

School of Engineering

**An Introduction to
Engineering Quality**

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WHAT IS QUALITY?

Fitness for Purpose or use
(Dr. Joseph Juran)

Or Meeting the Customer's Requirements

Requirements include:-

- ❖ Reliability
- ❖ Cost
- ❖ Function
- ❖ Delivery
- ❖ Life
- ❖ Aesthetics

Customers are both internal and external

QUALITY v INSPECTION

Quality systems prevent
errors being created

Inspection systems identify errors
which have already been created

TOTAL QUALITY

Total Quality Embraces

- ❖ BS/ISO – Quality accreditation
- ❖ Company Culture
- ❖ Individual Attitudes
- ❖ Continuous Improvement
- ❖ Commitment – ownership of problems
- ❖ Relationships (with suppliers and customers)

And applies to all parts of the organisation

“Quality is both thinking why something is done, and why it is done that way: Then thinking differently to improve” Mr Ohno, Chairman of Toyota.

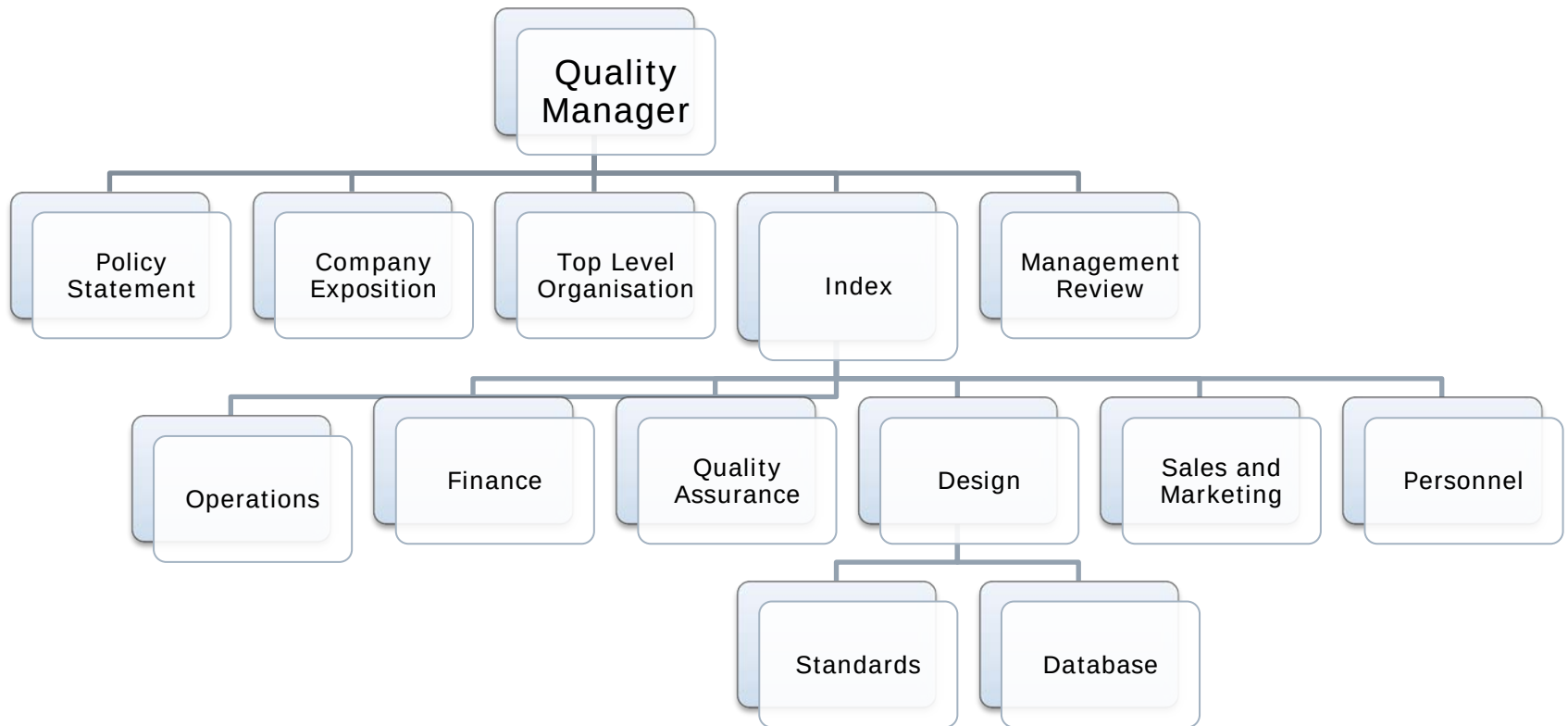
QUALITY ASSURANCE

- ❖ Applies to both the product and the process
 - ❖ Ensures that you meet the customer's requirements in all respects, e.g.
 - Presentation
 - Standards
 - ❖ Should take account of any requirement for
 - Records
 - Audit
 - Traceability
 - ❖ Would ideally be built into a quality plan to which you would work
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THE QUALITY MANUAL

- ❖ Is the heart of the formal quality system
 - ❖ Contains the quality policy, business organisation, and manager's accountabilities
 - ❖ Contains the procedures by which the company is managed
 - ❖ Must be regularly reviewed and updated
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QUALITY MANUAL



JURANS 10 STEPS

- ❖ Build awareness of the need and opportunity for improvement
 - ❖ Set goals for improvement
 - ❖ Organise to meet goals
 - ❖ Promote training
 - ❖ Carry out projects to solve problems
 - ❖ Report progress
 - ❖ Give recognition
 - ❖ Communicate results
 - ❖ Keep score
 - ❖ Maintain momentum. Make annual improvement part of regular systems of company continuous improvement
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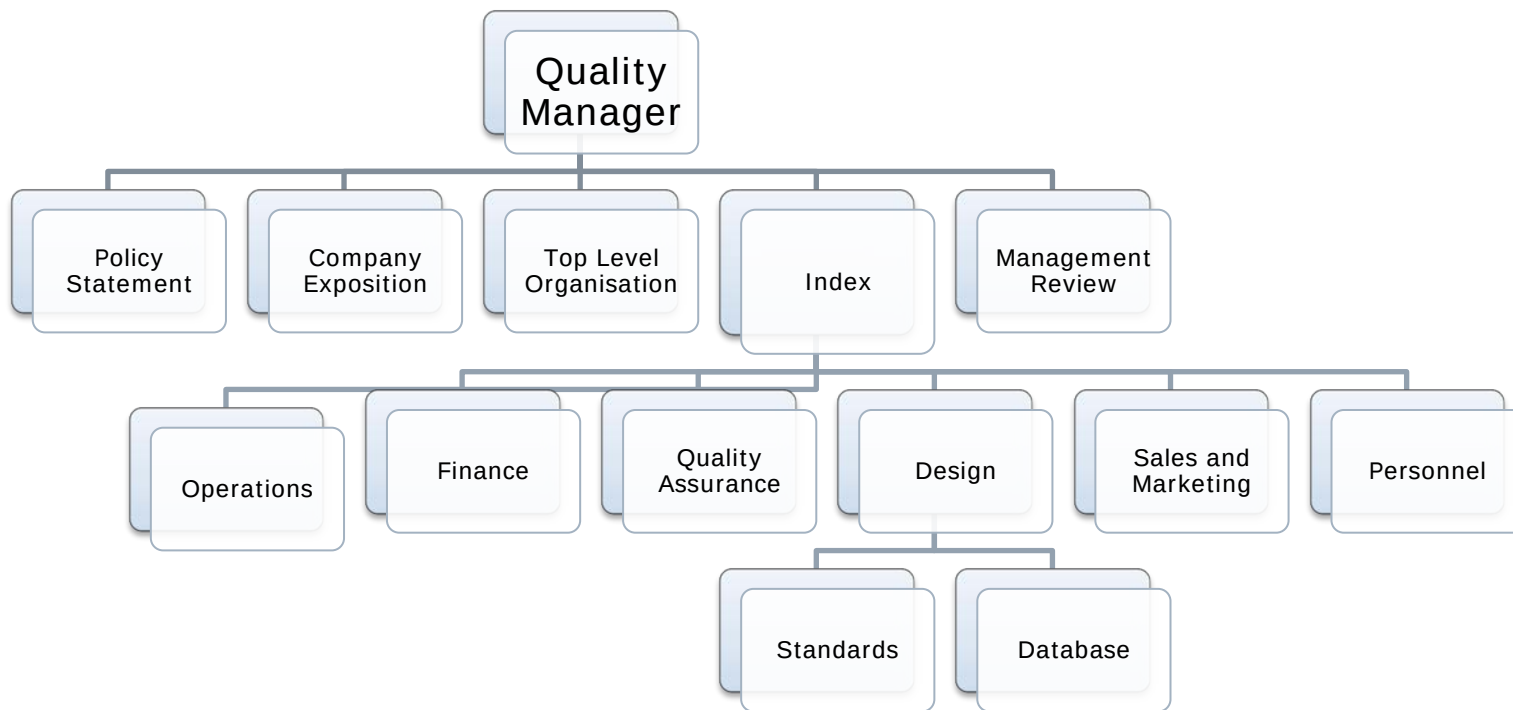
TQM STRATEGY

- ❖ TQM Must be owned by senior management
 - ❖ TQM requires continuous improvement
 - ❖ TQM involves everybody
 - ❖ TQM applicable to all parts of the company
design, production, purchase, finance
 - ❖ TQM means satisfying your customers
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SUB-MANUAL CONTENT

- ❖ Organisation structure
 - ❖ Job descriptions and accountabilities
 - ❖ Procedures
 - ❖ Index of sub-sub-manuals e.g.
 - Company standards
 - Reports
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Applicable Quality Standards



SUBJECTS TO BE COVERED BY PROCEDURES

- ❖ Contract review
 - ❖ Design control
 - ❖ Document control
 - Drawings
 - Bills of material
 - Drawing change
 - ❖ Purchasing
 - Sub-contractors
 - Traceability
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- ❖ Process control
 - ❖ Inspection and test
 - ❖ Control of non-conforming product
 - ❖ Corrective action
 - ❖ Records
 - ❖ Internal audit
 - ❖ Training
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INTERNAL AUDIT

- ❖ Requires a programme of regular (3, 6, or 12 month) reviews of the applicability of the procedures, and to see whether they are being followed
 - ❖ Best undertaken by another department on a rotating basis
 - ❖ Deviations are noted, and corrective action is required
 - ❖ Follow up ensures that action is taken
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EXTERNAL AUDIT

- ❖ A team from British Standards, or delegated organisation, spends time (1-10 days) examining the organisation
 - ❖ Deviations are classified 1, 2 or 3
 - ❖ Too many deviations will result in withdrawal of approval
 - ❖ Deviations are required to be corrected in a defined timescale
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COST OF POOR QUALITY

Cost arises from

- ❖ Error
 - Eg. Scrap, rework, waste in any form
- ❖ Policing
- ❖ Loss of reputation
- ❖ Loss of market share

Costs can be as high as 40% of sales turnover, and are typically as high as 15-25% of sales.

80-85% of quality problems originate in areas other than manufacture.

EXAMPLES OF WASTE

- ❖ Service/warranty costs
 - ❖ Retyping
 - ❖ Redesign
 - ❖ Shortages
 - ❖ Incorrect deliveries
 - ❖ Material handling damage
 - ❖ Lack of information
 - ❖ Unclear communication
 - ❖ Rework
 - ❖ Excess inventory
 - ❖ Time wasting
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MEASURES

It is necessary to establish ways in which quality (and customer satisfaction) can be measured and Monitored. Measures might include:

- ❖ Late deliveries
 - ❖ Design modifications
 - ❖ Defect rates
 - ❖ Unplanned waiting time
 - ❖ Rework
 - ❖ Parts not fitting
 - ❖ Concrete strength
 - ❖ Weld faults
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Customer survey construction

Core business

- ☐ What business are you in?
 - ☐ What are the major components you supply?
 - ☐ What customer groups should be surveyed (there are usually more than one customer group for any process).
 - ☐ What are you trying to accomplish?
 - Are you looking for a feel good report card ?
 - or data to improve your performance?
 - ☐ Timing is critical
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Paths to obtaining customer satisfaction rating

- ❑ Ask customers (e.g., formal and informal interviews, casual conversations, focus groups, etc.).
 - ❑ Direct experience of people involved in delivering services (e.g., distributors, fitters).
 - ❑ Other information sources (e.g., statistics on returns, letters written by customers, verbatim comments on surveys, etc.).
 - ❑ Research methods directly involving customers of the people who provide services to customers.
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Step 1 –Less structured

- Use less structured research methods for determining customer needs, expectations, and delights.

- Direct observation.

- Participant observation.

- Individual interviews.

- Focus group interviews.

- Content analysis of spontaneous letters and comments (complaints and praises).

Step 2 More structured

- Use more structured methods to prioritize what is important to customers.

Mapping major dimensions/indicators of quality.

Identifying quality characteristics of each dimension/indicator.

Planning and conducting a pilot test (who, when, where, how, data collection forms, and interpretation).

Step 3 –Structured, formal

- Use structured methods for measuring quality based on customer judgments.

Personal interview - scripted.

Telephone interview - scripted.

Self-administered questionnaire.

Paper based

Web based

Group work

- ☐ For a product or service
 - ☐ Evaluate the purchase experience
 - Generate a chronological list
 - ☐ List the customer expectations for each point

 - ☐ Generate a customer satisfaction questionnaire
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Reviewing the problems

Improving the process

- ❑ Process improvement is the systematic effort to understand every aspect of a process in order to reduce rework, variation, and needless complexity in order to exceed customer expectations.
 - ❑ When embarking on organizational improvement, the first step is to be sure that you are doing the **right** things right. This means that you have some knowledge of your customers (i.e., what they need, want, and expect).
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Reviewing the problems

Improving the process

- ❑ Know how work gets done in the organization - **core process**
 - ❑ Knowledge of your suppliers and customers. This knowledge prepares you to begin process improvements.
 - ❑ Unless you know what a process looks like, you will not know where the waste and/or rework occur.
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Reviewing the problems

Improving the process

- Improvement can sometimes begin with performance measures or indicators that tell you performance is not up to par. This can be customer or employee feedback (qualitative data), or financial reports, defect rates, etc. (quantitative data).
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QUALITY TECHNIQUES

- ❖ Benchmarking – set goals for best practice baseline
 - ❖ Statistical process control (SPC)
 - Control charts
 - Histograms
 - Process capability
 - Acceptance sampling
 - ❖ Fault reporting and corrective action (FRACAS)
 - ❖ Pareto analysis (80/20 rule)
 - ❖ Taguchi
 - Tolerancing
 - Experiment design
 - ❖ Ishikawa diagrams
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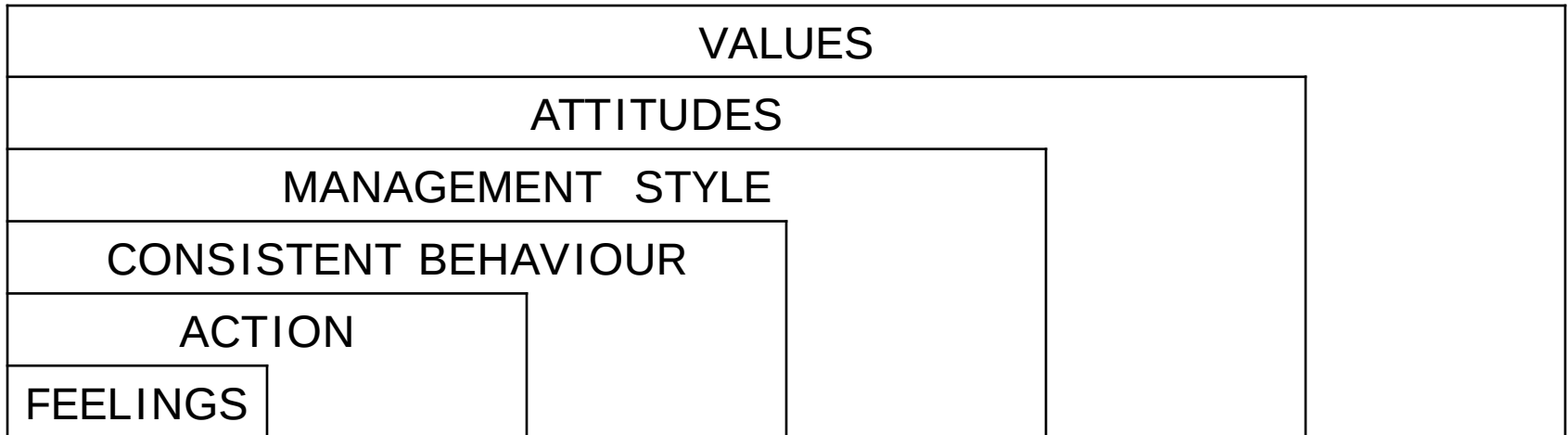
THE ROUTE TO TOTAL QUALITY

- ❖ Create a company culture which identifies TQM as an objective, and creates the conditions for change
 - Mission statement
 - Objectives
 - Management style
 - Communications
 - Commitment
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THE ROUTE TO TOTAL QUALITY

- ❖ Introduce vehicles for change eg.
 - Quality circles
 - Measures
 - Feedback
 - Methodology (SPC, Taguchi)
 - Awareness
 - Targets
 - Training
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DIFFICULTY OF CHANGE



SUPPLIER QUALITY

- ❖ You must be able to demonstrate that you have control of incoming material
 - ❖ Carry out your own audit of their systems and processes
 - ❖ Set quality standards
 - eg Delivery times
 - Defect rates (zero ?)
 - ❖ Require self certification
 - ❖ Have a vendor rating system based on inspection data
 - ❖ Build a good relationship
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SUB-CONTRACTORS

- ❖ Create the required culture, particularly with the supervisors, by:-
 - Training
 - Communication
 - ❖ Require a quality plan, including:
 - Documentation
 - Procedures (eg. Welding, conformity to BS 8000)
 - Test data
 - Inspection data
 - Traceability
 - ❖ Audit
 - Personal
 - Random
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