Quality

What is Quality?

"In technical usage, quality can have two meanings: 1. the characteristics of a product or service that bear on its ability to satisfy stated or implied needs; 2. a product or service free of deficiencies. According to Joseph Juran, quality means "fitness for use;" according to Philip Crosby, it means "conformance to requirements."

-- American Society for Quality (www.asq.org/glossary/q.html)

- Juran
  - "fitness for use"
- Crosby
  - "conformance to requirements"

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Quality is…

- Quality is meeting customer requirements
- Meeting product and service requirements
- Delivery on Schedule, Cost within budget, aiming for zero defects
- Setting measurable goals and improving performance

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Quality is…

"(1)The degree to which a system, component, or process meets specified requirements.

(2) The degree to which a system, component, or process meets customer or user needs or expectations."

IEEE Standard (Std 610.12-1990)

Perspectives of quality…

- Management
  - contractual commitments are met and the result should foster enduring business from the customer
- Project Manager
  - achievement of goals as per project success criteria
- Developer
  - no rework; code works as desired
- Tester
  - application should be free of errors/ problems
- Customer
  - product should be fit for use and meet needs
- QA
  - standardised processes have been adhered to

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Quality – evolving views

Past	Present
Quality is the responsibility of the blue-collar worker	Quality is the responsibility of all workers and the management
Defects should be hidden from the customer	Defects should be highlighted to the customer with a preventive/corrective action
Quality problems lead to history	Quality problems lead to conducive environment
Minimum documentation would suffice for quality problems	Documentation is essential 'lessons learned' so that mistakes are not repeated
Increased quality will increase project costs	Improved quality saves money and increases business
Quality is internal issue	Quality is customer focused

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Quality today

- Quality is defined by the customer
- Quality is a competitive weapon
- Quality is integral part of planning
- Quality requires organization-wide commitment
- Prevention over Inspection
  - “Cease dependence on inspection to achieve quality. Eliminate the need for massive inspection by building quality into the product in the first place.”

    -- (W Edwards Deming, Out of the Crisis)

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Quality…

- An attribute of something that can be measured and compared
- Conformity to specified and implicit requirements and process standards
  - applies to product and process

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Important…

- Quality is not absolute. It is subject to contexts and constraints.
- Quality criteria are not always independent.

- GRADE is not QUALITY
  - products have grades. For example, a car manufacturer may have different versions of the same car – each version offering something “extra”.

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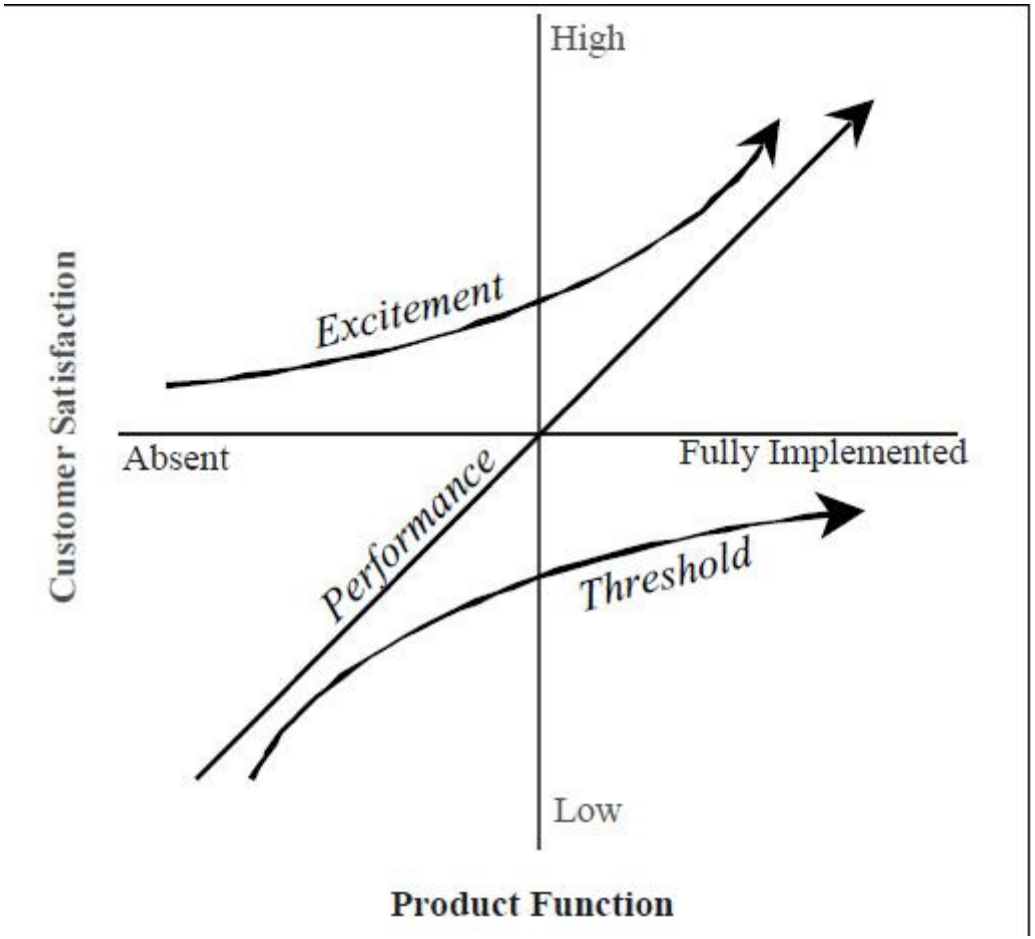
Prof. Noriaki Kano's model



- **Threshold attributes**
- **Performance attributes**
- **Excitement attributes**

Why does quality matter in business?

- Meeting customer expectations is most important
- Quality improvement leads to increase productivity, cost effectiveness and profitability
- Cost of poor quality
  - cost of fixing defects, rework, scrap/waste, penalties, loss of reputation…..

What does 99% quality performance mean?

- Two unsafe landings in Chicago airport everyday
- 16,000 lost pieces of mail per hour
- 20,000 incorrect drug prescriptions every year
- 500 incorrect surgical operations performed every week
- 50 newborn babies dropped by doctors each day
- 22,000 checks deducted from wrong accounts each hour

(Paul F Wilson, Larry D Dell, Gaylord F Anderson, Root Cause Analysis: A Tool for Total Quality Management, quoted by L Charles Smeby, Fire and Emergency Services Administration: Management and Leadership Practices)

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Six Sigma

- Developed by Motorola
- Seeks to improve quality of process outputs by removing causes of defects and minimising variability in processes
- A 6 sigma level ensures not more than 3.4 defects per million opportunities
  - process operating at defect level of 0.00034%

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Aspects of software quality: McCall's factors

- Efficiency
- Integrity
- Reliability
- Usability
- Accuracy
- Maintainability
- Testability
- Flexibility
- Interface facility
- Reusability
- Transferability

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Formal definitions : QC and QA

- **Quality Control**

  “(1)A set of activities designed to evaluate the quality of developed or manufactured products. “

- **Quality Assurance**

  “(1) A planned and systematic pattern of all actions necessary to provide adequate confidence that an item or product conforms to established technical requirements.

  (2) A set of activities designed to evaluate the process by which products are developed or manufactured.”

IEEE Standard (Std 610.12-1990)

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Measurement and Quality

"I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind…"

-- Baron Kelvin

From 'Electrical Units of Measurement', a lecture delivered at the Institution of Civil Engineers, London (3 May 1883), *Popular Lectures and Addresses* (1889), Vol. 1, 73. Quoted in American Association for the Advancement of Science, *Science* (Jan-Jun 1892), **19**, 127.

"In God we trust; all others must bring data."

-- attributed to W Edwards Deming

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Quality Measures and Metrics

- Measures
  - raw numbers from measuring a product or process.
  - lines of code, number of defects, total effort expended, duration

- Metrics
  - useful ratios or percentages derived from the measures
  - Examples: defect density (DD) is defined as the number of defects per thousand lines of code (KLOC)

Some metrics used in HCLT

- Schedule variance
- Effort variance
- Defect density
- Review efficiency
- Defect removal efficiency
- Productivity
- SLA compliance
- Mean Time to Repair (MTTR)
- Defect flow rate
- Fix Validity index

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