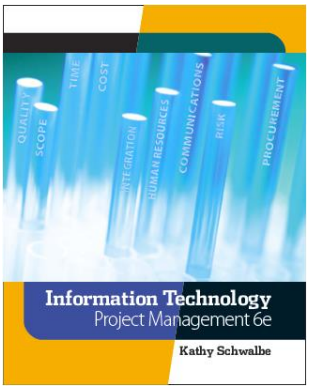
Chapter 8:
Project Quality Management

Information Technology Project Management, Sixth Edition



Learning Objectives

- Understand the importance of project quality management for information technology products and services
- Define project quality management and understand how quality relates to various aspects of information technology projects
- Describe quality planning and its relationship to project scope management
- Discuss the importance of quality assurance
- Explain the main outputs of the quality control process

Learning Objectives (continued)

- Understand the tools and techniques for quality control, such as the Seven Basic Tools of Quality, statistical sampling, Six Sigma, and testing
- Summarize the contributions of noteworthy quality experts to modern quality management
- Describe how leadership, the cost of quality, organizational influences, expectations, cultural differences, and maturity models relate to improving quality in information technology projects
- Discuss how software can assist in project quality management

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What is Quality?

It is about "how good it is".

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If GM goes like IT advancement, we should have cars as cheap as $25, can run 1,000 miles with only a gallon of gasoline.

If GM development tech like Microsoft, we would be all driving a car with the following characteristics:

- *Such as breaking down twice a day for no reason whatsoever;*
- *Occasionally, the car will lock you out for no reason, and you need to re-start to run again.*

Responded by GM's CEO

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What Is Project Quality?

- The International Organization for Standardization (ISO) defines **quality** in ISO9000:2000 as:

  "The degree to which a set of inherent characteristics fulfils requirements"

- In PM, **Quality** is commonly defined based on:
  - **Conformance to requirements**: the project's processes and products meet written specifications
  - **Fitness for use**: a product can be used as it was intended

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Inherent characteristics and functions or Fitness for use

- A product should be suitable for its intended purpose.

Examples:

- The car is for driving, transporting something
- The chair is for being seated
- The telephone is for voice communication (more now…)
- The lamp is for providing light

(*These do not match with their intended purposes.*)

- The pen is very sharp for drilling holes in wood
- The bus/truck has an instantaneous pickup speed.

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Quality vs Grade

- Quality
  - The degree to which a set of inherent characteristics fulfill requirements.
  - A measure of conformance to requirements and fitness for use
- Grade
  - A category assigned to deliverables having the same functional use but different technical characteristics

Low grade is acceptable to end users,
but **Low quality** is not.

High **Quality** - Low **Grade**: Ordinary car with good condition √
Low **Quality** - High **Grade**: High-performance sports car with engine problems **x**

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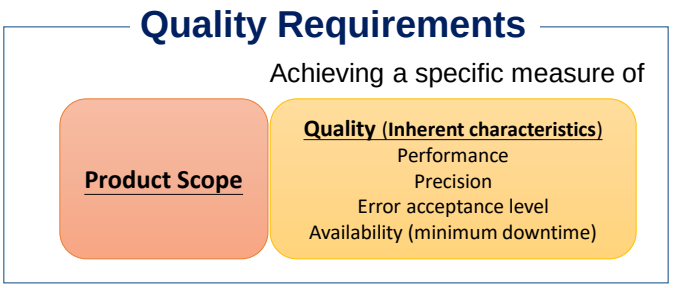
Quality, Scope and Requirement's Attributes



Let's compare the two systems…

ePayment	**Quality** Security (*Very high*) Availability (*Very high*) Performance (*High*)	eSport Controller	**Quality** Security (*Mid*) Availability (*High*) Performance (*Very high*)

What about …?

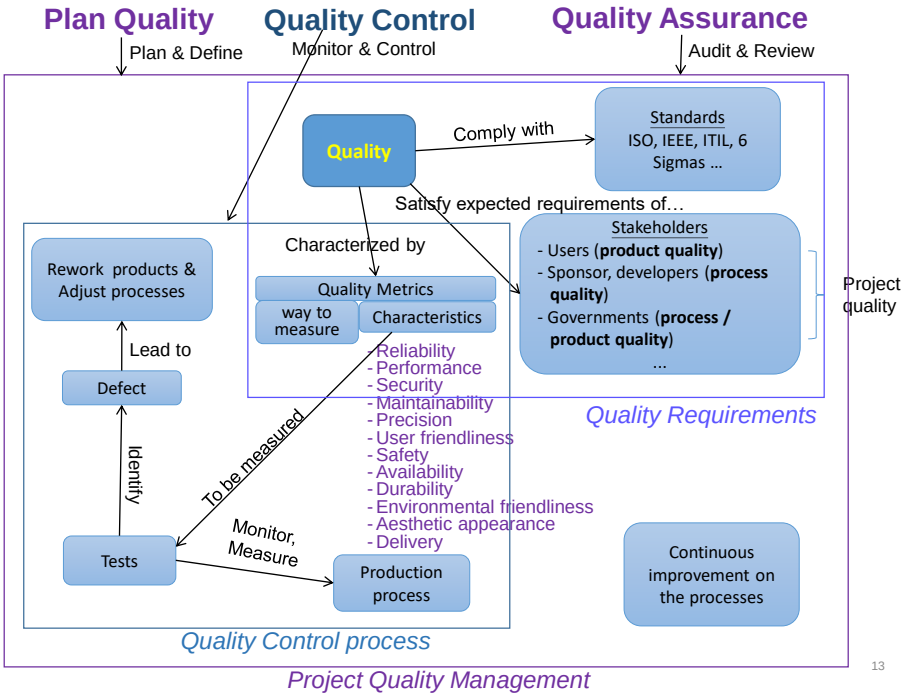
Smart phone	**Quality** ???? ??% ???? ??%
Flight transportation	**Quality** ???? ??% ???? ??%

Standards of quality

- Standard organizations and references can help project managers and their teams understand quality
  - **ISO 9000:2000** (International Organization for Standardization)
  - **IEEE** (Institute of Electrical and Electronics Engineers)
  - **CMMI** (Capability Maturity Model Integration)
  - **ITIL** (Information Technology Infrastructure Library)
  - **Six Sigma**
  - Greenhouse gas Emission control standards
  - *etc.*

What Is Project Quality Management?

- **Project quality management** ensures that the project will satisfy the needs for which it was undertaken
- Processes include:
  - **Planning quality**: identifying which quality standards are relevant to the project and how to satisfy them; a **metric** is a quantifiable standard of measurement
  - **Performing quality assurance**: periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards
  - **Performing quality control**: monitoring specific project results to ensure that they comply with the relevant quality standards



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Planning Quality

> ***Plan Quality*** *is the process of identifying quality requirements and/or standards for the project and its deliverables, and documenting how the project will demonstrate compliance with quality requirements.*

- Set quality goal for the project
- Not just product process, but also project process
- Plan time and resources to do QC and QA

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Performing Quality Assurance

> ***Quality Assurance (QA)*** *is the process of auditing the quality requirements and the results from quality control measurements to ensure appropriate quality standards and operational definitions are used.*

- It involves establishing specific processes
  - to assure the product to be able to meet the quality requirements
  - to audit the results from quality control and to adjust it as needed for continuous quality improvement

Quality Control

> ***Control Quality (QC)*** *involves the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes.*

- The main outputs of quality control are:
  - **Acceptance decisions**
    - It determines if the products (or part of them) produced will be accepted or rejected.
  - **Rework**
    - It is action taken to bring rejected items into compliance with product requirements, or other stakeholder expectations.
  - **Process adjustments**
    - It correct or prevent further quality problems based on quality control measurements.
- There are Seven Basic Tools of Quality that help in performing quality control

Quality Assurance

- Focuses on defect prevention
- Ensures process quality
- Improves product quality by improving test process quality
- To achieve, need a good quality management and auditing system
- Audit QC info, establish standards, plan for improvement

Quality Control

- Focuses on defect inspection & correction
- Ensures product quality
- Improves product quality by testing on products
- To achieve, find and eliminate product quality problems
- Inspect, perform test

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Seven Basic Tools for the control processes

- **Cause-and-Effect Diagram (Fishbone Diagram)**
  - Identifying the causes
- **Flowchart**
  - Identifying failing process steps and process improvement opportunities
- **Scatter diagram**
  - Collecting data/documenting steps for defeat analysis
- **Histograms**
  - Sampling the frequency of failures for analysis
- **Pareto Chart**
  - Identifying critical issues in descending order of frequency
- **Control Chart**
  - Determining if a process is stable using statistical sampling
- **Run Chart**
  - Recording the controlled data

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Cause-and-Effect Diagrams

- **Cause-and-effect diagrams** trace complaints about quality problems back to the responsible production operations
- They help you find the root cause of a problem
- Also known as **fishbone** or **Ishikawa diagrams**
- Can also use the **5 whys** technique where you repeatedly ask the question "Why" (five is a good rule of thumb) to peel away the layers of symptoms that can lead to the root cause

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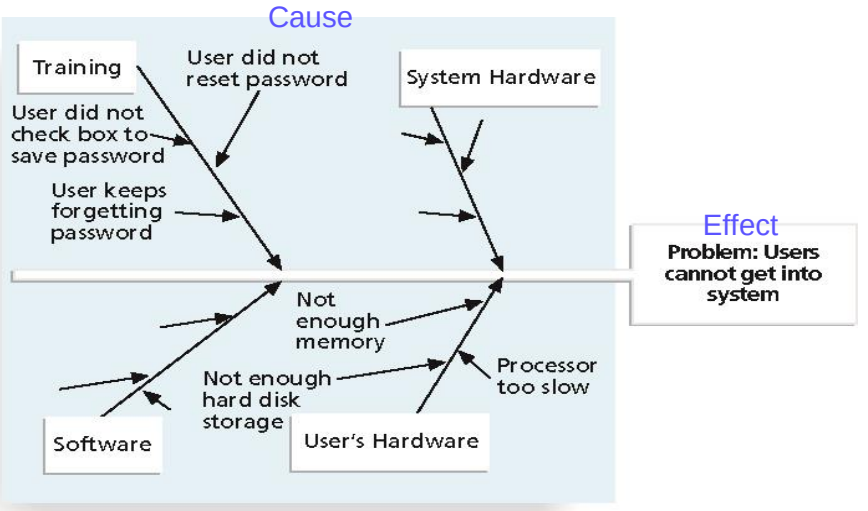
Figure 8-2. Sample Cause-and-Effect Diagram



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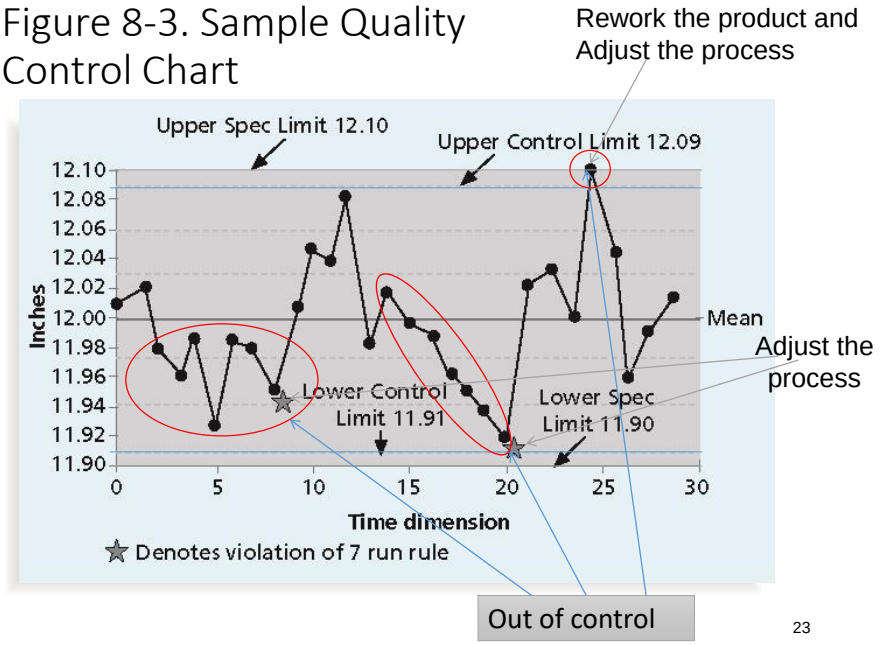
Quality Control Charts

- A **control chart** is a graphic display of data that illustrates the results of a process over time
- The main use of control charts is to prevent defects, rather than to detect or reject them
- Quality control charts allow you to determine whether a process is in control or out of control
  - When a process is in control, any variations in the results of the process are created by random events; processes that are in control do not need to be adjusted
  - When a process is out of control, variations in the results of the process are caused by non-random events; you need to identify the causes of those non-random events and adjust the process to correct or eliminate them

The Seven Run Rule

- You can use quality control charts and the seven run rule to look for patterns in data
- The **seven run rule** states that if seven data points in a row are all below the mean, above the mean, or are all increasing or decreasing, then the process needs to be examined for non-random problems

Figure 8-3. Sample Quality Control Chart



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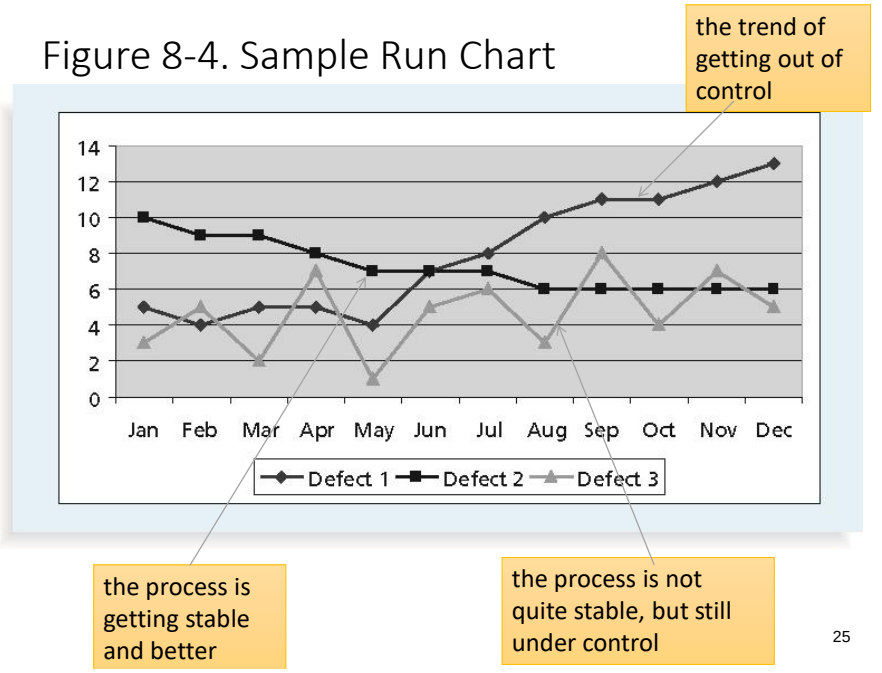
Run Chart

- A run chart displays the history and pattern of variation of a process over time
- It is a line chart that shows data points plotted in the order in which they occur
- Can be used to perform trend analysis to forecast future outcomes based on historical patterns

Figure 8-4. Sample Run Chart



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Scatter Diagram

- A **scatter diagram** helps to show if there is a relationship between two variables
- The closer data points are to a diagonal line, the more closely the two variables are related

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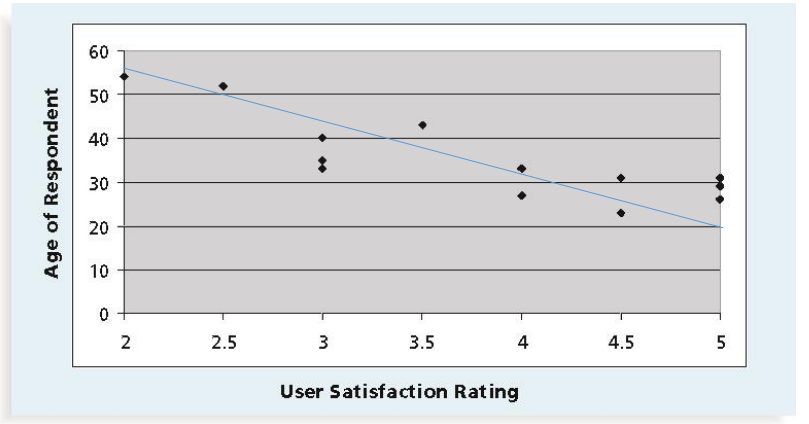
Figure 8-5. Sample Scatter Diagram



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Histograms

- A **histogram** is a bar graph of a distribution of variables
- Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency
  - Problem: Survey about people's satisfaction
  - Attribute: Age ranges (12-18; 19-29; 30-40; 50-60; 60+)
  - Frequency: The number of people who fall into the corresponding ranges.

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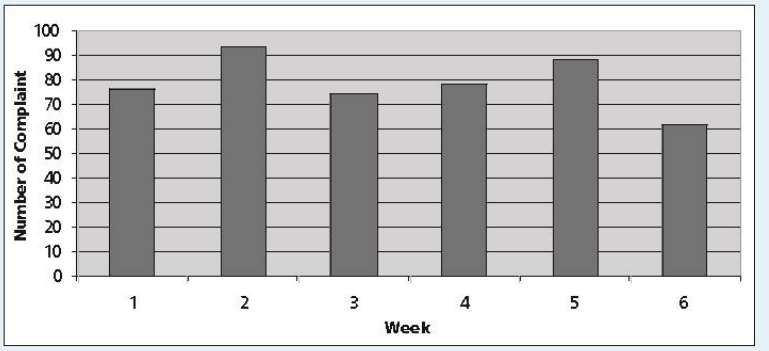
Figure 8-6. Sample Histogram



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Pareto Charts

- A **Pareto chart** is a histogram that can help you identify and prioritize problem areas, or critical problems
- **Pareto analysis** is also called the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes

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80-20 rule

- In a nation's health-care system, 20% of the population (or 20% of the diseases) consumes 80% of the nation's medication resource
- 80% of the world's fortune is owned by 24% of people
- 80% of the world's resource is used up by 15% of population
- 80% of the enterprise's core value is created by the 20% of employees
- 80% of the task is accomplished by the 20% key actions
- 80% of the supermarket's profit comes from the 20% of the commodities

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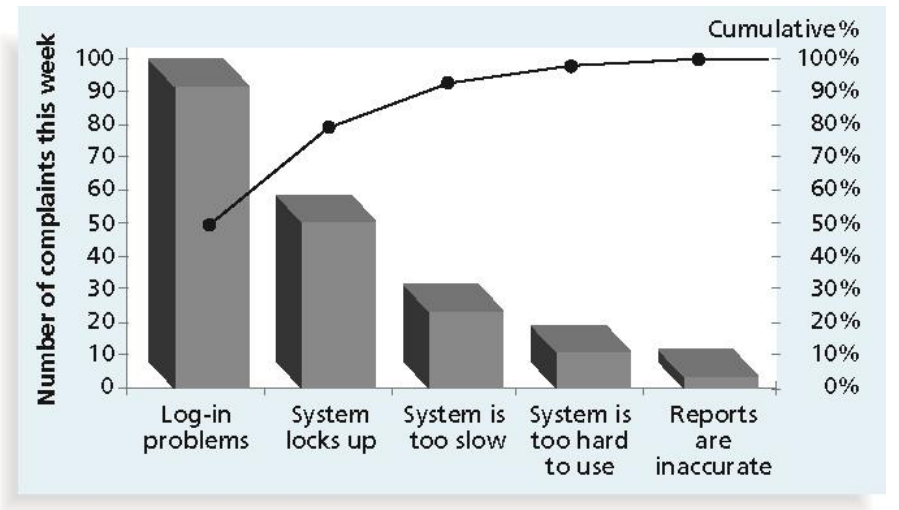
Figure 8-7. Sample Pareto Chart



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Six Sigma

- **Six Sigma** is "a comprehensive and flexible system for achieving, sustaining, and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes."*

*Pande, Peter S., Robert P. Neuman, and Roland R. Cavanagh, *The Six Sigma Way*, New York: McGraw-Hill, 2000, p. xi.

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Basic Information on Six Sigma

- The target for perfection is the achievement of no more than **3.4 defects per million opportunities**
- The principles can apply to a wide variety of processes
- Six Sigma projects normally follow a five-phase improvement process called DMAIC

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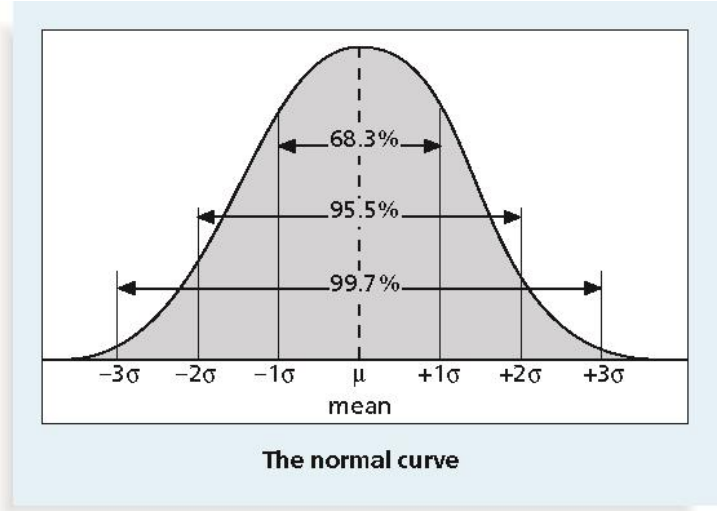
Six Sigma and Statistics

- The term *sigma* means standard deviation
- **Standard deviation** measures how much variation exists in a distribution of data
- Standard deviation is a key factor in determining the acceptable number of defective units found in a population
- Six Sigma projects strive for no more than 3.4 defects per million opportunities, yet this number is confusing to many statisticians

Six Sigma Uses a Conversion Table

- **Yield** represents the number of units handled correctly through the process steps
- A **defect** is any instance where the product or service fails to meet customer requirements

Figure 8-9. Normal Distribution and Standard Deviation



Six 9s of Quality

- **Six 9s of quality** is a measure of quality control equal to 1 fault in 1 million opportunities
- In the telecommunications industry, it means 99.9999 percent service availability or *30 seconds of down time a year*
- This level of quality has also been stated as the target goal for the number of errors in a communications circuit, system failures, or errors in lines of code

ISO Standards

- **ISO 9000** is a quality system standard that:
  - Is a three-part, continuous cycle of planning, controlling, and documenting quality in an organization
  - Provides minimum requirements needed for an organization to meet its quality certification standards
  - Helps organizations around the world reduce costs and improve customer satisfaction

See www.iso.org for more information

Improving Information Technology Project Quality

- Suggestions for improving quality for IT projects include:
  - Establish leadership that promotes quality
  - Understand the cost of quality
  - Focus on organizational influences and workplace factors that affect quality
  - Follow maturity models

The Cost of Quality

- The **cost of quality** is the cost of conformance plus the cost of nonconformance
  - **Conformance** means delivering products that meet requirements and *fitness for use*
    - *i.e. the costs associated with developing a quality plan, analyzing and managing product requirements, testing etc.*
  - **Cost of nonconformance** means taking responsibility for failures or not meeting quality expectations
    - i.e. the costs of downtime of the system, loss of business, damage of reputation etc.
- A study reported that software bugs cost the U.S. economy $59.6 billion each year and that one third of the bugs could be eliminated by an improved testing infrastructure

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Five Cost Categories Related to Quality

- **Prevention cost**: cost of planning and executing a project so it is error-free or within an acceptable error range.
  - Planning, training, quality surveys of suppliers and subcontractors etc.
  - Y2K example: if companies planned well and made use of 4 digits to represent years instead of 2, they would've saved billions of dollars shortly before year 2000.
- **Appraisal cost**: cost of evaluating processes and their outputs to ensure quality
  - Inspection, testing of products, maintenance of inspection equipment etc.
- **Internal failure cost**: cost incurred to correct an identified defect before the customer receives the product
  - Scrap, rework, charges related to delay of processes -- delivery, inventory costs, correction of a design error, etc.

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Five Cost Categories Related to Quality (cont.)

- **External failure cost**: cost that relates to all errors not detected and corrected before delivery to the customer
  - Warranty cost, field service maintenance, all expenses in the recall of products, product liability lawsuits, complaint handling, future business losses etc.
- **Measurement and test equipment costs**: capital cost of equipment used to perform prevention and appraisal activities

Maturity Models

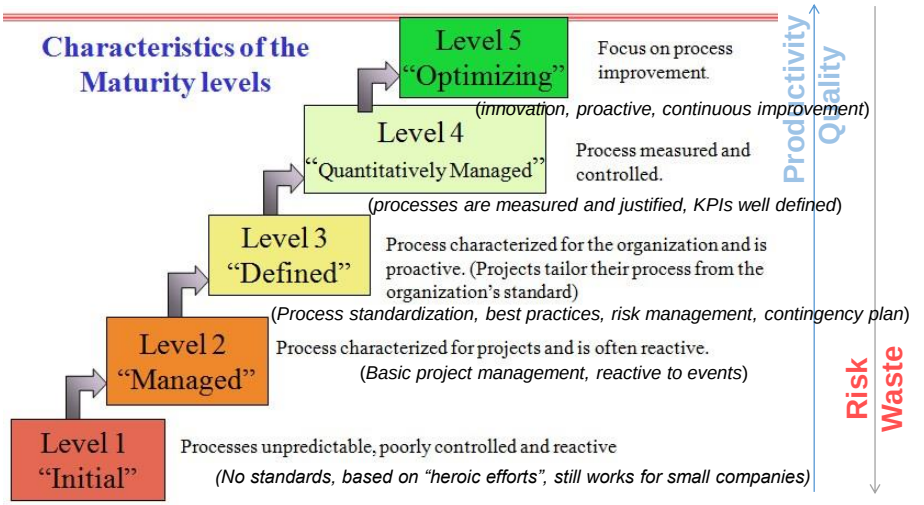
- **Maturity models** are frameworks for helping organizations improve their processes and systems
  - The **Software Quality Function Deployment Model** focuses on defining user requirements and planning software projects
  - The Software Engineering Institute's **Capability Maturity Model Integration** is a process improvement approach that provides organizations with the essential elements of effective processes
  - It helps guide process improvement across a project, a division or an entire organization.

- It can be used to
  - Help integrate traditionally separate organizational functions
  - Set process improvement goals and priorities
  - Provide guidance for quality processes
  - Provide a point of reference for appriasing current processes

CMMI Levels

- Capability levels of the CMMI, from lowest to highest, are:
  - Initial
  - Managed
  - Defined
  - Quantitatively Managed
  - Optimizing
- Companies may not get to bid on government projects unless they have a CMMI Level 3

5 CMMI Levels



PMI's Maturity Model

- PMI released the Organizational Project Management Maturity Model (OPM3) in December 2003
- Model is based on market research surveys sent to more than 30,000 project management professionals and incorporates 180 best practices and more than 2,400 capabilities, outcomes, and key performance indicators
- Addresses standards for excellence in project, program, and portfolio management best practices and explains the capabilities necessary to achieve those best practices