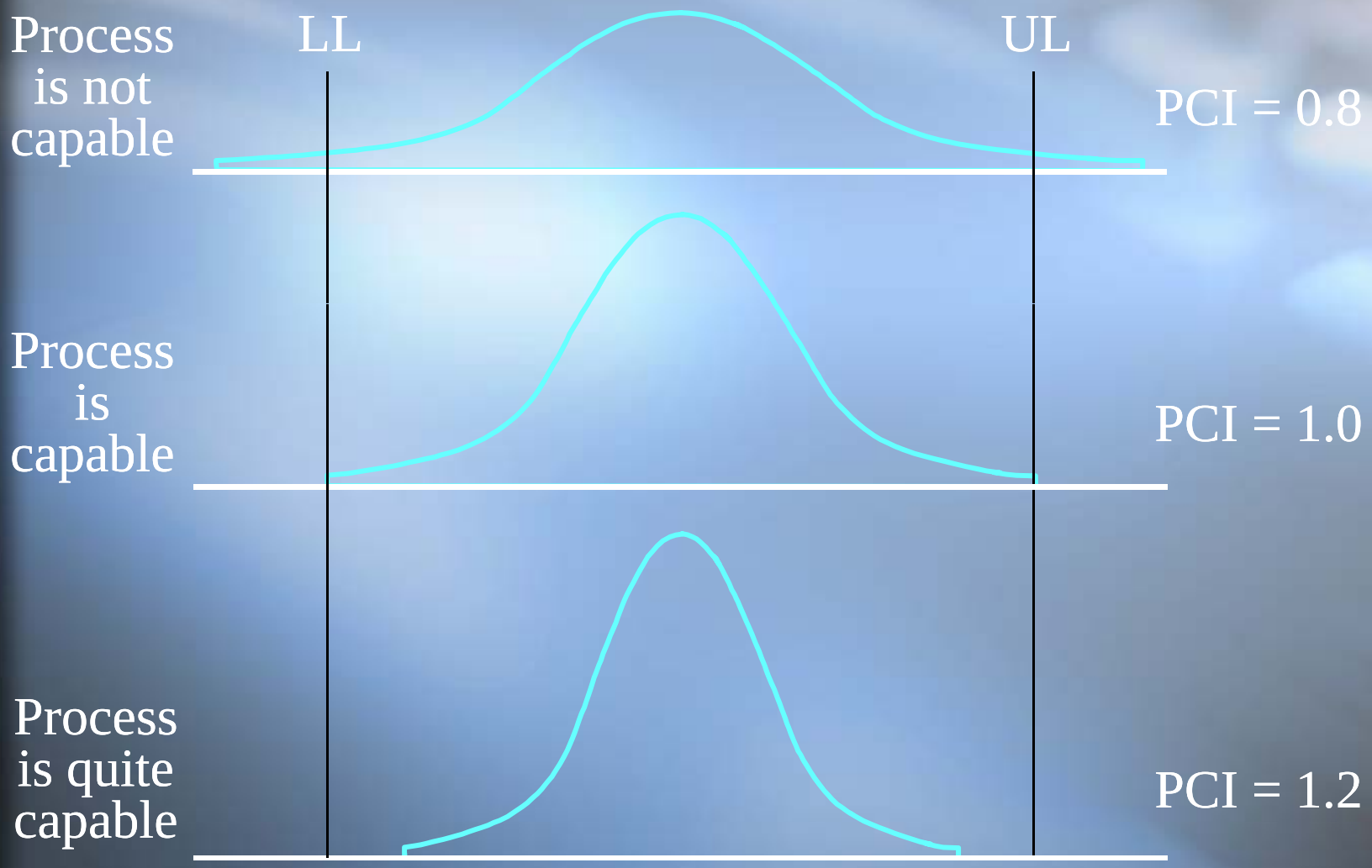
LL = allowed lower limit of the product characteristic, based on customer expect.

s = standard deviation of the product characteristic from the production process

PCI $\geq$ 1.00 Process is capable of meeting custome expectations.

PCI < 1.00 Process is not capable.

Process Capability Index (PCI)



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^{o} and the upper limit is 465^{o}.

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

PCI_A = (465 - 455) / (6(2.50)) = 10/15 = 0.67

PCI_B = (465 - 455) / (6(1.25)) = 10/7.5 = 1.33

PCI_C = (465 - 455) / (6(1.75)) = 10/10.5 = 0.95

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.

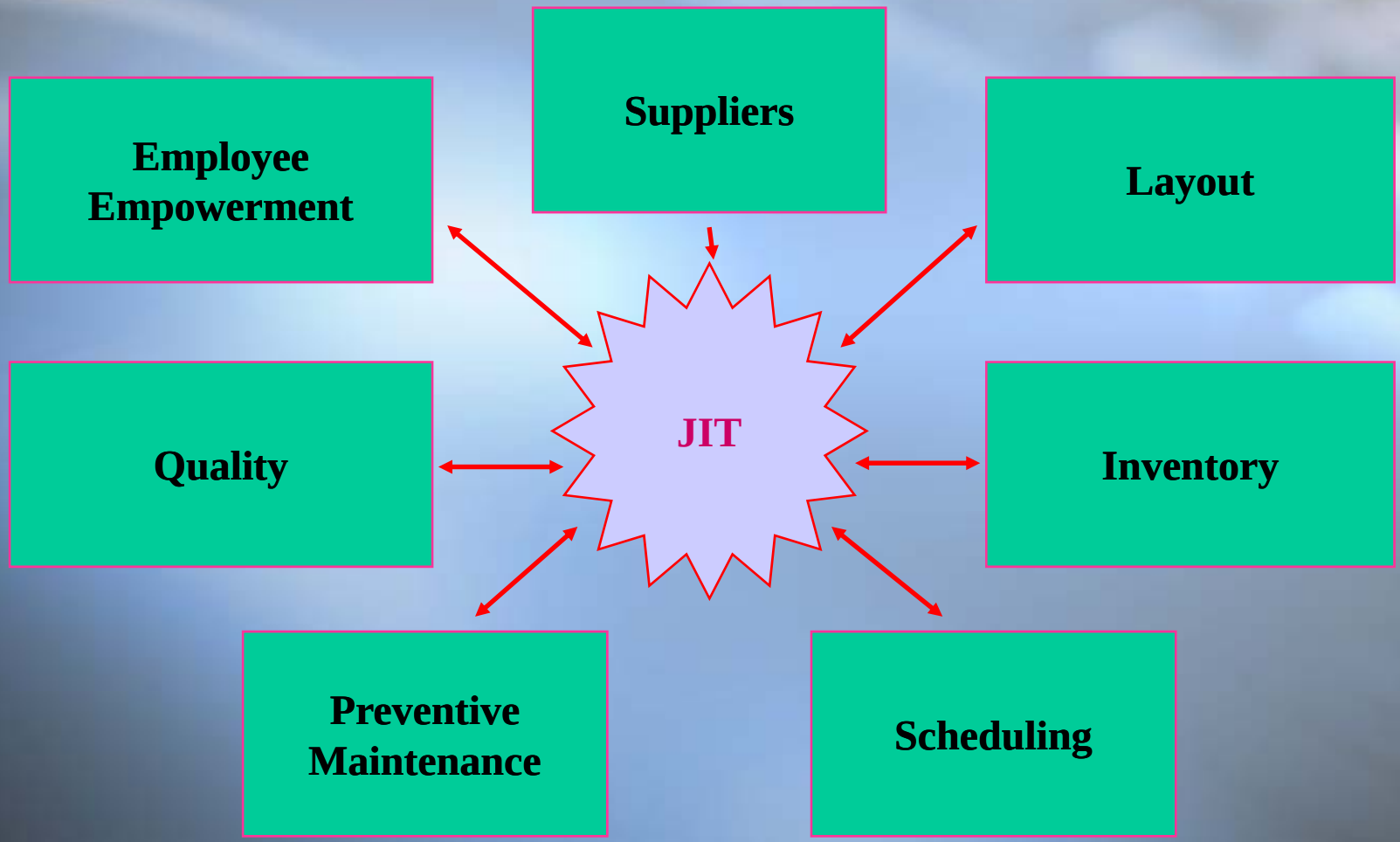
Benchmarking and Continuous Improvement

- 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

Just-in-Time Success Factors



ISO 9000

- Series of standards agreed upon by the International Organization for Standardization (ISO)
- Adopted in 1987
- More than 100 countries
- A prerequisite for global competition?
- ISO 9000 directs you to "document what you do and then do as you documented."

ISO 9000 Series

- 9001
  - Model for Quality Assurance in Design, Production Installation, and Servicing.
- 9002
  - Model for Quality Assurance in Production and Installation
- 9003
  - Model for Quality Assurance in Final Inspection Test

Guidelines for Use

- 9000
  - Quality Management and Quality Assurance Standards: Guidelines for Selection and Use
- 9004
  - Quality Management and Quality System Elements--Guidelines

Three Forms of ISO Certification

First party: A firm audits itself against ISO 9000 standards.

Second party: A customer audits its supplier.

Third party: A "qualified" national or international standards or certifying agency serves as auditor.

ISO 9000 In The US

- Level of registration has gone up significantly even though some companies were slow to adopt the standards
- Some saw it as a plot to bar US entry into Europe
- Certification is often easy, especially if company has quality system in place
- Lack of certification could impact world-wide competitiveness for the company

More About ISO 9000

- They are not award programs
- They just provide criteria for measuring quality systems
- They do not require prescribed method of process control
- Quite flexible: No one best way
  - Provides opportunities and frustrations
- Applies to all industries

Advantages of ISO 9000

- Offers chance for global competitiveness
- Improves operational efficiency
- Improves profitability
- Improves marketing
- Improves export sales
- Improves on-time deliveries
- Improves cycle time and first-pass yield

ISO 9000 versus the Baldrige Award

- Which should we pursue first?
- What are the differences between the two?
- Do you have to be ISO 9000 certified before going for the Baldrige Award?

ISO 9000 versus the Baldrige Award

- ISO provides building blocks for Baldrige
- Baldrige is more comprehensive
- ISO more limited in scope
  - Just a basic standard of minimal requirements
  - Worth perhaps about 400 Baldrige points
  - Designed to be inclusive not exclusive
  - Mandates no approach over another

INTEGRATING ISO 9000 WITH TQM - THROUGH TQP MODEL

TOTAL QUALITY PRACTICES (TQP) MODEL

- TQM
- TPM
- QCC
- ISO
- PPC
- 5S

COMPARISON BETWEEN TQM PRINCIPLES AND 8 MANAGEMENT PRINCIPLES

	ISO 9001:2000	TQM
1.	Leadership	Leadership
		Commitment
2.	Customer Focus Organization	Total Customer Satisfaction
3.	Employee Involvement	Total Involvement
		Cooperation & Teamwork
4.	Process Approach	Ownership
5.	System Approach	Error Prevention
6.	Continual Improvement	Continuous Improvement
7.	Fact Based Decision Making	
8.	Supplier-Relationship	Total Involvement
		Training & Education
		Reward & recognition