



## **SYSTEMS DEVELOPMENT METHODOLOGY**

### **Day 2**



## **Software Quality**

## Software Quality

- In a mass produced software like MS Word, if one copy is tested and found ok, we can create any number of reliable copies from it.
- In a custom produced software, testing alone is not sufficient.
- Just because one software is having good quality other software need not have high quality.
- To achieve high quality in all the custom made software, we have to improve the quality of the processes involved.
- This is required to be successful in the market and to gain customer satisfaction.



## Software Quality

The International Organization for Standardization (ISO) defines quality as:

*The totality of features and characteristics of a product or service that bears on its ability to satisfy stated or implied needs. (ISO 8402, 1986)*



This definition is not used to express a degree of excellence in a comparative sense. It merely identifies a product's quality with a subset of its attributes (which usually includes its price). The word "implied" is important. A decade ago the emphasis was on products, and quality meant a product's ability to conform to specifications i.e. stated needs. In the last several years, the word "quality" has been used increasingly to encompass features and characteristics that have a bearing on an organization's many stakeholders, including community, suppliers, shareholders, employees and management. Quality now includes measures of work life, workplace diversity, environmental conditions and competitiveness.

## What is Quality?

- Can we say that a pocket radio costing Rs. 200/- has lesser quality than a hi-fi system costing Rs. 20,000/-?
- Quality can be measured only in terms of attributes of the product.
- The user will be measuring the quality of the product based on some of the attributes, depending on his requirements.
- So some may think that the pocket radio is having more quality while others may think that the hi-fi system is having more quality.



What are the “features and characteristics” of software that define its quality?  
These quality factors are what form the management’s view of product quality.

Some important software quality factors are:

**Correctness:** The extent to which a program satisfies its specifications and fulfils its user’s mission objectives.

**Maintainability:** The effort required to locate and fix an error or introduce new features in an operational program.

**Reliability:** The extent to which a program can be expected to perform its intended function with the required precision.

**Portability:** Effort required in transferring a program from one hardware configuration and/or software system environment to another.

**Usability:** Effort required for learning, operating, preparing input, and interpreting output of a program.

**Reusability:** Extent to which a program can be used in other applications.

When the customer speaks about quality in a software it will be based on the combinations of these attributes

## Cost of Quality

- Cost of quality comprises of three components
  - Cost of Prevention
  - Cost of Appraisal
  - Cost of Failure
- From these three costs, we can get the total cost of quality.



There are two well-accepted and documented ways of recording your quality costs which are described in the British Standard BS 6143: Guide to the economics of quality. These are the Process Analysis model and the Prevention, Appraisal, Failure (PAF) model.

**Process Analysis Model:** Here all the activities of the firm are first viewed as well-defined processes. They are taken for granted. The cost of quality is then deduced in terms of the cost of conformance or non-conformance to these processes, without making judgments about the efficiency or relevance of the processes themselves.

In the **PAF model**, as the name suggests, costs are split into the three categories Prevention, Appraisal and Failure.

## Cost of Prevention

- Cost of prevention is the cost incurred in preventing an error from occurring.
- It could be doing a good requirements analysis, doing a good design and following a good standard.
- *Prevention costs increase with increased degree of quality.*



## Cost of Appraisal

- Cost of appraisal is the cost incurred for all testing we do including code reviews and other forms of testing.
- As the cost of appraisal increases degree of quality also increases to an extend.
- But after a certain limit the degree of quality does not increase with cost of appraisal.
- *Appraisal costs increases with increased degree of quality but reduces after it reaches a certain point.*

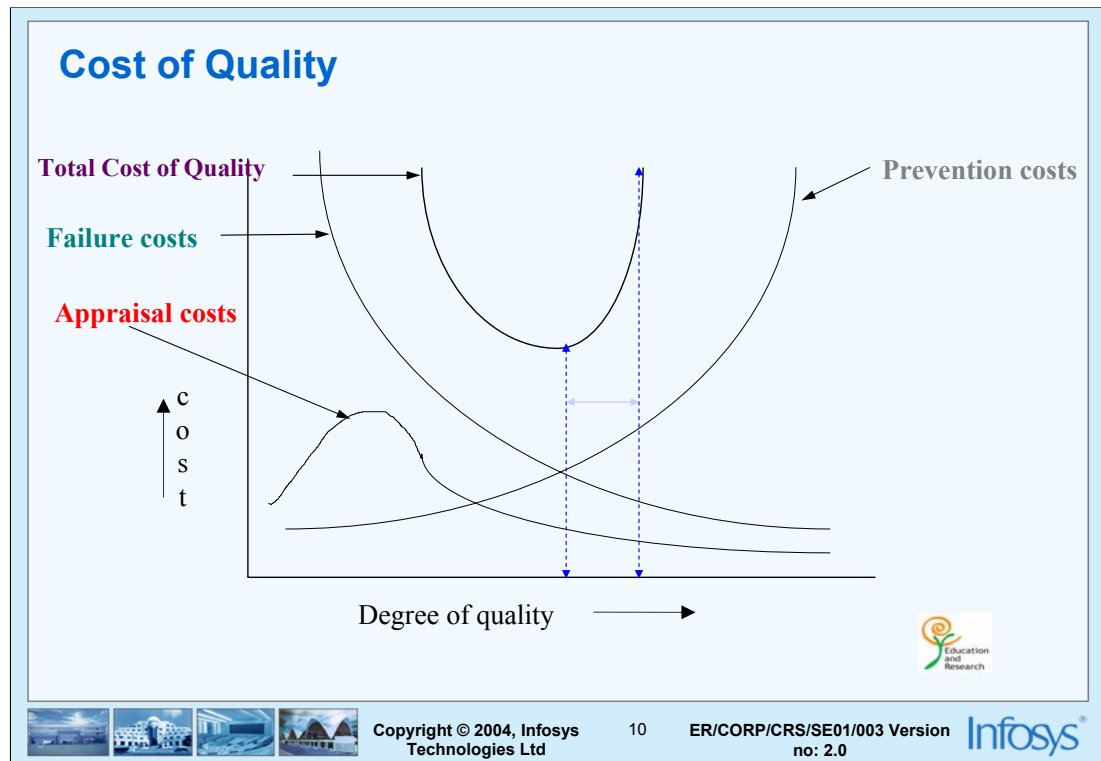




## Cost of Failure

- Cost of failure is the cost incurred in removing all the errors that have got into the software.
- Cost of failure also includes the good will lost which may not be measurable.
- *Failure costs reduce with increase in degree of quality.*





*Failure costs reduce with increase in degree of quality.*

*Prevention costs increase with increased degree of quality.*

*Appraisal costs increases with increased degree of quality but reduces after it reaches a certain point.*

**Total Cost of Quality:** This curve represents the sum of Prevention Costs, Appraisal Costs, Internal Failure Costs and External failure Costs. As the figure shows, there is usually an optimum level of quality at any given point of time.

## Cost of Quality...

- The graph shows that every organization has an optimum level of quality.
- But one should go beyond these graphs as these graphs are not measuring customer satisfaction that goes up with quality!



## ISO 9000

- ISO specifications just give a skeletal idea of the processes to be followed.
- Each organization has to define and follow processes based on these specifications.
- ISO 9000 will not certify the quality of the product but that of the processes.
- ISO 9000 has a series of standards
  - The series consists of ISO 9000, ISO 9001 and ISO 9004.



International Standards Organization (ISO) defines Quality System as:

*“The organizational structure, responsibilities, procedures, processes and resources needed to implement quality management.” - (ISO 8402, 1991)*

ISO is based on TQM standards and defines various standards.

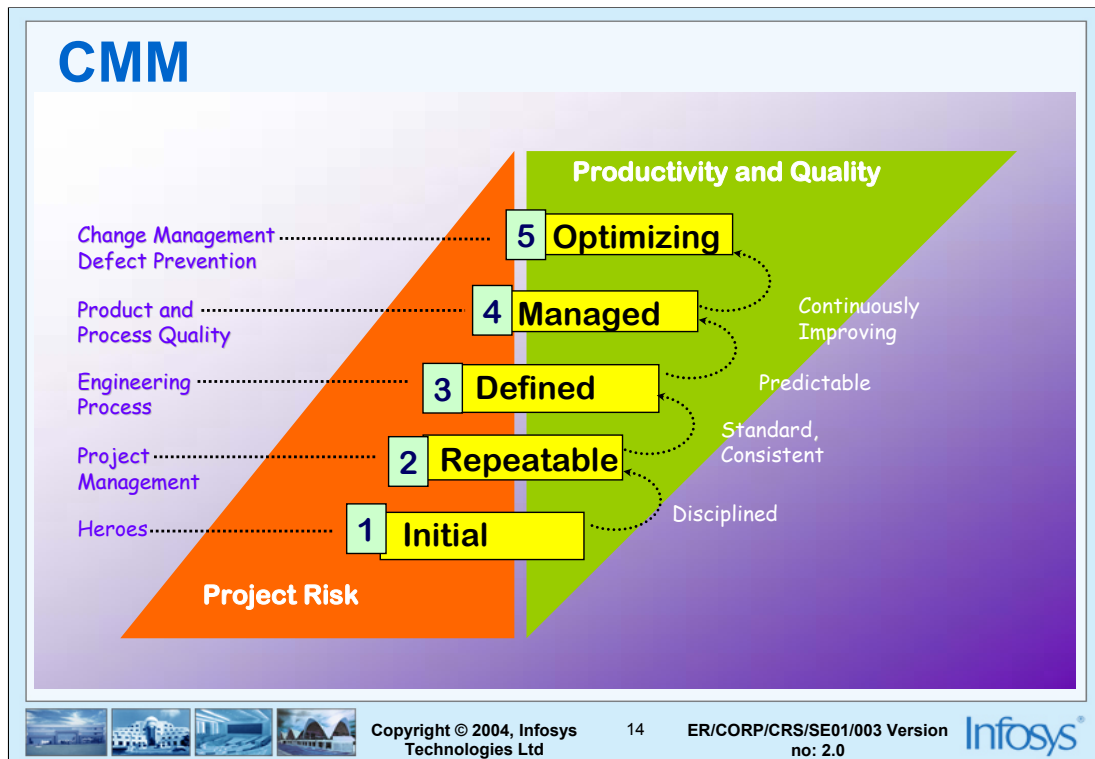
ISO 9000 and ISO 14000 are Generic Management System Standards. Generic means that the same standards can be applied to any organization large or small, whatever its product and whether it is a private enterprise, a public administration or a government department.

ISO 9000 is a series of five international standards on quality management and assurance. The series consists of ISO 9000, ISO 9001 and ISO 9004.

## SEI CMM

- SEI-CMM stands for Software Engineering Institute - Capability Maturity Model.
- CMM defines 5 levels
  - Level 1 - Initial
  - Level 2 - Repeatable
  - Level 3 - Defined
  - Level 4 - Managed
  - Level 5 - Optimizing





**Level 1 Initial:** There are no processes defined and success is person dependent. The process capability of this level, therefore, is defined as ‘Heroes’.

**Level 2 Repeatable:** The focus area of this level is ‘Project Management’. Project standards are defined and followed. Projects functionality, scheduled and costs are tracked. Projects history data is available and used. Risks can be identified at early stages of the projects. Projects processes are therefore under control. The process capability of the organization at level two is disciplined.

**Level 3 Defined:** The focus area of this level is ‘Engineering Process’. At this level the processes are defined and standardized at organization level. Projects tailor these standard processes to suit their need. The process capability of the organization at this level is standard & consistent.

**Level 4 Managed:** The focus area of this level is ‘Product & Process Quality’. At this level quantitative quality goals are set for software products and processes at organization level. Organization-wide “Process Capability Data” is maintained deriving data from completed projects. Projects use this data as a benchmark or quality goal. The process capability of the organization at this level is predictable.

**Level 5 Optimizing:** The focus area of this level is ‘Continuous Improvement’. Organization has means to identify weakness and strengthen the process proactively, with a goal of preventing the occurrence of defect. The process capability achieved at this level is continuous improvement.

## ISO Vs CMM

ISO	CMM
ISO is a generic standard. It is applicable for all industries.	CMM is very specific to software industry.
ISO is a standard. It tells what needs to be done, in an organization.	CMM is a model. It doesn't mandate the practices.
ISO focuses on the entire organization's processes	CMM is specific to software processes
ISO Certification is followed by surveillance audit once in 6 months	After CMM assessment, there are no such checks. It is up to the organization to use it for internal process improvements.
ISO is continuous.	CMM is staged (It has different levels of process maturity)
Internal Audits are mandatory	Not mandatory



## Summary

- Quality of a software can be determined by various attributes like complexity, reliability, portability, flexibility etc.
- The cost of quality comprises of three components : Cost of prevention, cost of failure and cost of appraisal.
- Prevention costs increase with increased degree of quality.
- Failure costs reduce with increased degree of quality.
- Appraisal costs increase with increased degree of quality and remains constant after a certain period of time.
- ISO certifies the quality of the processes.
- CMM defines how an organization mature in their ability to develop software.
- CMMI integrates all CMM models into a framework for organization's purpose.





## References

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Thank You!



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18

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