

# Fundamentals of Quality Management

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# Aim for Today

- Awareness of quality issues and their application to continuous improvement

## **Contents**

1. The Meaning of Quality
2. The Costs of Quality
3. Quality Strategies and Standards
4. Quality Techniques

# 1. The Meaning of Quality

- Definitions
- Business Context

# Definitions

***Think of yourself as  
a customer for a  
moment....***

***What would you  
want from a product  
and service?***

- Product quality:
  - Meets the specification
  - Defect free
  - Quantitatively measured
- Service quality
  - Fitness for intended purpose
  - Technically sound
  - Qualitatively measured
- Both:
  - Fully satisfy customer expectations

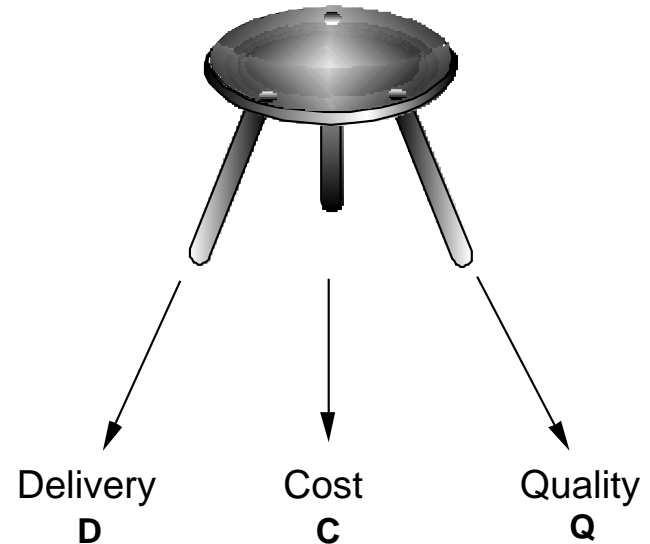
# Business Context

- The achievement of quality is not a one off act, but a continuous improvement process by a company
- The achievement of quality is linked to cost:
  - There is no point achieving the required quality at a cost that will not be competitive for the company
  - Conversely, it is equally no use achieving competitive cost by degrading the quality, thereby eroding customer satisfaction or risking future return business
- Quality products and services which meet the customer's requirements, leads to repeat business and customer loyalty

# Business Context (cont'd)

- A successful company must continually satisfy three demands:
  - **Delivery**, on time
  - **Cost**, as budgeted
  - **Quality**, as required by the customer

**A company must achieve all three to be competitive**



## 2. The Costs of Quality

- Elements of the Costs of Quality
- Quality Cost Models
- Prevention versus Detection

# Elements of the Costs of Quality

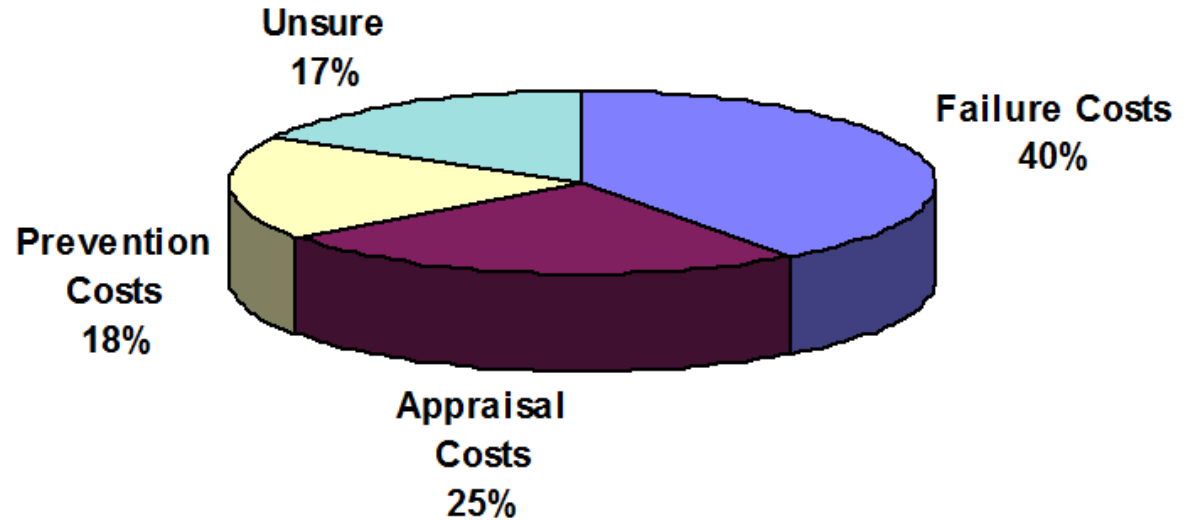
1. **Prevention Costs** – Costs to achieve things ‘right first time’ e.g. quality in design, planning, quality assurance, training and quality improvement projects
2. **Appraisal Costs** – Costs to inspect and check materials and products
3. **Failure Costs** –
  - a). Internal Failure Costs - The cost of failures identified and rectified before the final product gets to the external customer
  - b). External Failure Costs - Return of defective goods, rectify deficiencies, warranties, product liability claims, etc
4. **Lost Opportunities** – History of poor quality by a company impacting on sales - impossible to quantify accurately

***Therefore, any effective costing system can only  
determine the costs incurred under items 1-3***

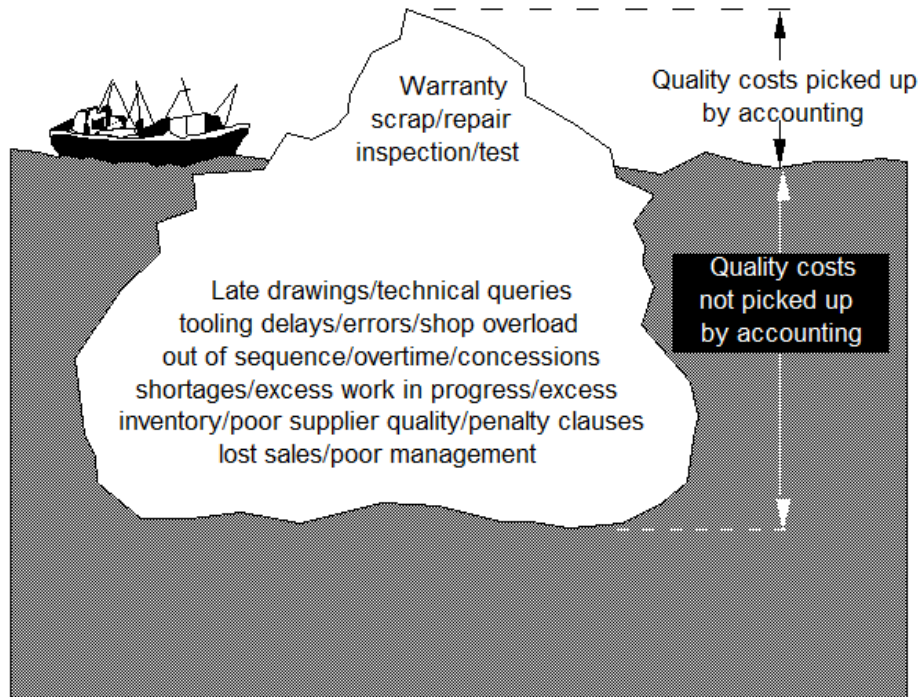


# Elements of the Costs of Quality (cont'd)

- Costs of quality can range from 1% to 40% of the turnover of a company – with 20% typical (good <4%)
- 50% of the total costs can be attributed to failure costs alone



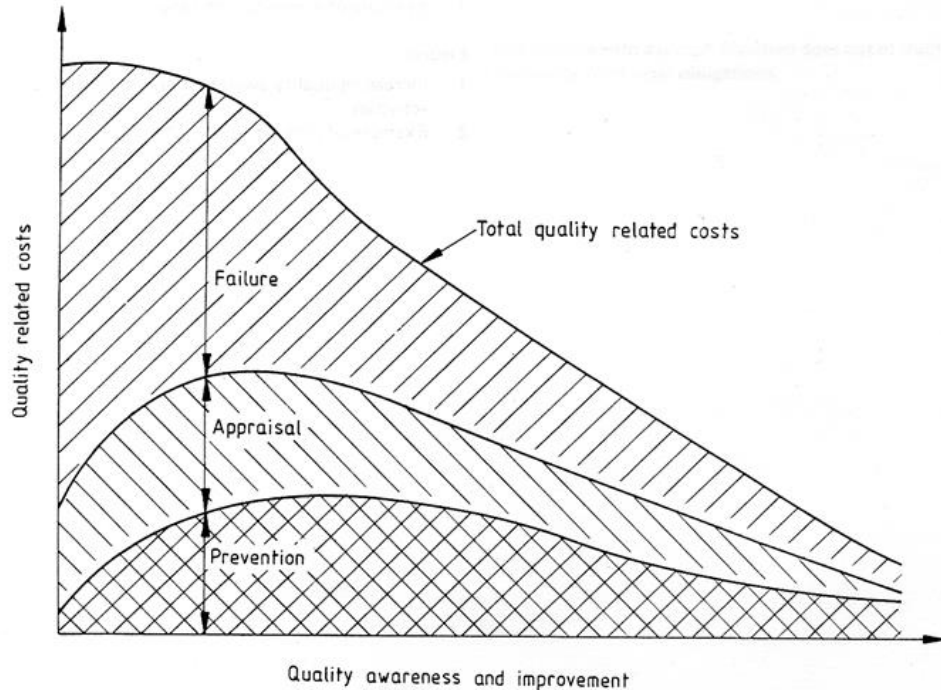
# Elements of the Costs of Quality (cont'd)



[bristol.ac.uk](http://bristol.ac.uk)

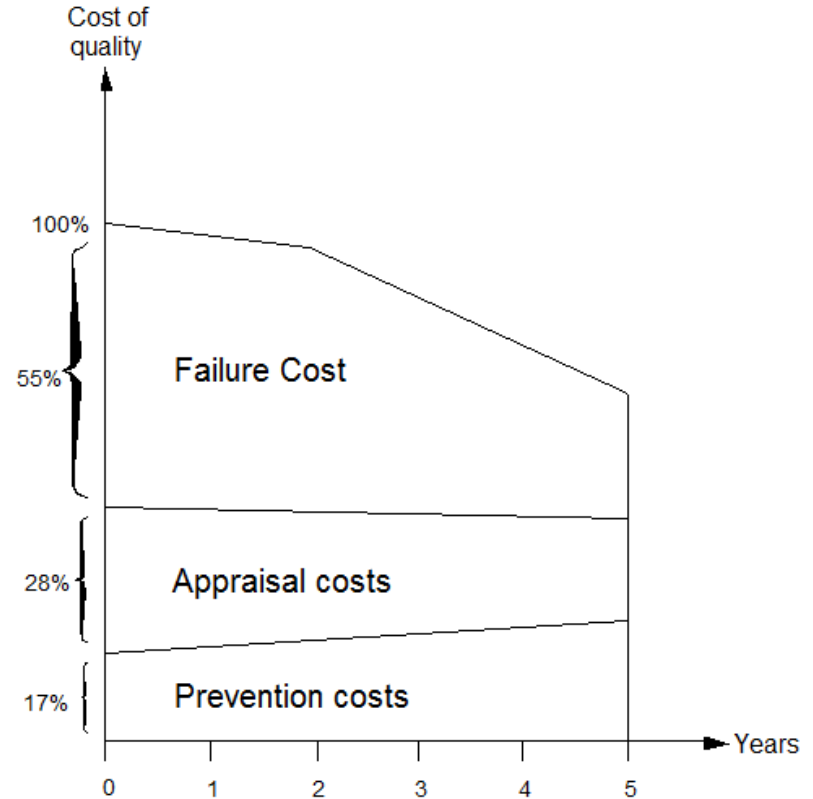


# Quality Cost Models



**BS 6143 (1990)**

[bristol.ac.uk](http://bristol.ac.uk)



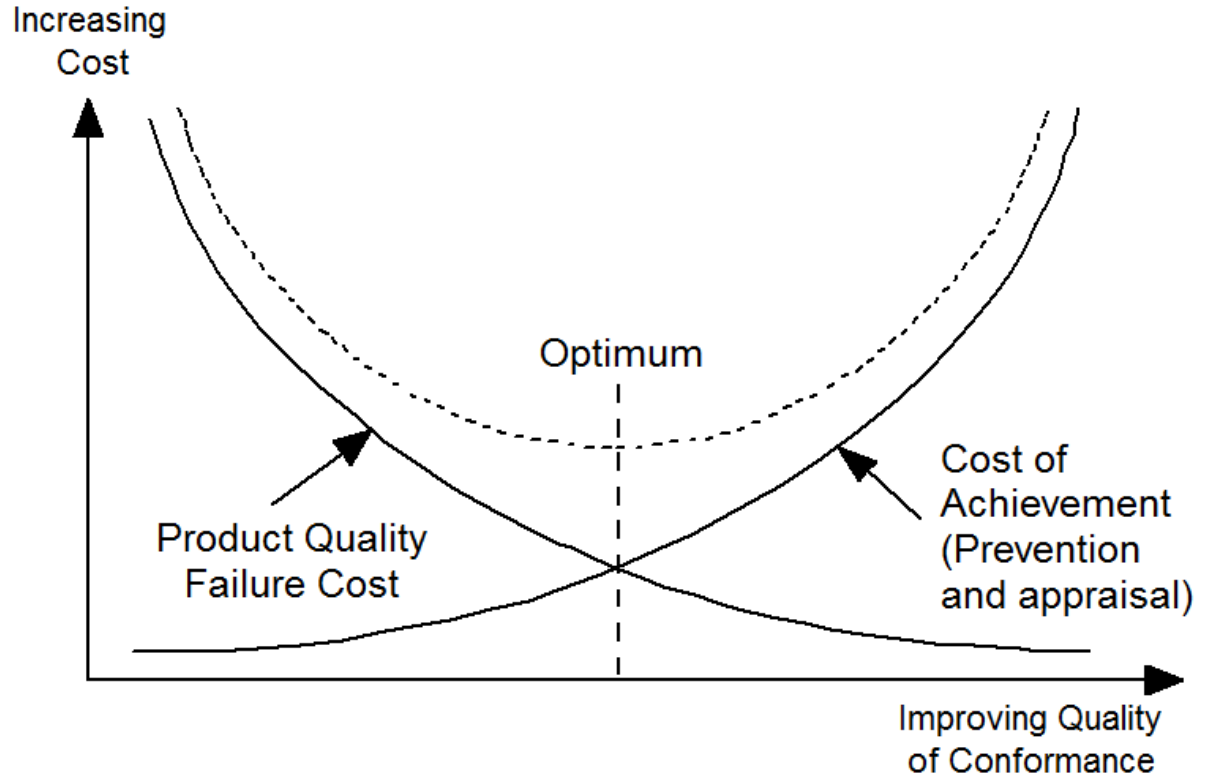
**BAe Systems (c.2000)**

# Prevention versus Detection

- In terms of product quality, the concept of detection (inspection/appraisal) is wasteful, not fool proof and does not add any value to the product
- It is better to focus on prevention, which is more cost effective and can identify problems early, by:
  - Building quality into the design
  - Tackling the cause, not the effect
  - Solving problems at source, not managing around them
  - Removing the problem for good, not just once
  - Getting things 'right first time'
  - Controlling the manufacturing process

# Prevention versus Detection (cont'd)

- Cost of failure declines as conformance quality levels improve toward perfection
- Cost of appraisal plus prevention increases
- There is some “optimum” target quality level where the sum of prevention, appraisal, and failure costs is at a minimum

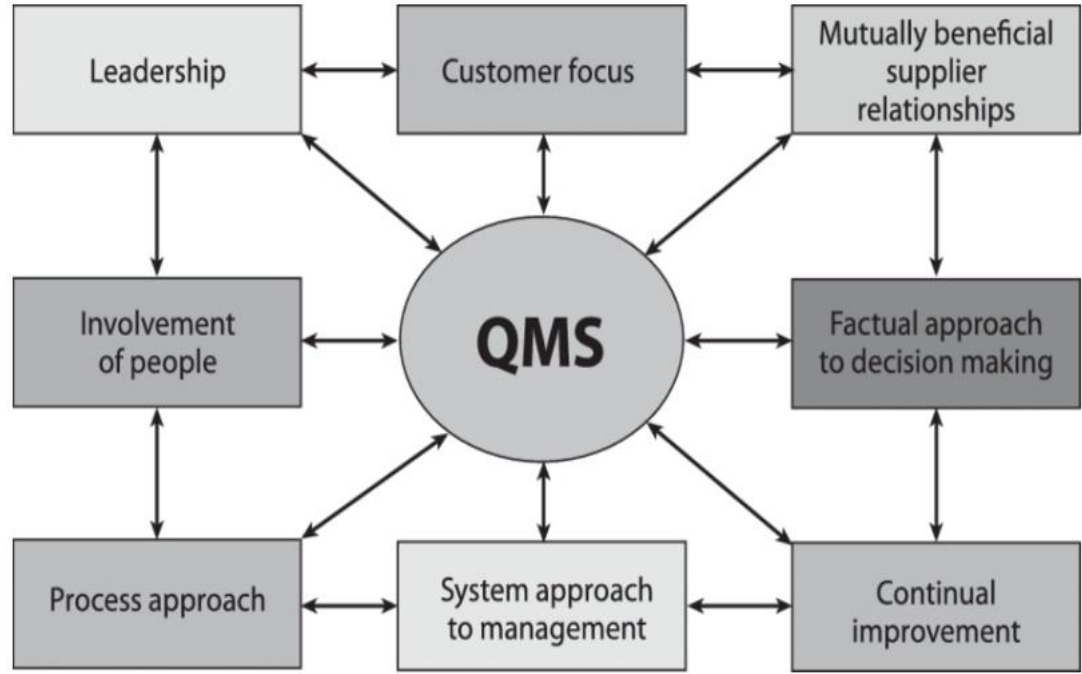


### 3. Quality Strategies and Standards

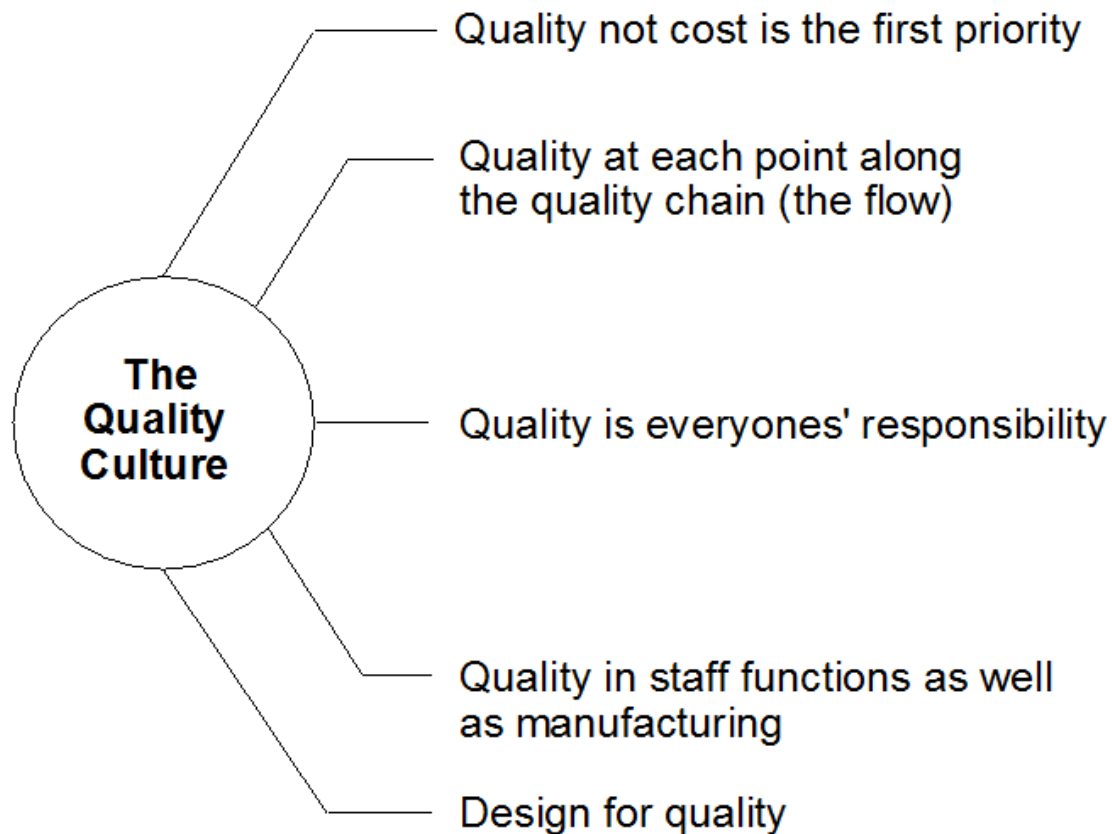
- Quality Management System
- Quality Culture
- Quality Standards
- The 13 Principles of Quality
- Kaizen Approach
- Total Quality Management

# Quality Management System (QMS)

- A collection of business processes which are focused on consistently meeting customer requirements and enhancing their satisfaction
- Represents the foundation for compliance with regulations and standards and helps improvement with a single, integrated system
- Applicable to both product quality and service quality



# Quality Culture





# Quality Standards

- Describes quality assurance elements a business should have:
  - ISO 9000 (2015) – QMS fundamentals
  - ISO 9001 (2015) – QMS requirements
  - ISO 9004 (2009) – Guidance to achieve sustained success
- If a company meets the required standard, they can become registered/certified with ISO
- Good for business as customers have a guarantee for quality

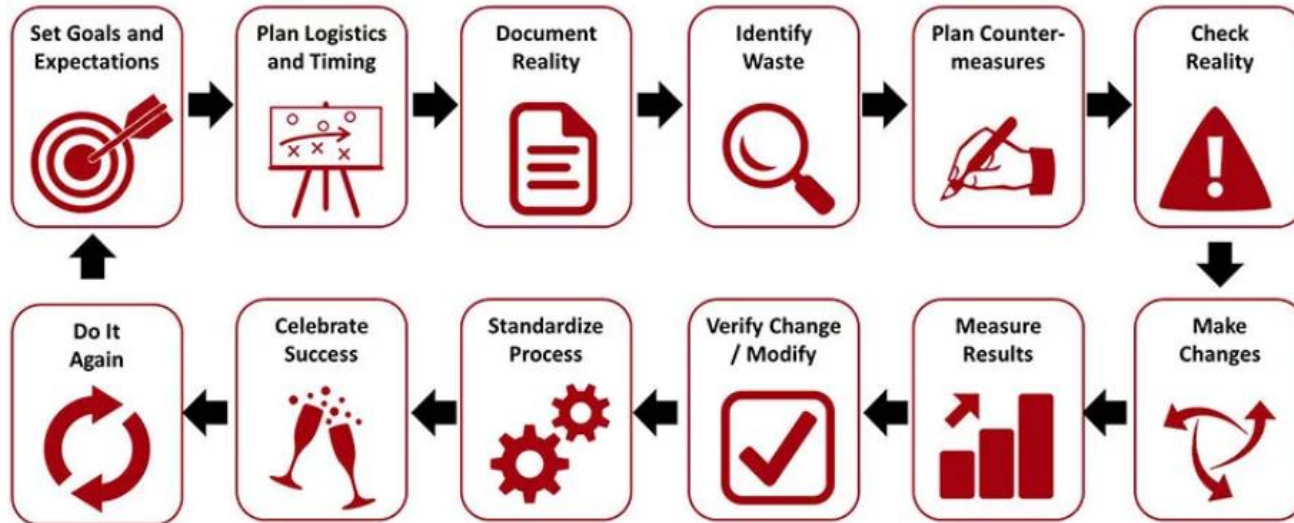


# 13 Quality Principles (from the Gurus\* of Quality)

1. **Innovate in all areas including training and provide resources to assist.**
2. **Learn the 'Zero Defect' philosophy and the need for continued improvement.**
3. **Do not rely on mass inspection for quality. Put quality prevention on-line via Statistical Process Control.**
4. **Reduce the number of suppliers and develop them for continuous improvement of service as well as cost.**
5. **Use statistical techniques to identify sources of waste and cure both system faults and local faults at source.**
6. **Ensure that organisational and management systems support innovation and continuous improvement.**
7. **Provide supervision with on-line techniques for problem identification and problem solution via their teams.**
8. **Create openness by encouraging questions and then reporting the problems.**
9. **Attack waste by the use of multi-disciplinary teams.**
10. **Avoid exhortative slogans as a substitute for team approaches.**
11. **Beware of over-bureaucratic imposition of work standards.**
12. **Provide elemental statistical training to all employees.**
13. **Make maximum use of statistical data to focus on priority problems and direct the effort of all.**

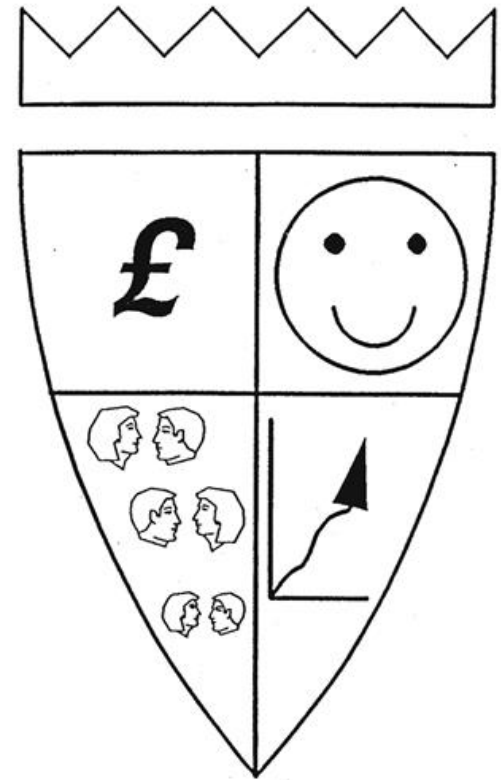
# The Kaizen Approach

- Means “Improvement” in Japanese
- Aims for improvements in productivity, effectiveness, safety, and waste reduction



# Total Quality Management

- Impacts on strategic, cultural and technical aspects of a business
- Complements ISO 9001 registration
- Applied to product and service quality
- TQM is the strategy of efficiently harnessing the skills of all the entire company workforce through:
  - Continuous quality improvement
  - Focus on customer Satisfaction
  - ‘Right First Time’ operations
  - Prevention not correction
  - To achieve quality at the lowest cost
  - Management commitment and leadership



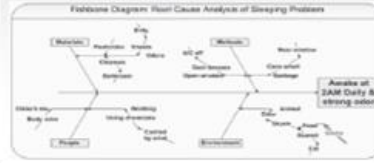
**Crown = Leadership from the top**  
**£ = The costs of quality**  
**Smile = The customer-supplier relationship**  
**Graph = Continuous improvement**  
**People = Involvement of everyone**

## 4. Quality Techniques

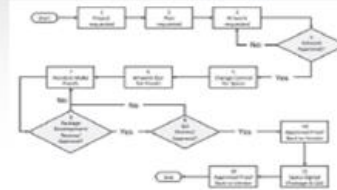
- The 7 Quality Techniques
- Statistical Process Control
- Process Capability
- Six Sigma

# The 7 Quality Techniques

**Cause & Effect Diagram**



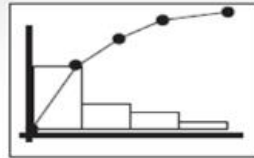
**Flowcharts**



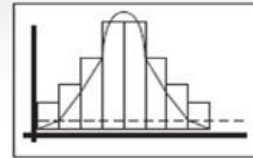
**Checksheets**

Category	Strokes	Frequency
Attribute 1		
Attribute 2		
Attribute ..		
Attribute n		

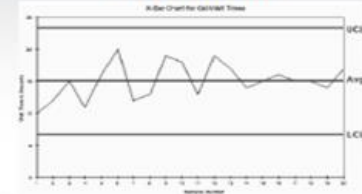
**Pareto Diagrams**



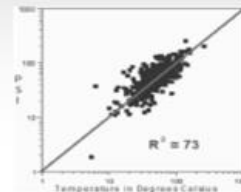
**Histograms**



**Control Charts**

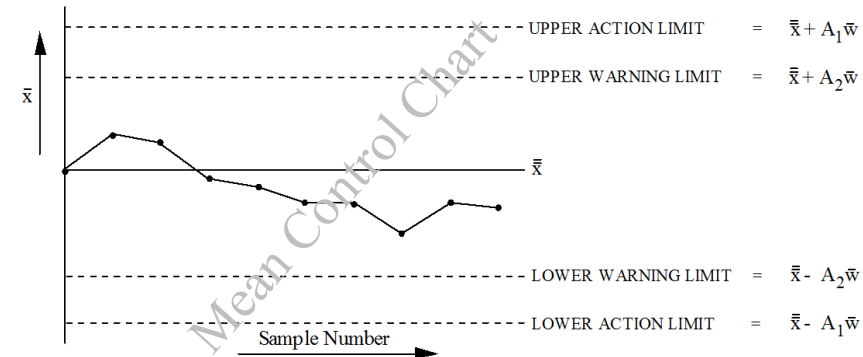
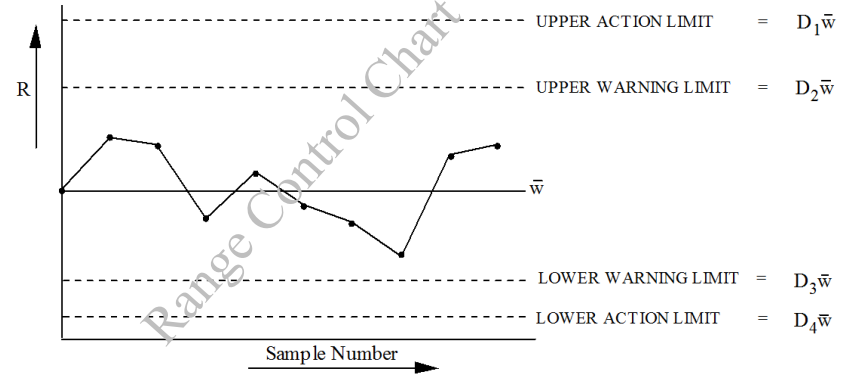


**Scatter Diagrams**



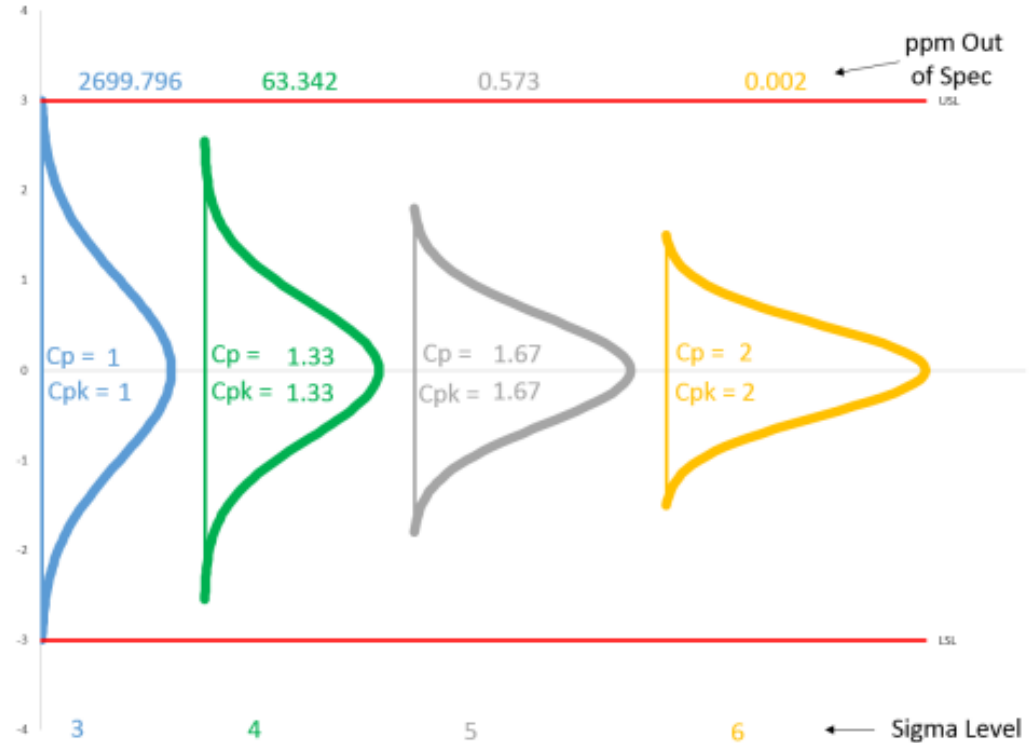
# Statistical Process Control (SPC)

- By measuring the characteristic of interest from small samples of components taken successively from an 'in control' process, it is possible to predict whether the process will be in control in the future without having to measure every component
- The two main types of statistical process control technique for measuring variables are: range and mean charts
- Rules exist to indicate when the process is getting out of control/or when to take action



# Process Capability

- Large number of sample characteristics are measured at successive periods
- Parts-per-million prediction of defects in relation to the target/specification
- $C_p$  and  $C_{pk}$  are the measures for centred and shifted processes respectively, and typically anything over 1.33 is in control (<30ppm defects)





# Six Sigma

- Six Sigma is a registered training programme common in companies
- Started out at Motorola as a statistical analysis toolbox for tolerancing, and builds on the principles of process capability
- Used to predict ppm defects
- Provides a suite of preventative tools for defect reduction
- Essentially suggests having the manufacturing process so in control, that you can put your specification at  $\pm 6$  standard deviations ( $\sigma$ ) from the process mean, and even if the process drifts, it will still produce <3ppm defects



Define	Step 0	Select a Project
Measure	Step 1 Step 2	Establish Performance Parameters Validate Measurement System for 'Y'
Analyze	Step 3 Step 4 Step 5	Establish Process Baseline Define Performance Goals Identify Variation Sources
Improve	Step 6 Step 7 Step 8	Explore Potential Causes Establish Variable Relationship Design Operating Limits
Control	Step 9 Step 10 Step 11	Validate Measurement System for 'X' Verify Process Improvement Implement Process Controls

## In Summary

***“Strive for complete satisfaction of your products and services by the customer at competitive cost through prevention strategies involving all aspects of the business, including suppliers, and continuously improve”***