Quality is a relative term. It is generally used with reference to the end use of the product. The quality is defined as the fitness for use or purpose at the most economical level.

**THE NEED FOR QUALITY**

The first thing that we need to consider, in any organization, is that quality is the most important thing. The quality of your work defines you.

- Whoever you are,
- Whatever you do,
- I can find the same products and services cheaper somewhere else.

But your quality is your signature.

Developing and delivering high quality products and services means that you are doing things correctly from the beginning. As a consequence, you are reducing the need for additional services, from verification to warranty.

**EVOLUTION OF QUALITY CONCEPTS**

Here we detail how the definition of quality did evolve over time.

1) **Fitness to standard**

Here is a first definition. It just says that a product is of quality if it is what it is supposed to be.

**Definition:** conformance to the specifications

The quality is thus checked by comparison between the output and the specifications.

**Methods:**
- Standardization;
- Statistical quality control;
- Inspection.

Standardization is the set of actions taken for the product and the process to be clearly identified. A set of written procedures for example. The classical test for checking whether standardization has taken place is: "If the people go, do the procedures stay?" Inspection is a simple mean by which the items are sorted. Good items are kept and bad ones are dropped. We can decide to check all the products (total inspection) or only some of them (statistical control). Inspection plans are discussed later in this chapter.

**Drawbacks:**
- Inspectors are "the enemy";
- Inspections do not add any value;
- Conformance to specifications does not mean conformance to needs

Based on this last drawback, the following definition was introduced.

2) Fitness of use

Here, a product is of quality if it performs as expected not as specified. The difference is between the intended use of a product (its specification) and its real use.

**Definition:** conformance to the expected use

A screwdriver is specified for a given size. We generally want to use the same screwdriver for any kind of screws. And maybe for opening a can of paint. Note that the fitness of use is difficult to reach since this use may vary over customers and time.

**Methods:** market research / contact

Here we enter the world of marketing. The only way is to ask the consumer.

**Drawbacks:**
- Inspectors are "the enemy";
- Inspections do not add any value

"Fitness of use" supposes that definitions of the specifications are "consumer based". Fitness of use requires thus fitness to (the new) specifications and therefore also requires inspections.

Higher quality implies better inspection and therefore higher costs. Too large inspection costs could also be dangerous. The answer is then the following. Instead of "inspecting" the quality of the product, the focus came on "building" the quality in the product.

3) Fitness of cost

This means high quality in the eye of the users but now at low or reasonable cost.

**Definition:** conformance to the expected use and to the expected price.

To reach this goal you need to reduce the variability of the processes so that no products have to be discarded (and therefore none need to be checked). The only way of reaching this goal is to control the processes and not the products.

**Methods:**
- Statistical quality control (SQC)
- Stochastic process control (SPC);
- Providing feedback at each step;
- Promote participation of the workers in the design and improvement; (7 QC steps and 7 QC tools)

SPC is a technique aiming at controlling the process by which products are made. The aim is to detect any disfunctioning of the process. Techniques are described in more details later in the chapter.

Each worker should provide some feedback on the work of his/her predecessor. The goal is first to detect any mistake as quickly as possible and second to allow some learning to take place.

**Drawbacks:** everybody can copy

Examples are given by the four Asian tigers: Korea, Hong Kong, Taiwan, and Singapore.

4) **Fitness to latent requirement**

This means high quality in the eye of the users and low cost.

**Definition:** conformance to the unexpected needs

Examples of products which fitted to latent requirements are the Polaroid camera and the walkman. The idea is to give the company a monopoly for a while.

**Example:** The Watch

The "fitness to standards" is reached when all parts are ok; the "fitness to use" means that the watch gives the correct time; the "fitness of cost" means the watch works and its price is ok. Finally, the swatch is an example of the fitness to latent requirement.

**DEFINITION**

"Quality is customer satisfaction"

The term ‘*quality*’ refers to the ability of a product or service to consistently meet or exceed customer expectations.

**According to Deming,** Quality is a predictable degree of uniformity and dependability, at low cost and suited to the market.

The standard of something as measured against other things of a similar kind; the degree of excellence of something: **“an improvement in product quality”**
**DIMENSION OF QUALITY**

The term quality is used in a variety of ways. Sometimes it refers to the grade of a product. At other times, it refers to materials, workmanship, price, or special features. However, generally speaking, quality has nine different dimensions.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Dimension</th>
<th>Meaning and Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Performance</td>
<td>Primary operating characteristics of a product, such as signal coverage, audio quality, display quality, etc.</td>
</tr>
<tr>
<td>2</td>
<td>Features</td>
<td>Secondary characteristics, added features, such as calculators, and alarm clock features.</td>
</tr>
<tr>
<td>3</td>
<td>Conformance</td>
<td>Meeting specifications or industry standards, workmanship (or) the degree to which a product’s design or operating characteristics match pre-established standards.</td>
</tr>
<tr>
<td>4</td>
<td>Reliability</td>
<td>The probability of a product’s failing within a specified period of time.</td>
</tr>
<tr>
<td>5</td>
<td>Durability</td>
<td>It is a measure of product’s life having both economic and technical dimensions.</td>
</tr>
<tr>
<td>6</td>
<td>Service</td>
<td>Resolution of problem and complaints, ease of repair.</td>
</tr>
<tr>
<td>7</td>
<td>Response</td>
<td>Human to human interface, such as the courtesy of the dealer.</td>
</tr>
<tr>
<td>8</td>
<td>Aesthetics</td>
<td>Sensory characteristics, such as exterior finish.</td>
</tr>
<tr>
<td>9</td>
<td>Reputation</td>
<td>Past performance and other intangibles, such as being ranked first.</td>
</tr>
</tbody>
</table>

These dimensions are somewhat independent. Therefore a product can be excellent in one dimension and average or poor in another. Rarely very few products excel in all nine dimensions. For example, the famous Japanese high quality cars, in the 1970s, are based only on the dimensions of reliability, conformance, and aesthetics.

Therefore, quality products can be determined by using a few of the dimensions of quality.

**DIMENSIONS OF MANUFACTURING AND SERVICE QUALITY**

The dimensions of quality can be best understood separately for product and service with the help of the examples presented below;

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Dimension</th>
<th>Manufacturing (Automobile)</th>
<th>Service (Automobile Repair)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Performance</td>
<td>(i) Everything works, fit and finish. (ii) Ride, handling, grade of materials used.</td>
<td>(i) All work done, at agreed price. (ii) Friendliness, courtesy. (iii) Competency quickness.</td>
</tr>
<tr>
<td></td>
<td>Features</td>
<td>Placement of gauges and controls. Cellular phone, CD player</td>
<td>Location, call when ready Computer diagnostics,</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------</td>
<td>------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>(i) Convenience</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ii) High tech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Conformance (to safety)</td>
<td>Antilock brakes, airbags</td>
<td>Separate waiting area</td>
</tr>
<tr>
<td>4</td>
<td>Reliability</td>
<td>Infrequency of breakdowns</td>
<td>Work done correctly, ready when promised</td>
</tr>
<tr>
<td>5</td>
<td>Durability</td>
<td>Useful life in miles, resistance to rust and corrosion</td>
<td>Work holds up over time</td>
</tr>
<tr>
<td>6</td>
<td>Service after sale</td>
<td>Handling of complaints and / or requests for information</td>
<td>Handling of complaints.</td>
</tr>
<tr>
<td>7</td>
<td>Response</td>
<td>Quicker response of system components</td>
<td>Quicker response to customer complaints and queries</td>
</tr>
<tr>
<td>8</td>
<td>Aesthetics</td>
<td>Interior design, soft – touch</td>
<td>Clean work / waiting areas.</td>
</tr>
<tr>
<td>9</td>
<td>Reputation (Perceived quality)</td>
<td>Top-rated car</td>
<td>Award-winning service department.</td>
</tr>
</tbody>
</table>

**Cost of Quality**

“Quality cost is the cost of poor products or services.”

Thus quality cost is the cost of not meeting the customer’s requirement, i.e., the cost of doing things wrong.

Quality costs are defined as those costs associated with the non-achievement of product / service quality as defined by the requirements established by the organization and its contracts with customers and society.

**Elements of Quality Costs**

The cost of quality (COQ) can be classified into the following four categories:

1. Cost of prevention (or cost of conformance),

   Prevention costs are the costs that are incurred on preventing a quality problems from arising. It includes:
   - Cost of quality planning
   - Cost of documenting
   - Process control cost
   - Cost of training
   - Costs associated with preventing recurring defects
Cost of investigation, analysis and correction of causes of defects by quality control and engineering departments.

Cost of quality awareness programme.

2. Cost of appraisal

Appraisal costs are the costs that are incurred in assessing that the products/services conform to the requirements. It includes:

- Cost of receiving test and inspection.
- Cost of laboratory acceptance testing
- Cost of installation testing
- Cost of installation and commissioning
- Cost of maintenance and calibration of testing and inspecting equipments.
- Cost of test equipment depreciation.
- Cost of analysis of reporting of tests and inspection results.
- Cost of line quality engineering
- Cost of vendor rejects

3. Cost of internal failures (or cost of non-conformance), and

Internal failure costs arise due to internal failures. It includes:

- Cost associated with scrap and rejects.
- Cost of repair and rework
- Cost of design changes.
- Cost of trouble-shooting or defect failure analysis
- Cost of reinspection and retesting.
- Cost of sales discounts for inferior products.
- Cost of downgrading
- Cost of downtime.


External failure costs arise from the rejection of the products/services by the customers due to poor quality. It includes:

- Cost of processing complaints from customers.
- Cost of commissioning failures.
- Cost of servicing or replacing the defective items.
- Cost of guarantee and warranty claims
- Cost of lost goodwill of customer.
Cost of product reliability compensation (voluntary or legal)
Cost of concessions offered to customers (due to sub-standard products being accepted by customers).

**INTRODUCTION**

Total Quality Management (TQM) has captured the worldwide attention in recent years. TQM has become a buzzword for the entire successful business organizations world over. All organizations have realized the potential benefits of TQM approach.

The importance of TQM has been realized because of the following important reasons:

1. It has become a question of survival in the intense competitive environment.
2. Increasing customer consciousness all over the world.
4. Crucial role played by organizational issues, such as leadership, human resource, revolution in information technology, etc., in quality management.

First, we analyze the word **TQM**.

**Total** – Made up of the whole.

**Quality** – Degree of Excellence a product or service provides.

**Management** – Act, art, or manner of handling, controlling, directing, etc.

**DEFINITION**

*According to Prof. Leopald S. Vasin defines,* “TQM is the control of all transformation processes of an organization to best satisfy customers needs in the most economical manner”.

**BASIC CONCEPTS OF TQM**

A successful TQM programme requires the following six basic concepts:

1. Top management commitment
2. Focus on the customer
3. Effective involvement and utilization of the entire work
4. Continuous improvement
5. Treating suppliers as partners
ELEMENTS OF TQM (TQM FRAMEWORK)

1. *The philosophical elements* of TQM stress the operation of the company using quality as the integrating element.

2. *The generic tool* consists of various statistical process control (SPC) methods that are used for problem solving and continuous improvement by quality teams. Quality function deployment is typically used by managers to drive the voice of the customer into the organization.

3. *Tools of the QC department* consists of statistical quality control (SQC) methods such as sampling plans, process capability and Taguchi methods.

PILLARS OF TQM

QUALITY STATEMENTS

Quality statements are established by a quality council to provide overall direction for achieving the total quality culture.

Three elements of quality statements are:
1. Vision statement (desired future state of the organization)
2. Mission statement, and (what we do and whom we serve)
3. Quality policy statement. (Commitment to customer).

**DEMING’S CONTRIBUTIONS:**

Deming’s contributions can be grouped under the following four topics:
1. Deming’s 14 points on route to quality
2. Deming cycle (or PDCA cycle);
3. Seven deadly diseases of Management; and

**DEMING’S 14 POINTS**

1. *Create constancy of purpose toward improvement of product and service,* with the aim to become competitive and to stay in business, and to provide jobs.
2. *Adopt the new philosophy.* We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.
3. *Cease dependence on inspection to achieve quality.* Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
4. *End the practice of awarding business on the basis of price tag.* Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. *Improve constantly and forever the system of production and service,* to improve quality and productivity, and thus constantly decrease costs.
6. *Institute training* on the job.
7. *Institute leadership.* The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.
8. *Drive out fear,* so that everyone may work effectively for the company.
9. *Break down barriers between departments.* People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.
10. *Eliminate slogans, exhortations, and targets for the work force* which ask for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, since the bulk of the causes of low quality and low productivity belongs to the system and thus lie beyond the power of the workforce.
11. *Eliminate work standard (quotas) on the factory floor.* Substitute leadership. **Eliminate management by objectives.** Eliminate management by numbers, numerical goals, substitute leadership.

12. **Remove barriers to pride of workmanship.** The responsibilities of supervisors must be changed from sheer numbers to quality. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, for example, abolishment of annual or merit rating and of management by objectives.

13. **Institute a vigorous program of education and self-improvement.**

14. Put everybody in the company to work to *accomplish the transformation.* The transformation is everyone’s job.

**PDCA Cycle:**

Plan – *what is needed?*

Do – *it*

Check – *that it works*

Act – *to correct problems or improve performance.*

**Seven Deadly Diseases of Western Management**

The implementation of Deming’s 14 points can transform the Western style of management. This transformation can fully materialize only when certain bad practices, called by Deming *unforgivable sins or deadly diseases (DD),* are eliminated.

1. Lack of consistency of purpose.
2. Emphasis on short term profits.
3. Reliance on performance appraisal and merits.
4. Staff mobility.
5. Reliance on financial figures.
6. Excessive medical costs.
7. Excessive legal costs.

**SYSTEM OF PROFOUND KNOWLEDGE**

The system of profound knowledge, or management by positive co-operation, is described by Deming. The four ingredients (or elements) of the system of profound knowledge that is necessary to learn and practice.

1. **Appreciation for a system:** The need for managers to understand the relationships between functions and activities, and that the long term aim is for everyone to win – employees, shareholders, customers, suppliers and the environment.

2. **Knowledge of statistical theory:** Knowledge and understanding of variation, process capability, control charts, interactions and loss functions.

3. **Theory of knowledge:** As all plans require prediction based on historical information, the theory must be understood before it can successfully be copied.

4. **Knowledge of psychology:** The understanding of human interactions, how people are motivated and what disillusion them.

**JURAN’S CONTRIBUTIONS**

Juran’s contributions can be studied under the following six topics:

1. Internal customer;
2. Cost of quality;
3. Quality trilogy;
4. Juran’s 10 steps for quality improvement, and
5. The breakthrough concept.

1. **Internal Customer:**

   Juran realized that the customer was not just the end customer and that each person along the chain has an internal customer. Each person along the chain, from product designer to final user, is a supplier and a customer.

![Three role model](Supplier→Process→Customer)

*Three role model*

2. **Cost of Quality:**

   Juran classified the cost of quality into three classes as:

   (i) **Failure costs:** Scrap, rework, corrective actions, warranty claims, customer complaint, and loss of customer.
(ii) Appraisal costs: Inspection, compliance auditing and investigations.
(iii) Prevention costs: Training, preventive auditing, and process improvement implementation.

3. **Juran’s Quality Trilogy:**
   Juran views quality as fitness – for – use. He also believes that roughly 80% of quality defects are management controllable. Thus management has the responsibility to correct this deficiency. He divides quality management into three parts. They are:
   (i) Quality planning;
   (ii) Quality control; and
   (iii) Quality improvement.

4. **Juran’s 10 Steps for Quality Improvement:**
   Juran proposed 10 steps for quality improvement. These are;
   (i) Build awareness of the need and opportunity for improvement.
   (ii) Set goals for improvement.
   (iii) Organize to reach the goals.
   (iv) Providing training.
   (v) Carry out projects to solve problems.
   (vi) Report progress.
   (vii) Give recognition.
   (viii) Communicate results.
   (ix) Keep score.
   (x) Maintain momentum by making annual improvement part of the regular systems and processes of the company.

5. **The Breakthrough Concept:**
   Like the Deming cycle, Juran’s breakthrough concerns itself with the product / service life cycle. In essence, this splits it up into two areas: the “journey from symptom to cause” and the journey from cause to remedy”.

**Crosby’s Contributions**
   Crosby is known for his following contributions:
   1. Four absolutes of quality;
   2. Fourteen steps to quality management; and
   3. Crosby’s quality vaccine.
1. **Crosby’s Absolutes for Quality Management:**

<table>
<thead>
<tr>
<th>Absolute</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Absolute</td>
<td>The definition of quality is conformance to requirements, not goodness.</td>
</tr>
<tr>
<td>Second Absolute</td>
<td>The system for causing quality is preventive, not appraisal.</td>
</tr>
<tr>
<td>Third Absolute</td>
<td>The performance standard must be zero defect, not “that’s close enough”.</td>
</tr>
<tr>
<td>Fourth Absolute</td>
<td>The measurement of quality is the price of non–conformance, not indexes.</td>
</tr>
</tbody>
</table>

2. **Crosby’s Fourteen Steps for Quality Improvement:**

   Step 1 : Establish and ensure management commitment.

   Step 2 : Form quality improvement teams (QITs) for quality improvement process planning and administration.

   Step 3 : Establish quality measurements.

   Step 4 : Evaluate the cost of quality and explain its use as a management tool to measure waste.

   Step 5 : Raise quality awareness among all employees.

   Step 6 : Take actions to correct problems identified through previous steps.

   Step 7 : Establish a zero defects committee and programme.

   Step 8 : Train supervisors and managers on their role and responsibilities in the quality improvement process.

   Step 9 : Hold a zero defects day to reaffirm management commitment.

   Step 10: Encourage individuals and groups to set improvement goals.

   Step 11: Obstacle reporting (i.e., encourage employees to communicate to management any obstacles they take in attaining their improvement goals).

   Step 12: Recognize and appreciate all participants.

   Step 13: Establish quality councils to discuss quality matters on a regular basis.

   Step 14: Do it all over again to demonstrate that the improvement process never ends.

3. **Crosby’s Quality Vaccine:**

   In the Crosby style, the “vaccine” is explained as medicine for management to prevent poor quality. The five sections of vaccine that cover the requirements of total quality management.

   **Section 1:** Integrity

   **Section 2:** Systems

   **Section 3:** Communication

   **Section 4:** Operations

   **Section 5:** Policies.