INFO 6245 Planning & Managing Information Systems Development

Module 7

Project Quality Management

Topics of Discussion

- Quality Management
- Tools & Techniques
- Six Sigma
- Quality Testing
- Modern Quality Management

Quality Management

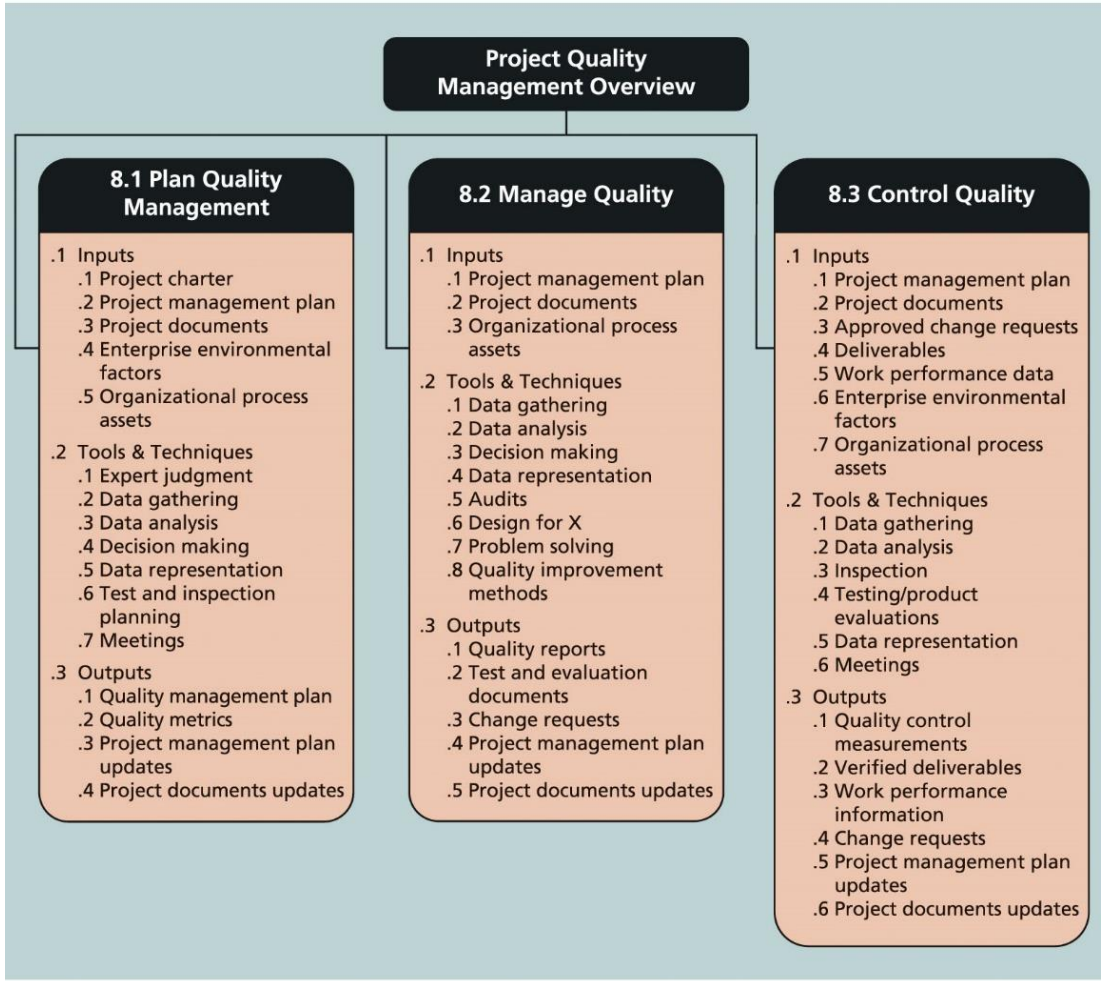
- ISO definition of quality
  - “Totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs” (ISO8042:1994)
  - “The degree to which a set of inherent characteristics fulfills requirements” (ISO9000:2000)
- Other definitions of quality
  - Conformance to requirements - Project’s processes and products meet written specifications
  - Fitness for use - Product can be used as it was intended
- Project quality management ensures the project will satisfy the needs for which it was undertaken
- Understanding what Quality means to the customer is key – the customer ultimately decides if quality is acceptable.

PMI Summary

1. **Planning quality management** includes identifying which quality requirements and standards are relevant to the project and how to satisfy them. Incorporating quality standards into project design is a key part of quality planning. The main outputs of planning quality management are a quality management plan, quality metrics, project management plan updates, and project documents updates. A metric is a standard of measurement. Examples of common metrics include failure rates of products, availability of goods and services, and customer satisfaction ratings.

2. **Managing quality** involves translating the quality management plan into executable quality activities. These activities must adhere to the organization's quality policies. The main outputs of this process are quality reports, test and evaluation documents, change requests, project management plan updates, and project documents updates.

3. **Controlling quality** involves monitoring specific project results to ensure that they are complete, correct, and meet customer expectations. This process is often associated with the technical tools and techniques of quality management, such as Pareto charts, quality control charts, and statistical sampling. The main outputs of quality control include quality control measurements, verified deliverables, work performance information, change requests, project management plan updates, and project documents updates.



Planning Quality Management

Implies the ability to anticipate situations and prepare actions to bring about the desired outcome.

Prevention of defects by 1) Selecting proper methods and materials, 2) Training and indoctrinating the team in maintaining quality standards, 3) Planning a process that ensures the appropriate outcome.

Important to identify relevant quality standards for each project and to design quality into the products and the processes.

Project managers need to consider all scope issues in determining quality goals for the project.

All project stakeholders must work together to balance the quality, scope, time, and cost dimensions of the project.

Scope Aspects Affecting Quality

Functionality: Degree to which a system performs its intended function

Features: System's special characteristics that appeal to users

System outputs: Screens and reports the system generates

Performance: Addresses how well a product or service performs the customer's intended use

Reliability: Ability of a product or service to perform as expected under normal conditions

Maintainability: Ease of performing maintenance on a product

Managing Quality

Managing quality includes all quality assurance activities plus product design and process improvements.

Quality assurance includes all the activities related to satisfying the relevant quality standards for a project; QA focuses on **preventing defects**

Important inputs for managing quality are the quality management plan, project documents, and organizational process assets.

Organizations need detailed processes in place to make sure their products and services conform to various quality requirements

Organization use best practices to focus on **continuous quality improvement**

Kaizen is the Japanese word for improvement or change for the better

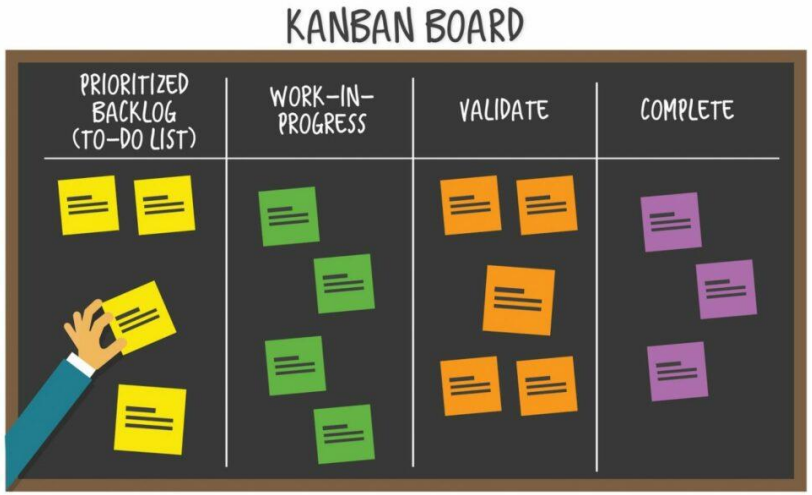
Lean involves evaluating processes to maximize customer value while minimizing waste

Benchmarking generates ideas for quality improvements by comparing specific project practices or product characteristics to those of other projects or products within or outside the performing organization

A **quality audit** is a structured review of specific quality management activities that help identify lessons learned that could improve performance on current or future projects

Kanban

- Application of Kanban is different for every team.
- It is used to incrementally improve the process.
- Five core properties:
  - Visual workflow
  - Limit work-in-progress
  - Measure and manage flow
  - Make process policies explicit
  - Use models to recognize improvement opportunities
- The simple act of limiting work-in-progress with kanban encourages higher quality and greater performance.



Controlling Quality

Main goal of quality control is to continuously improve quality of the output (product or service); it focuses on **finding defects**

Acceptance decisions determine if the project outputs will be accepted or rejected. If accepted, they are validated deliverables. If project stakeholders reject some of the project's products or services, there must be rework.

Rework means to bring rejected items into compliance with product requirements, specifications, or other stakeholder expectations. Rework can be very expensive and can be avoided with good quality planning and quality assurance.

Process adjustments correct or prevent further quality problems based on quality control measurements. Process adjustments often result in updates to organization process assets and the project management plan.

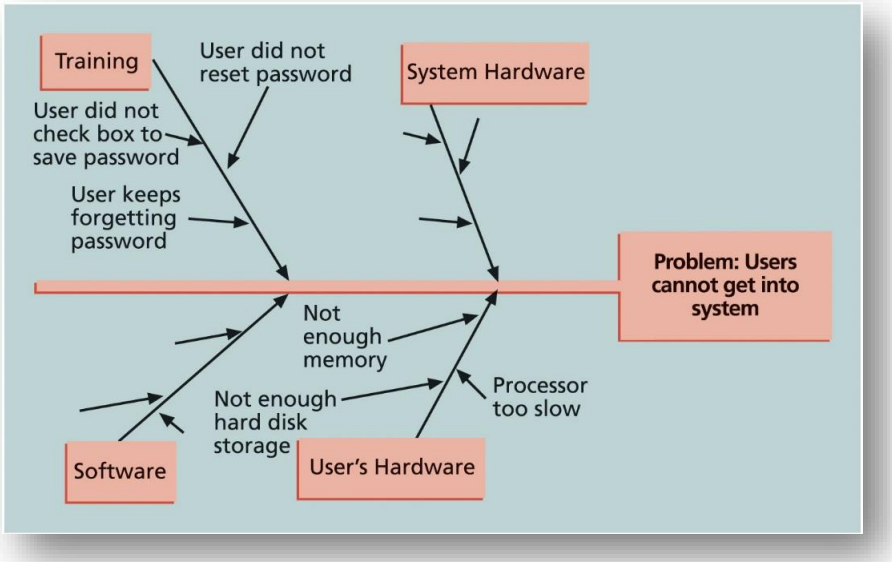
Tools & Techniques

Tools & Techniques

- Basic tools of quality that help in performing quality control
  - Cause-and-effect diagrams
  - Control chart
  - Checksheet
  - Scatter diagram
  - Histogram
  - Pareto chart
  - Flowcharts/run charts

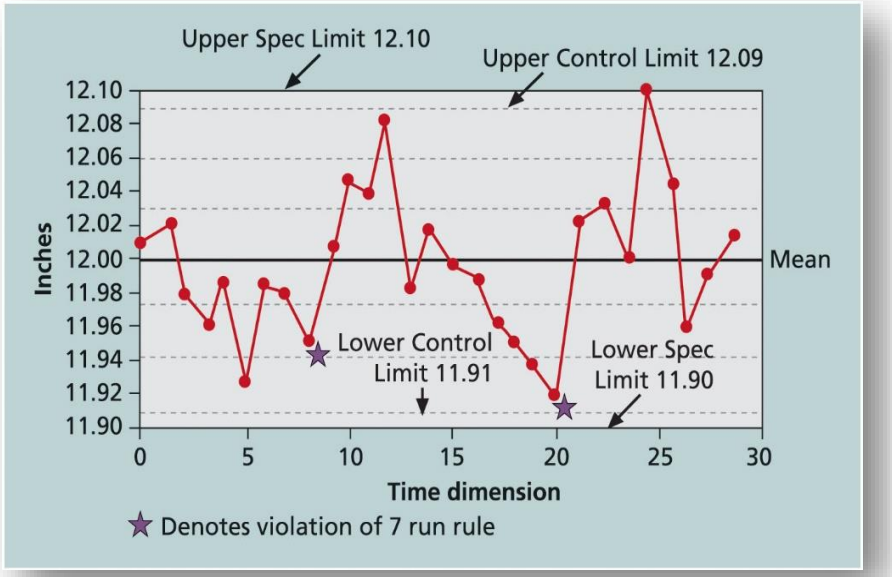
Cause-and-Effect Diagrams

- Trace complaints about quality problems back to the responsible production operations.
- They help find the root cause of a problem.
- Also known as fishbone or Ishikawa diagrams.
- The **5 Whys** technique can help peel away the symptoms to get to the root cause.



Control Chart

- A graphic display of data that illustrates the results of a process over time.
- Help 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. These processes do not need to be adjusted
- When a process is out of control, the nonrandom events that cause the variations need to be identified, and process should be adjusted to correct or eliminate them
- Looking for and analyzing patterns in process data is an important part of quality control.
- The **seven-run rule** helps with finding patterns in data mapped on quality control charts
- The seven run rule states that if seven consequent data points show the same variation (all below the mean or above the mean, or are all increasing or decreasing), then the process needs to be examined for nonrandom problems.



System Complaints

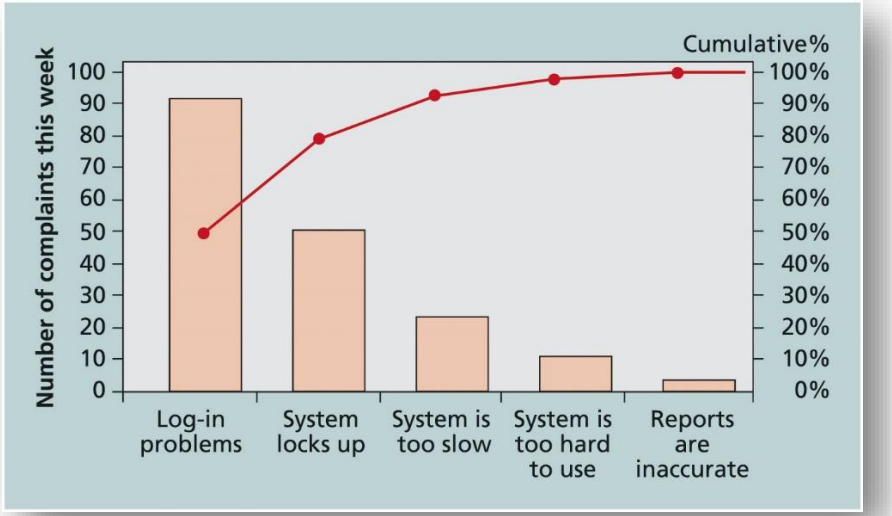
Source	Day							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
E-mail	𝍸	𝍸	𝍸	𝍸	𝍸		𝍸	12
Text	𝍸 𝍸	𝍸	𝍸	𝍸	𝍸	𝍸	𝍸	29
Phone call	𝍸	𝍸	𝍸	𝍸	𝍸	𝍸		8
Total	11	10	8	6	7	3	4	49

Check Sheet & Scatter Diagram

- A **check sheet** is used to collect and analyze data. It is sometimes called a tally sheet or checklist, depending on its format.
- 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.

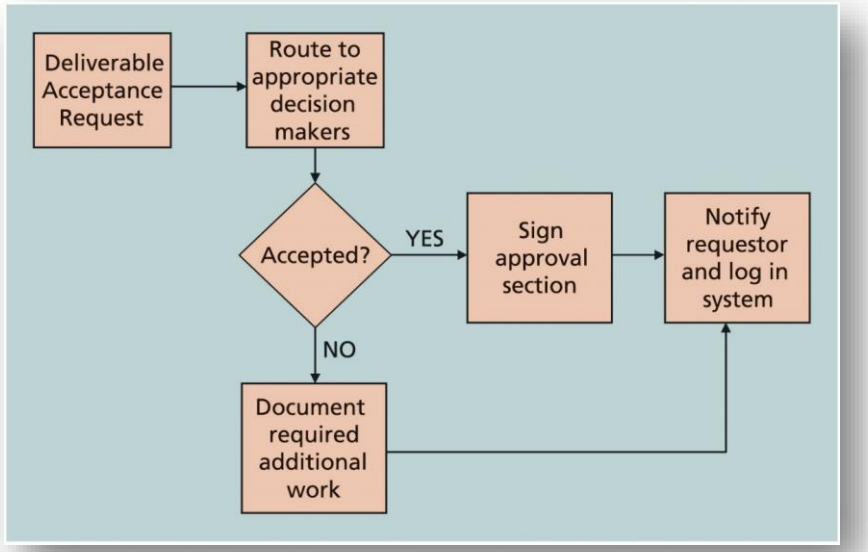
Histogram & Pareto Chart

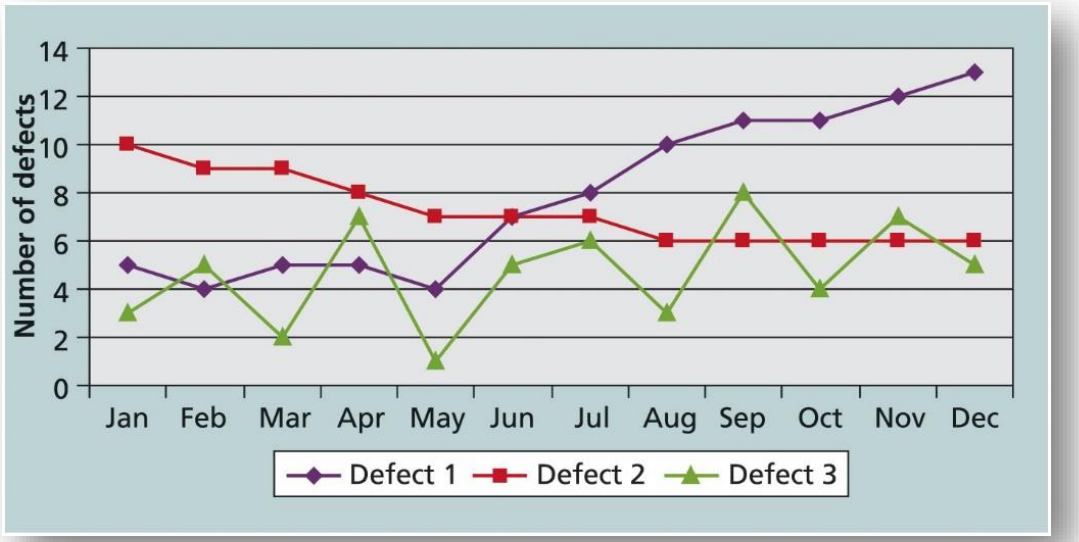
- A **histogram** is a bar graph of a distribution of variables. Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency.
- A **Pareto chart** is a histogram that helps identify and prioritize problem areas.
  - The variables described by the histogram are ordered by frequency of occurrence.
  - Pareto charts help you identify the vital few contributors that account for most quality problems in a system.
  - Pareto analysis is sometimes referred to as the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes.



Flowcharts & Run charts

- **Flowcharts** are graphic displays of the logic and flow of processes that help analyze how problems occur and how processes can be improved. They show activities, decision points, and the order of how information is processed.
- **Stratification** is a technique that shows data from a variety of sources to see if a pattern emerges.
- **Run charts** display the history and pattern of variation of a process over time. It shows data points plotted in the order of occurrence. They can be used to perform trend analysis and forecast future outcomes based on historical results.





Statistical Sampling

- **Statistical sampling** involves choosing part of a population of interest for inspection.

$$\text{Sample size} = 0.25 * (\text{certainty factor/acceptable error})^2$$

- The certainty factor denotes the confidence level that the sampled data includes only variations that naturally exist in the population.
- The acceptable error is related to the desired certainty and is

  1 – percent certainty/100.
- If the desired certainty is 95%, then

  the acceptable error value is 1 – (95/100) = 0.05.

Six Sigma

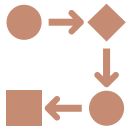
Six Sigma

Six Sigma principles are used worldwide to improve quality, decrease costs, and better meet customer needs.

It is a comprehensive and flexible system for achieving, sustaining and maximizing business success.

Six Sigma's target for quality is no more than 3.4 defects, errors, or mistakes per million opportunities.

DMAIC



DEFINE

Identify the problem/opportunity, process, and customer requirements

MEASURE

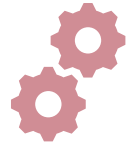
Assign measures/metrics, then collect, compile, and display data

ANALYZE

Scrutinize process details to find improvement opportunities

IMPROVE

Generate solutions and ideas for improving the problem



CONTROL

Track and verify the stability of the improvements and the predictability of the solution

Unique Principles

Help organizations improve their competitiveness and bottom-line results

Requires an organization-wide commitment

Training follows the “belt” system similar to martial arts

Organizations have the ability and willingness to adopt contrary objectives, such as reducing errors and getting things done faster

An operating philosophy that is customer focused and strives to drive out waste, raise levels of quality, and improve financial performance at breakthrough levels

A potential Six Sigma Project

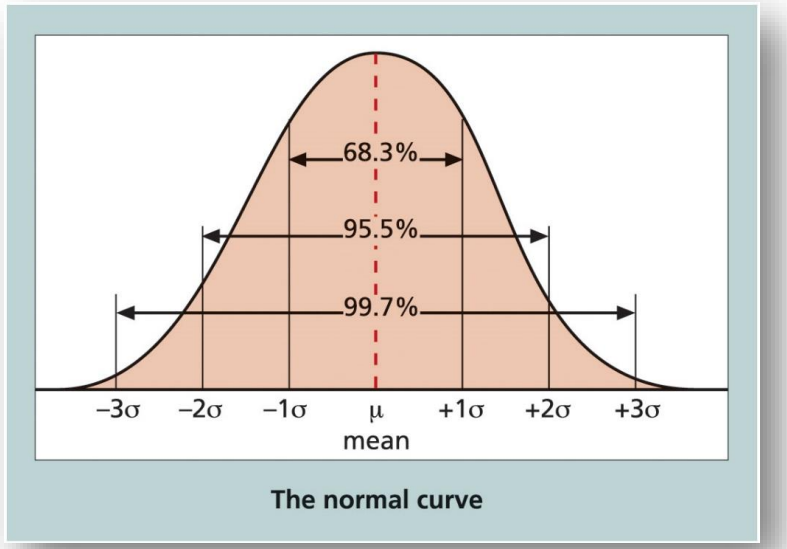
Must be a quality problem or gap between the current and desired performance

Project should not have a clearly understood problem

Solution should not be predetermined, and an optimal solution should not be apparent

Six Sigma Statistics

- Sigma means standard deviation
  - **Standard deviation** measures how much variation exists in a distribution of data; 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
- 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
- **Six nines of quality** is a measure of quality control equal to one fault in one million opportunities
  - 99.9999 percent service availability or *30 seconds of down time a year*



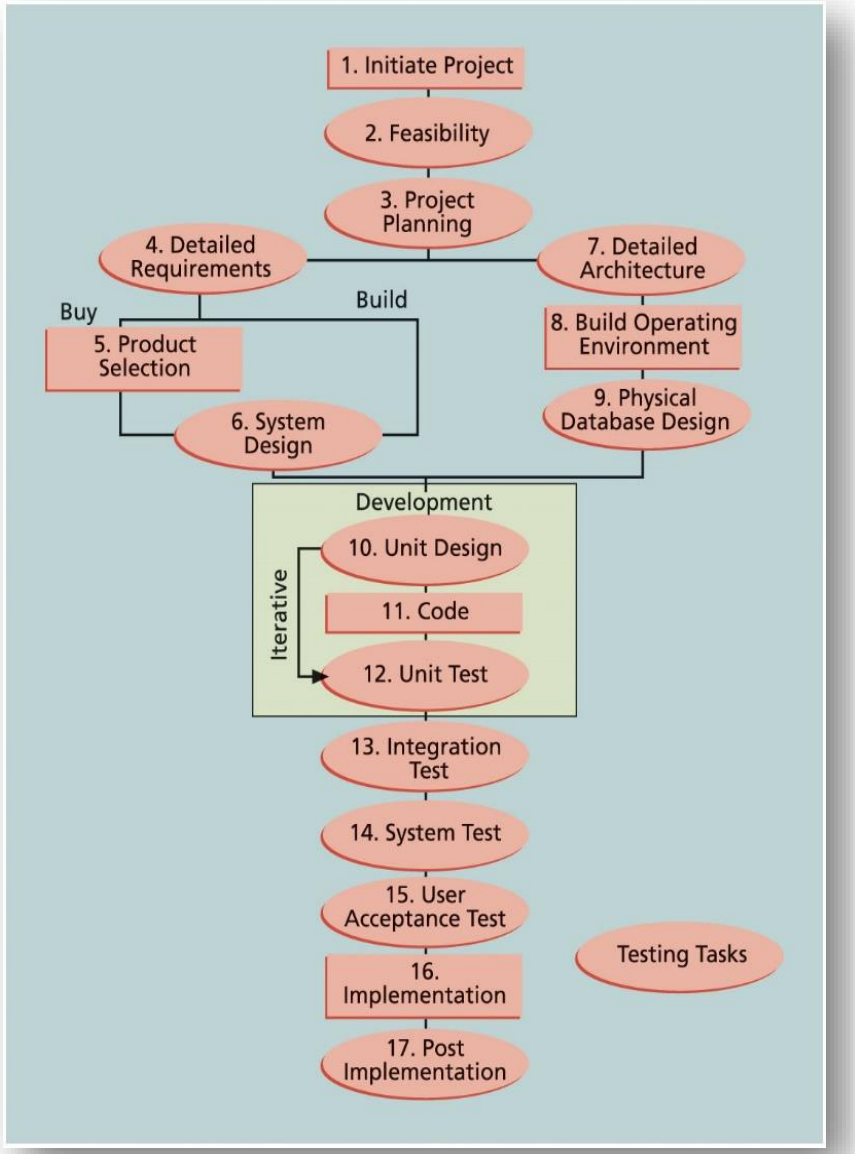
The normal curve

Sigma	Yield	Defects per Million Opportunities (DPMO)
1	31.0%	690,000
2	69.2%	308,000
3	93.3%	66,800
4	99.4%	6,210
5	99.97%	230
6	99.99966%	3.4


Quality Testing

Types of Testing

- Testing needs to be done during almost every phase of the systems development life cycle, not just before the organization ships or hands over a product to the customer
- **Unit testing** tests each individual component (often a program) to ensure it is as defect-free as possible
- **Integration testing** occurs between unit and system testing to test functionally grouped components
- **System testing** tests the entire system as one entity
- **User acceptance testing** is an independent test performed by end users prior to accepting the delivered system



Software Quality Testing

Testing alone is not enough

- Focus should be on software quality; a software defect is anything that must be changed before delivery of the program

Testing does not sufficiently prevent software defects

- The number of ways to test a complex system is huge and users will continue to invent new ways to use a system that its developers never considered

Rethink the software dev process to reduce potential defects prior to entering system testing

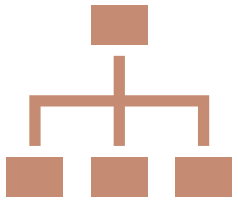
- Developers must be responsible for providing error-free code at each stage of testing

Modern Quality Management

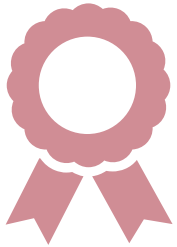
Modern Quality Management

Requires customer satisfaction, prefers prevention to inspection, and recognizes management responsibility for quality
Several noteworthy people helped develop the theories, tools, and techniques that define modern quality management
Deming was famous for his work in rebuilding Japan and his 14 Points for Management
Juran wrote the *Quality Control Handbook* and ten steps to quality improvement
Crosby wrote *Quality is Free* and suggested that organizations strive for zero defects
Ishikawa developed the concepts of quality circles and pioneered the use of cause-and-effect diagrams
Taguchi developed methods for optimizing the process of engineering experimentation
Feigenbaum developed the concept of total quality control
The **Malcolm Baldrige National Quality Award** is awarded by the US President to businesses that have achieved a level of world-class competition through quality management

ISO Standards



ISO 9000 is a three-part, continuous cycle of planning, controlling, and documenting quality in an organization



Provide minimum requirements needed for an organization to meet its quality certification standards

Help ensure that projects create products or services that meet customer needs and expectations

Improving IT Project Quality

Establish leadership that promotes quality

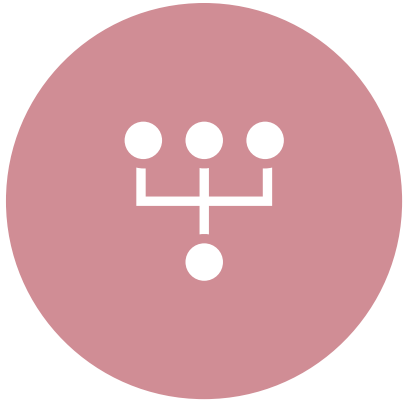
Understand the cost of quality

Provide a good workplace to enhance quality

Work toward improving the organization's overall maturity level in software development and project management

Cost of Quality

COST OF CONFORMANCE PLUS THE COST OF NONCONFORMANCE



CONFORMANCE MEANS DELIVERING PRODUCTS THAT MEET REQUIREMENTS AND FITNESS FOR USE, E.G., DEVELOPING A QUALITY PLAN, MANAGING PRODUCT REQUIREMENTS, QUALITY TESTING

COST OF NONCONFORMANCE MEANS TAKING RESPONSIBILITY FOR FAILURES OR NOT MEETING QUALITY EXPECTATIONS, E.G., REWORK, SCRAP, DESIGN CHANGES

Quality Cost Categories

Prevention cost

Cost of planning and executing a project so it is error-free or within an acceptable error range.

E.g., training, surveys, technical studies

Appraisal cost

Cost of evaluating processes and their outputs to ensure quality.
E.g., inspection, testing

Internal failure cost

Cost incurred to correct an identified defect before the customer receives the product.

E.g., rework and fixes before customer delivery

External failure cost

Cost that relates to all errors not detected and corrected before delivery to the customer.

E.g., warranty costs, escalations, liability suits

Measurement and test equipment costs

Capital cost of equipment used to perform prevention and appraisal activities.

E.g., test equipment and software

Maturity Models

Frameworks for helping organizations improve their processes and systems

Software Quality Function Deployment (SQFD) Model focuses on defining user requirements and planning software projects

Capability Maturity Model Integration (CMMI) is a process improvement approach that provides organizations with the essential elements of effective processes. This is rated by levels 0 to 5.

US Government prefers that all companies that want to work in the government market should have a CMMI Level 3.

Organizational Project Management Maturity Model (OPM3) by PMI addresses standards for excellence in project, program, and portfolio management best practices and explains the capabilities necessary to achieve those best practices

In-Class Group Exercise

Test Cases for Team Project

- Pick an instances of your product, similar to:
  - Home Page
  - Payment Page
  - User Account Dashboard
  - Download feature
- Write down 3 test cases for that page
- Consider what type of testing the test case relates to from the quality model (see the table →)
- Use the template provided and then upload to the discussion board for today's Module

Example Test Cases

S.No.	Test Cases	Pre Conditions	Expected Result	Actual Result	Post Condition	Pass/Fail	Test Owner
1	Verify that the game download page is displayed correctly.	The gaming platform is launched and the user is logged in to the platform.	The game download page is displayed correctly with all the necessary details such as game title, description, screenshots, system requirements, download size, and download button.	The actual result would be the display of the game download page. If the game download page is displayed correctly with all the necessary details, the actual result would match the expected result.	The user is able to download the game successfully and the game is added to the user's library.	Pass	John Doe
2	Verify that the game download is completed successfully.	The gaming platform is launched, the user is logged in to the platform, and the game download has been initiated.	The game is downloaded successfully without any errors or interruptions.	The actual result would be the completion of the game download. If the game is downloaded successfully without any errors or interruptions, the actual result would match the expected result.	The game is installed on the user's device and the user is able to launch and play the game without any issues.	Pass	John Doe
3	Verify that the game runs smoothly without lag or glitches.	The gaming platform is launched, the user is logged in to the platform, and the game is launched and ready to play.	The game runs smoothly without any lag, glitches, or frame drops. The user should be able to play the game without any issues or interruptions.	The actual result would be whether the game runs smoothly without any lag, glitches, or frame drops. If the game runs smoothly without any issues or interruptions, the actual result would match the expected result.	The user is able to complete the game level or task without any issues or interruptions, and the game progress is saved properly.	Pass	John Doe

QUALITY ASSURANCE PLANNING DOCUMENTS

Hierarchy	Goals	Review policy	Key elements	Users
Test policy				
Company	Represent a company's overall attitude and approach to testing	Very rarely reviewed	✓ Meaning of testing for the company ✓ Test objectives ✓ Testing standards and criteria ✓ Definition of testing terms ✓ Testing tools ✓ Success measurements ✓ Ways of improvement	Stakeholders, QA specialists, developers
Quality management plan				
Project	Define project deliverables, quality standards, and roles	Rarely reviewed	✓ Quality objectives ✓ Key deliverables ✓ Roles and responsibilities ✓ Quality standards ✓ Tools	Stakeholders, QA specialists, developers
Test strategy				
Product	Define software testing approaches and align QA with business objectives	Rarely reviewed	✓ Scope of testing ✓ Budget constraints ✓ Time constraints ✓ Industry standards ✓ Testing objectives	Stakeholders, QA specialists, developers
Test plan				
Release/sprint	Cover test scope and activities for product version, feature set, etc.	Regularly reviewed	✓ Test items ✓ Test approach ✓ Pass and fail criteria ✓ Features to be tested ✓ Deliverables ✓ Schedule ✓ Risks ✓ Responsibilities	QA specialists, developers
Test case				
Feature	Define testing conditions to verify the expected functionality of a feature	Constantly reviewed	✓ Test case ID ✓ Description ✓ Test steps ✓ Test data ✓ Expected result ✓ Actual result ✓ Status ✓ Date of creation ✓ Date of execution	QA specialists, developers