

Since the desired α is 5% and β is 10%, plan 1 and 2 come closest to the desired sampling plan.

I TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) is a major recent development in production and operations management. Though practiced in 1980s, TQM became truly pervasive in the 1990s. Many firms are now adopting a total quality management approach to their business. Under this approach, the entire organisation from the president or chief executive officer down to the lowest level employee are committed and involved in never-ending quest to improve the quality of outputs (continuous improvement or Kaizen in Japanese language). Key elements of TQM include top management commitment, customer involvement and focus, employee involvement and focus, leadership and strategic planning, company wide quality culture, continuous improvement and customer satisfaction and customer delight. However, before discussing about Total Quality Management some fundamental concepts of quality and quality management are discussed in the following paragraphs.

Total Quality Management (TQM);
A philosophy that involves everyone in an organisation in a continual effort to improve quality and achieve customer satisfaction.

What is Quality?

Quality is:

- Conformance to specifications.
- Conformance to requirements.
- What the customer thinks it is.
- Measure of the conformance of the product/service to the customer's needs.
- Combination of aesthetics, features and design.
- Value for money.
- The ability of a product to meet customer's needs.
- Meeting or exceeding customer requirements now and in the future.
- Fitness for use of a product/service by the intended customer.
- A customer's perception of the degree to which the product/service meets his/her expectations.
- Totality of features and characteristics of a product/service that bears on its ability to satisfy a stated or implied need.

New Thinking About Quality

Old Quality is "small q"

- About products
- Technical
- For inspectors
- Led by experts
- High grade
- About control

New Quality is "Big Q"

- About organisations
- Strategic
- For everyone
- Led by Management
- The appropriate grade
- About improvement

Eight Dimensions of Product Quality

1. Performance
2. Features
3. Reliability
4. Serviceability
5. Aesthetics (appearance)
6. Durability
7. Customer service
8. Safety

Ten Dimensions of Service Quality

1. Reliability
2. Responsiveness
3. Competence
4. Access
5. Courtesy
6. Communication
7. Credibility
8. Understanding
9. Security/Safety
10. Tangibles.

Benefits of Quality

1. Gives positive company image.
2. Improves competitive ability.
3. Increases market share and net profits.
4. Reduces costs.
5. Reduces product liability problems.
6. Improves employee morale.
7. Improves productivity.

Customer-Driven Definitions of Quality

1. Conformance to specifications (requirements).
2. Value for money
3. Fitness for use.
4. Support provided by seller (customer services)
5. Psychological impression (image, aesthetics)

Perceived Quality : "An assessment of quality based on the reputation of the firm." Customers base their assessment of quality on such factors as advertisements, media reports, reputations and past experience to indicate perceived quality.

Customer-Driven Quality : Quality is meeting or exceeding customer expectations. The term "customer" includes both the "internal customer" and the "external customer" in the "customer chain".

Three Levels of Quality

- | | | |
|---|---|---|
| 1. Organisation level | - | Meeting external customer requirements |
| 2. Process level | - | Meeting the needs of internal customers |
| 3. Performer level (job level*
or task design level) | - | Meeting the requirements of accuracy, completeness innovation, timeliness and cost. |

Determinants of Quality

1. Quality of design,
2. Quality capability of process,
3. Quality of conformance,
4. Quality of customer service,
5. Organisation quality culture.

QUALITY IS	Q	-	Quest for excellence
	U	-	Understanding customer needs
	A	-	Action to achieve customer satisfaction
	L	-	Leadership - determination to be a leader
	I	-	Involvement of all people
	T	-	Team spirit to work for common goals
	Y	-	Yardstick to measure progress.

I WHAT IS QUALITY MANAGEMENT?

Inspection to ensure quality (in early 1900s)

Statistical quality control (in the 1940s)

Total quality management: including the entire organisation (1960's onwards)

Nowadays Total Quality Management (TQM) means :

- Top Management Commitment to quality
- Customer involvement and focus
- Employee involvement and focus
- Leadership and strategic planning for quality
- Company-wide quality culture
- Continuous improvement
- Customer satisfaction and delight

TQM improves productivity and competitive advantage.

What is Quality Control?

1. Setting quality standards (objectives or targets)
2. Appraisal of conformance (quality measurement)
3. Taking corrective actions to reduce deviations
4. Planning for quality improvement

Quality control begins with product design and includes materials, bought-out items, manufacturing processes and finished goods at the hands of customers.

Quality control aims at prevention of defects rather than detection of defects (by inspection)

Objectives of quality control is to provide products/services which are dependable, satisfactory and economical.

Quality & Reliability : Reliability is the probability of performing without failure, a specified function under given conditions for a specified period of time.

Company-Wide Quality Control (CWQC) : System of activities that assume that quality products and services required by customers are economically designed, produced, and supplied involving all departments of an organisation

Quality Assurance : All activities required to ensure that the product performs to the customers' satisfaction

Quality Improvement : Finding ways to do better than standard and breaking-through to unprecedented levels of performance. It is the responsibility of those who produce the products and not of inspectors. (*i.e.*, quality at the source)

Concept of Total Quality : Systems approach to quality. Involves all employees (top to bottom) and extends backward to forward (*i.e.*, supply chain & customer chain). Total quality stresses learning and adaptation to continual change as key to organisational success. It includes systems, methods and tools.

Principles of Total Quality

- Focus on the customer (Both internal & external)
- Participation and Team work
- Employee involvement and empowerment
- Continuous improvement and learning.

What is Total Quality Control (TQC)?

It is quality control and improvement from **shop floors to board rooms**. It is an effective system for **integrating quality development, quality maintenance and quality improvement efforts of various groups in an organisations.**

Principles of Total Quality Control (TQC)

1. Top management policies – Zero defects, continuous improvement etc.
2. Quality control training for everyone
3. Quality at product/service design stage
4. Quality materials from suppliers
5. Quality control in production (SQC)
6. Quality control in distribution, installation and use.

What is Total Quality Management (TQM)?

A philosophy that involves everyone in an organisation in a continual effort to improve quality and achieve customer satisfaction.

Six Basic Concepts in TQM

1. Top management commitment and support.
2. Focus on both internal and external customers.
3. Employee involvement and empowerment.
4. Continuous improvement (KAIZEN)
5. Partnership with suppliers
6. Establishing performance measures for processes.

8 Essentials of TQM Focus

- | | |
|---------------------------------------|----------------------------|
| 1. Customer satisfaction | 2. Leadership |
| 3. Quality policy | 4. Organisation structure |
| 5. Employee involvement | 6. Quality costs |
| 7. Supplier selection and development | 8. Recognition and reward. |

Seven Underlying Principles in TQM

1. Strive for quality in all things (Total Quality)
2. The customer is the creation of quality
3. Improve the process or systems by which products are produced
4. Quality improvement is continuous, never ending activity (continuous improvement Kaizen)
5. Worker involvement is essential
6. Ground decisions and actions on knowledge
7. Encourage team work and cooperation.

Scope of TQM

1. Are integrated organisational infrastructure
2. A set of management practices
3. A wide variety of tools and techniques

I MODERN QUALITY MANAGEMENT

Quality Gurus and their Philosophies

1. W. Edwards Deming(USA) [U.S. statistician & consultant known as father of quality control]
 - (a) Higher quality means lower cost
 - (b) Quality means continuous improvement
 - (c) 14 points for quality management
 - (d) Seven deadly diseases and sins
 - (e) Deming wheel/cycle (P-D-C-A cycle)
 - (f) Deming's triangle
 - (g) Deming prize.

Deming's 14 Points for Quality Management

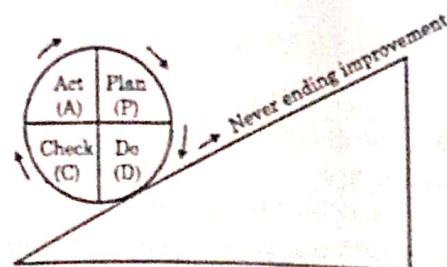
1. Create constancy of purpose for continual improvement of product/services.
2. Adopt the new policy for economic stability.
3. Cease dependency on inspection to achieve quality.
4. End the practice of awarding business on price tag alone.
5. Improve constantly and forever the system of production and service.
6. Institute training on the job.
7. Adopt and institute modern method of supervision and leadership.
8. Drive out fear. (Fear of failure, fear of change etc).
9. Breakdown barriers between departments and individuals.
10. Eliminate the use of slogans, posters and exhortations.
11. Eliminate work standards and numerical quotas.
12. Remove barriers that rob the hourly worker of the right to pride in workmanship.
13. Institute a vigorous program of education and retraining.
14. Define top management's permanent commitment to ever improving quality and productivity.

Deming's Seven Deadly Diseases and Sins

1. Lack of constancy of purpose (short-term quality programs)
2. Emphasis on short-term profits
3. Over reliance on performance appraisals
4. Mobility of management (Job hopping)
5. Over emphasis on visual figures
6. Excessive medical costs for employes healthcare
7. Excessive costs of warranty and legal costs.

Deming Wheel/Deming Cycle/P-D-C-A Cycle

- P – Plan (process) the improvement
 D – Do Implement the plan
 C – Check – Check how closely result meets goals
 A – Act – Use the improved process as standard practice



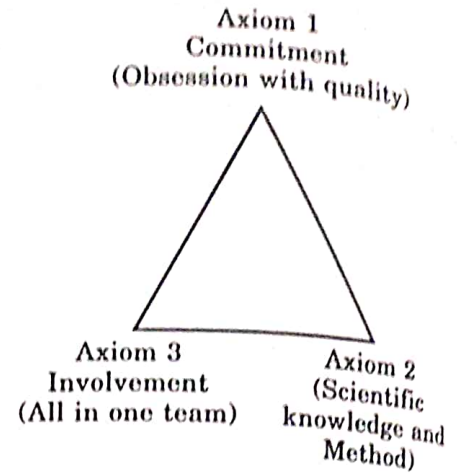
Deming's Triangle (3 Axioms)

Axiom 1 : **Commitment** (Obsession with quality)

Axiom 2 : **(Scientific Knowledge & Method)**

Axiom 3 : **Involvement** (All in one team)

Deming Prize : Awarded by the union of Japanese Scientists and Engineers (JUSE) to a firm or its division based on the distinctive performance improvements achieved through the application of Company Wide Quality Control (CWQC).

**2. Joseph Juran (USA)**

(Professor and Quality consultant – wrote 12 books on quality including Quality Control Hand Book) Defined quality as "fitness for use".

Philosophy :

(a) Top management commitment, (b) Costs of quality, (c) Quality trilogy, (d) 10 steps for quality improvement, (e) Universal breakthrough sequence.

Costs of Quality

1. **Prevention costs** : Costs of quality planning, new product review, training, process planning, quality data and improvement projects.
2. **Appraisal costs** : Costs of incoming inspection, process inspection, finished goods inspection, quality laboratories and calibration of instruments.
3. **Internal failure costs** : Costs of scrap, rework, down grading (seconds quality products) retest, downtime.
4. **External failure costs** : Costs of warranty, returned goods, customer complaints, allowances to customers for substandard quality products.

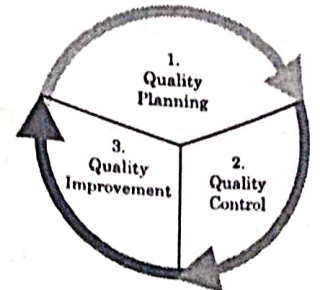
Costs of quality can be reduced by revising the production system including technology, management, attitudes and training.

Quality Trilogy

(i) Quality planning, (ii) Quality control and (iii) Quality improvement.

Quality Habit

1. Establish specific goals
2. Establish plans for achieving these goals
3. Assign clear responsibilities to employees
4. Base rewards on results.

**Juran's 10 Steps for Quality Improvement**

1. Build awareness for the need and opportunity for improvement 2. Set goals for improvement 3. Organise people to reach the goals 4. Provide training throughout the organisation 5. Carryout projects to solve problems 6. Report progress 7. Give recognition 8. Communicate results 9. Keep score 10. Maintain momentum by making annual improvement part of the regular system and processes of the company.

Universal Breakthrough Sequence

Break-through or major improvements follow the 7 steps given below:

1. Proof of need 2. Project identification 3. Organising for improvements 4. Diagnostic journey 5. Remedial action 6. Resistance to change 7. Holding on to gains.

3. **Philip B Crosby (USA)**

(Management consultant and director of Crosby's Quality College. Wrote a book titled "Quality is free" of which 1 million copies sold)

- philosophies
- (a) Quality is free (b) Goal of zero defects (c) 6 'C's – Comprehension, Commitment, Competence, Correction, Communication, Continuance. (d) Four absolutes of Quality (e) 14 steps for quality improvement (f) Quality Vaccine/Crosby Triangle.

4. **Absolute of Quality**

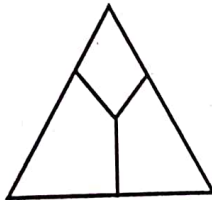
1. Quality is defined as conformance to requirements, not goodness.
2. The system for achieving quality is prevention, not appraisal.
3. The performance standard is zero defects not that is close enough.
4. The measurement of quality is the price of non-conformances, not indexes.

Crosby's 14 Steps for Quality Management

- (i) Management commitment (ii) Quality improvement team (iii) Quality measurement (iv) Cost of quality (v) Quality awareness (vi) Corrective action (vii) Zero defects planning (viii) Supervisor training (ix) Zero defects day (x) Goal setting (xi) Error cause removal (xii) Recognition (xiii) Quality councils (xiv) Do it all over again.

Crosby's Quality Vaccine or Crosby Triangle

1. Integrity, policies



3. Communication 2. Systems, operation

5. **Armand V. Feigenbaum (USA)**

- (i) Concept of TQC (Total Quality Control)
- (ii) Quality at the source
- (iii) Three steps to quality – Quality leadership, Modern quality technology, Organisational Commitment.
- (iv) SQC and CWQC (Company-Wide Quality Control)

6. **Kaoru Ishikawa (Japan) (Japanese Quality Authority)**

- (i) Quality circles (ii) Ishikawa diagram for problem solving (iii) Quality training (iv) Root cause elimination (v) Total employee involvement (vi) Customer focus (vii) Elimination of inspection (viii) C.W.Q.C. (ix) Japanese quality strategy.

7. **Genichi Taguchi (Japan)**

- (i) Quality Engineering (ii) Taguchi Methods (iii) Taguchi's quality loss function ($L = cd^2$)
- [L = Loss - C = Constant d = deviation i.e., $x - T$]

8. Masaki Imai (Management Consultant of Japan) – (Continuous improvement)
9. Shigeo Shingo (Japan)
“Poka Yoke” – means “Fail proofing” or “Fool-proofing” to reduce defects to zero (Handle errors as they occur)
10. Dr. Walter Shewhart (USA) : (Statistician at Bell Laboratories)
Statistical Quality Control : (a) SPC control charts (b) Acceptance sampling (with Dodge & Romig)

Elements of TQM Concept

1. Sustained top management commitment to quality
2. Focus on Customer requirement and expectations
3. Preventing defects rather than detecting them
4. Recognising that responsibility for quality is universal
5. Quality measurement
6. Continuous improvement (Kaizen) approach
7. Root-cause corrective action
8. Employee involvement and empowerment
9. Synergies of Team work
10. Process improvement (Continuous Improvement – Kaizen, 6 σ – Quality, Break-through Improvement, Reengineering)
11. Thinking statistically
12. Bench marking
13. Inventory reduction (JIT)
14. Value improvement (Value analysis, cost reduction) $\left[\text{Value} = \frac{\text{Performance}}{\text{Cost}} \right]$
15. Supplier partnership
16. Quality training for all
17. Business process reengineering (Break-through improvement)

Total Quality Management Program

1. **Top management commitment and involvement** : Top management support for TQM – Leadership, strategic quality planning, Organising for quality, Quality training for all, Quality policies and Quality objectives, Human resources for quality, building superior quality into business strategy, Company-wide quality culture, Supplier partnering, employee involvement and empowerment, process improvement and benchmarking and Business process reengineering.
2. **Customer involvement** : Customer focus, knowing what the customer wants - Voice of the customer to be considered while designing the product using QFD approach (i.e., Quality Function Deployment), involving both internal and external customers.
3. **Designing products for quality** : Designing for robustness, designing for production (Producibility or economic production) designing for reliability.
4. **Designing and controlling production processes** : Process capability, six-sigma quality (i.e., 3.4 defects per million opportunities for defects) and zero defects.

5. **Developing supplier partnerships** : Quality at the source, Suppliers as partners not adversaries Supplier development (TQM suppliers, JIT supplies)
6. **Customer service, distribution, installation** : Packing, shipping and installation of products, after sales service, warehousing, marketing and distribution function to be committed to perfect quality.
7. **Building teams of empowered employees** : Employee training, work teams, empowerment, quality at source (worker, not inspector to ensure quality), quality circles, quality improvement teams, management teams etc.
8. **Bench marking and continuous improvement (Kaizen)** : Bench marking is the practices of establishing internal standards of performance by looking at how world-class companies (leaders in the class) run their businesses. The practices of world-class companies become the basis for continuous improvement to achieve excellence in performance.

PROCESS MANAGEMENT