8 : Project Quality Management

IT4306– IT Project Management

Level II - Semester 4

Intended Learning Outcomes

- At the end of this lesson, you will be able to;
  - Appreciate the importance of project quality management for information technology products and services
  - Define project quality management and describe its main three processes
  - Describe given tools and techniques for quality control (Pareto Analysis, Statistical sampling, testing)
  - Summarize major contributions to the modern quality management
  - Describe major cost categories related to information technology project quality

8.1. Importance of Project Quality Management

- Many people joke about the poor quality of IT products.
- People seem to accept systems being down occasionally or needing to reboot their PCs.
- But quality is very important in many IT projects.

What Went Wrong?

- In 1981, a small timing difference caused by a computer program caused a launch abort.*
- In 1986, two hospital patients died after receiving fatal doses of radiation from a Therac 25 machine after a software problem caused the machine to ignore calibration data.**
- Britain's Coast Guard was unable to use its computers for several hours in May 2004 after being hit by the Sasser virus, which knocked out the electronic mapping systems, e-mail, and other computer functions, forcing workers to revert to pen, paper, and radios.***

*_Design News_ (February 1988).
**_Datamation_ (May 1987).
***Fleming, Nic, "Virus sends coastguard computers off course" (_http://news.telegraph.co.uk/news/main.jhtml?xml=/news/2004/05/05/ncoast05.xml)_ (May 15, 2004).

What Is Quality?

- The International Organization for Standardization (ISO) defines **quality** as "the degree to which a set of inherent characteristics fulfils requirements" (ISO9000:2000).

- Other experts define quality 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.

8.2. What is Project Quality Management

- Project quality management ensures that the project will satisfy the needs for which it was undertaken.
- Processes include:
  - **Quality planning**: Identifying which quality standards are relevant to the project and how to satisfy them.
  - **Quality assurance**: Periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards.
  - **Quality control**: Monitoring specific project results to ensure that they comply with the relevant quality standards.

8.3. Planning Quality Management

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

- Important to prevent defects by:
  - Selecting proper materials.
  - Training and indoctrinating people in quality.
  - Planning a process that ensures the appropriate outcome.

Design of Experiments

- **Design of experiments** is a quality planning technique that helps identify which variables have the most influence on the overall outcome of a process.

- Also applies to project management issues, such as cost and schedule trade-offs.

- Involves documenting important factors that directly contribute to meeting customer requirements.

Scope Aspects of IT Projects

- **Functionality** is the degree to which a system performs its intended function.
- **Features** are the system's special characteristics that appeal to users.
- **System outputs** are the screens and reports the system generates.
- **Performance** addresses how well a product or service performs the customer's intended use.
- **Reliability** is the ability of a product or service to perform as expected under normal conditions.
- **Maintainability** addresses the ease of performing maintenance on a product.

Who's Responsible for the Quality of Projects?

- Project managers are ultimately responsible for quality management on their projects.

- Several organizations and references can help project managers and their teams understand quality.

  - International Organization for Standardization (www.iso.org)
  - IEEE (www.ieee.org)

8.4. Quality Assurance

- Quality assurance includes all the activities related to satisfying the relevant quality standards for a project.
- Another goal of quality assurance is continuous quality improvement.
- **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.

Table of Contents for a Quality Assurance Plan*

1. Draft Quality Assurance Plan
2. Introduction
3. Purpose
4. Policy Statement
5. Scope
6. Management
7. Organizational Structure
8. Roles and Responsibilities
   1. Technical Monitor/Senior Management
   2. Task Leader
   3. Quality Assurance Team
   4. Technical Staff

3.0 Required Documentation

1. Quality Assurance Procedures
2. Walkthrough Procedure
3. Review Process
   1. Review Procedures
3. Audit Process
   1. Audit Procedures
4. Evaluation Process
5. Process Improvement
   1. Problem Reporting Procedures
   2. Noncompliance Reporting Procedures

6.0 Quality Assurance Metrics Appendix

Quality Assurance Checklist Forms

*U.S. Department of Energy

8.5. Controlling Quality

- The main outputs of quality control are:
  - Acceptance decisions
  - Rework
  - Process adjustments

8.6. Tools and Techniques for Quality Control

- Some tools and techniques include:
  - Pareto analysis
  - Statistical sampling
  - Six Sigma
  - Quality control charts

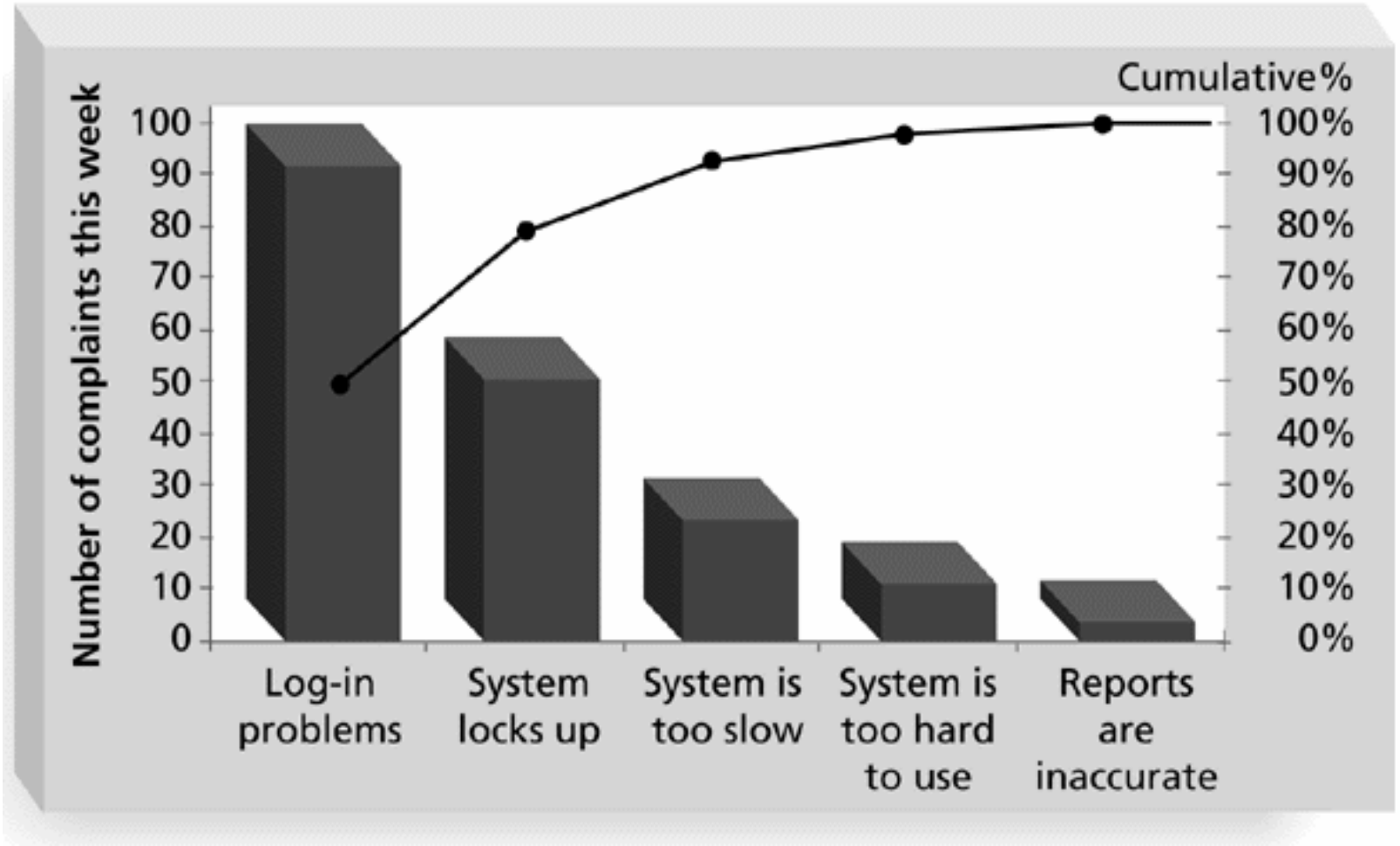
Pareto Analysis

- **Pareto analysis** involves identifying the vital few contributors that account for the most quality problems in a system.

- Also called the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes.

- **Pareto diagrams** are histograms, or column charts representing a frequency distribution, that help identify and prioritize problem areas.

Sample Pareto Diagram



Statistical Sampling and Standard Deviation

- **Statistical sampling** involves choosing part of a population of interest for inspection.
- The size of a sample depends on how representative you want the sample to be.
- Sample size formula:

$$\text{Sample size} = .25 \text{ X } (\text{certainty factor}/\text{acceptable error})^2$$

- Be sure to consult with an expert when using statistical analysis.

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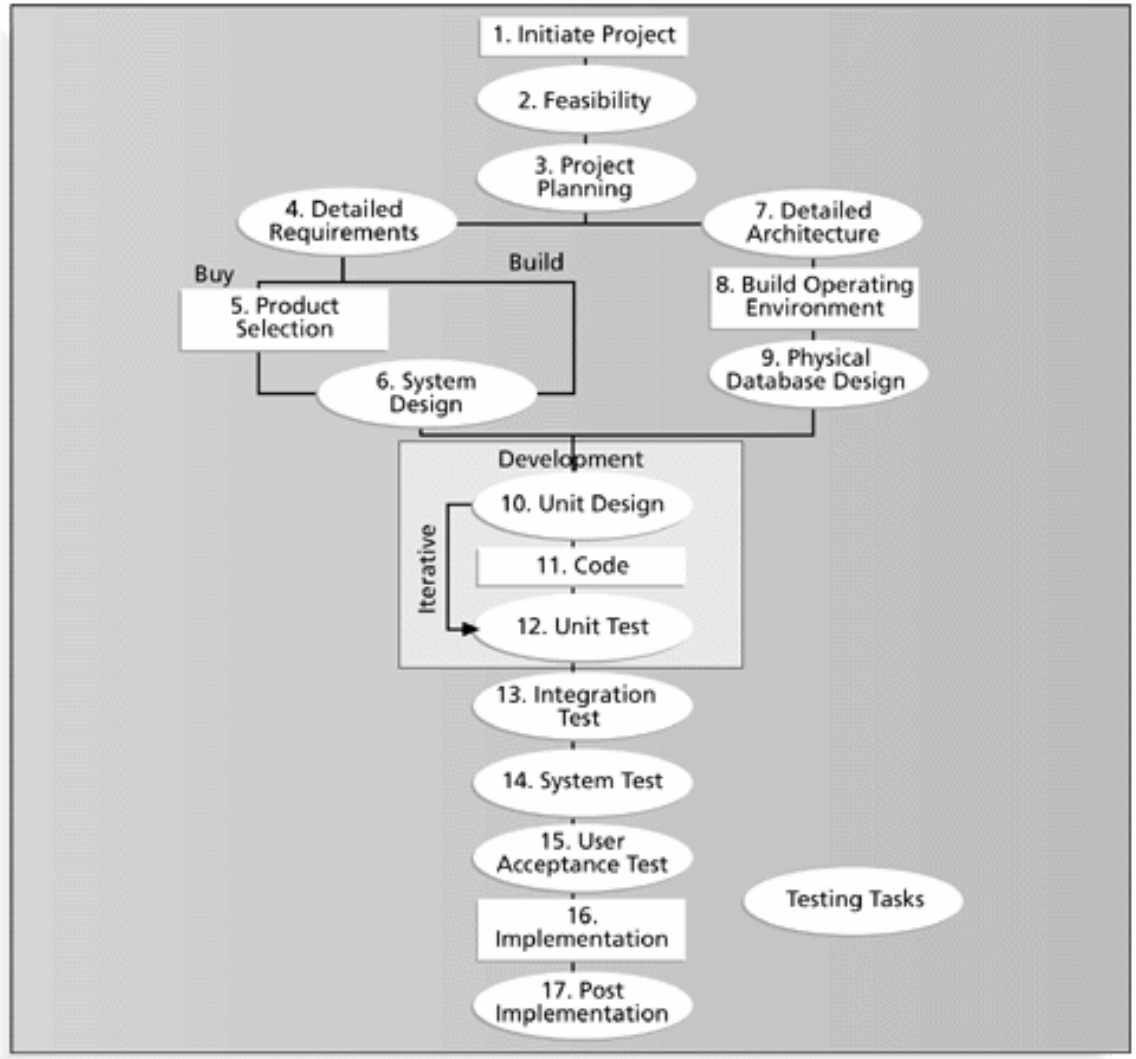
Testing

- Many IT professionals think of testing as a stage that comes near the end of IT product development.

- Testing should be done during almost every phase of the IT product development life cycle.

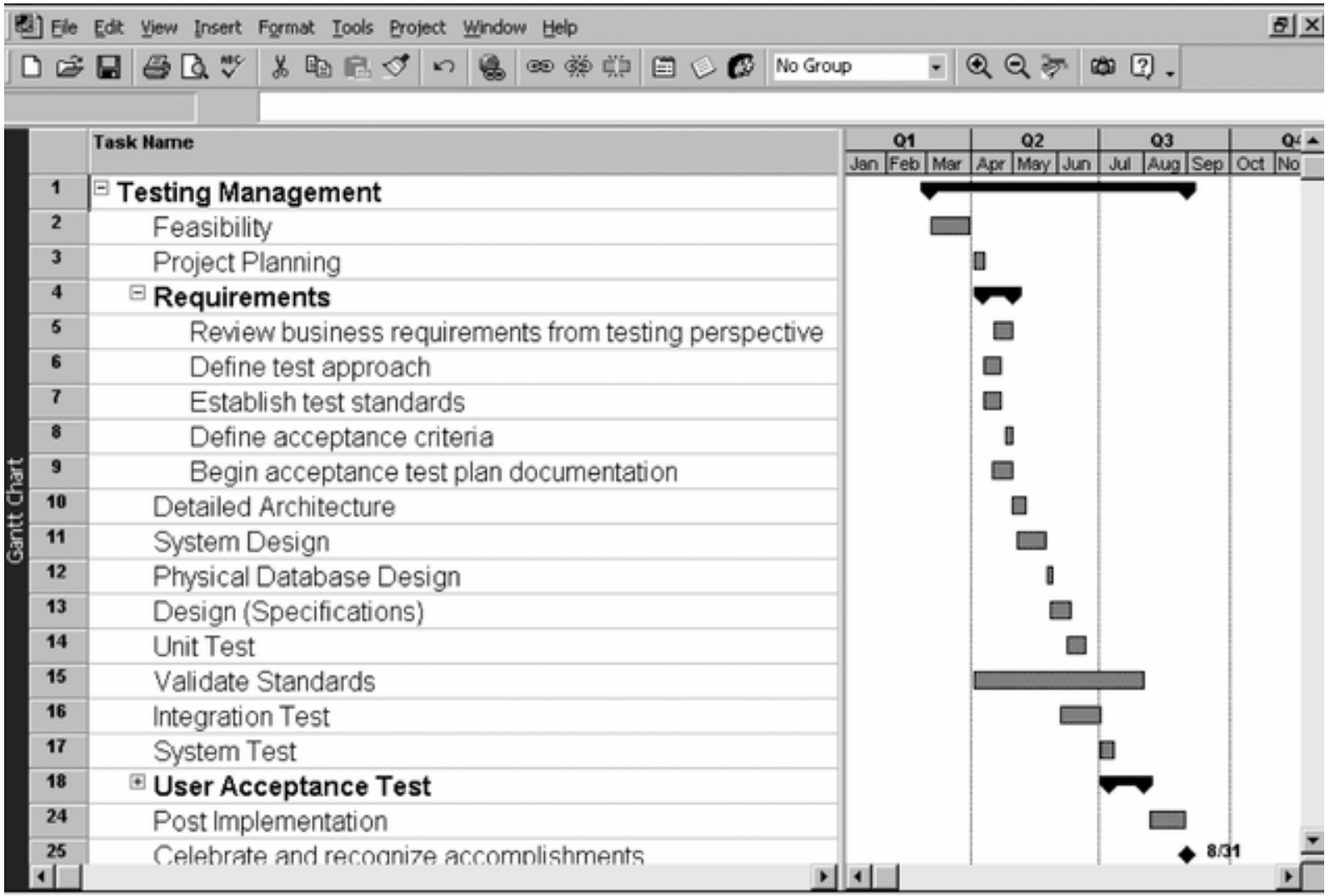
Testing Tasks in the Software Development Life Cycle



Types of Tests

- **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.

Gantt Chart for Building Testing into a Systems Development Project Plan



Testing Alone Is Not Enough

- Watts S. Humphrey, a renowned expert on software quality, defines a **software defect** as anything that must be changed before delivery of the program.
- Testing does not sufficiently prevent software defects because:
  - The number of ways to test a complex system is huge.
  - Users will continue to invent new ways to use a system that its developers never considered.
- Humphrey suggests that people rethink the software development process to provide no potential defects when you enter system testing; developers must be responsible for providing error-free code at each stage of testing.

8.7. Modern Quality Management

- Modern quality management:
  - Requires customer satisfaction.
  - Prefers prevention to inspection.
  - Recognizes management responsibility for quality.
- Noteworthy quality experts include Deming, Juran, Crosby, Ishikawa, Taguchi, and Feigenbaum.

Quality Experts

- 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 fishbone diagrams.
- Taguchi developed methods for optimizing the process of engineering experimentation.
- Feigenbaum developed the concept of total quality control.

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.

- **ISO 15504**, sometimes known as SPICE (Software Process Improvement and Capability dEtermination), is a framework for the assessment of software processes.

8.8. Improving IT Project Quality

- Several 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.
  - **Cost of nonconformance** means taking responsibility for failures or not meeting quality expectations.
- A 2002 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.*

*RTI International, "Software Bugs Cost U.S. Economy $59.6 Billion Annually, RTI Study Finds," July 1, 2002.

Costs Per Hour of Downtime Caused by Software Defects

Business	Cost per Hour Downtime
Automated teller machines (medium-sized bank)	$14,500
Package shipping service	$28,250
Telephone ticket sales	$69,000
Catalog sales center	$90,000
Airline reservation center (small airline)	$89,500

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.
- **Appraisal cost**: Cost of evaluating processes and their outputs to ensure quality.
- **Internal failure cost**: Cost incurred to correct an identified defect before the customer receives the product.
- **External failure cost**: Cost that relates to all errors not detected and corrected before delivery to the customer.
- **Measurement and test equipment costs**: Capital cost of equipment used to perform prevention and appraisal activities.

*RTI International, "Software Bugs Cost U.S. Economy $59.6 Billion Annually, RTI Study Finds," July 1, 2002.

Media Snapshot*

- A 2004 study by Nucleus Research Inc. estimates that spam will cost large companies nearly $2,000 per employee in lost productivity in 2004 alone, despite investments in software to block spam. Spam currently accounts for more than 70 percent of total e-mail volume worldwide.
- In just one month (August 2003), at least 50 new Internet viruses surfaced, and losses related to computer viruses cost North American companies about $3.5 billion. Businesses have suffered at least $65 billion in lost productivity because of computer viruses since 1997.

*McGuire, David, "Report: Spam Costs Are Rising at Work," *Washington Post* (June 7, 2004).

Summary

- Project quality management ensures that the project will satisfy the needs for which it was undertaken.
- Main processes include:
  - Quality planning
  - Quality assurance
  - Quality control