University of Malaya

Course Title :

Software Development Management

(WXGC6106)

Week 10

Project Quality Management

(Information Technology Project Management)

Chapter 8

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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

What Is Project 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

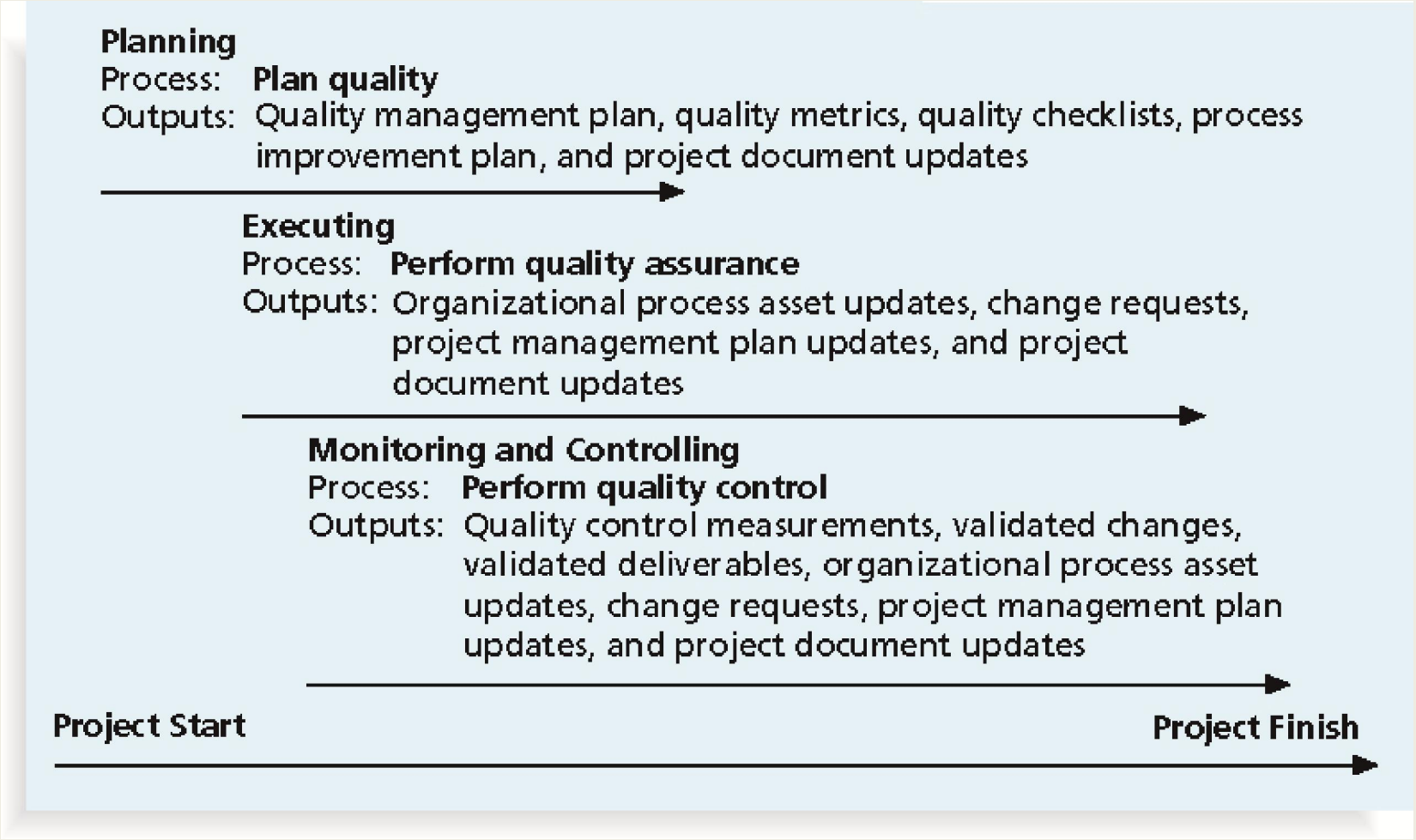
What Is Project Quality Management?

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 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

Project Quality Management Summary



Planning Quality

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

Important Scope Aspects of IT Projects that affect quality

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

Performing 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

Quality Control

The main outputs of quality control are:

- Acceptance decisions
- Rework
- Process adjustments

There are Seven Basic Tools of Quality that help in performing quality control

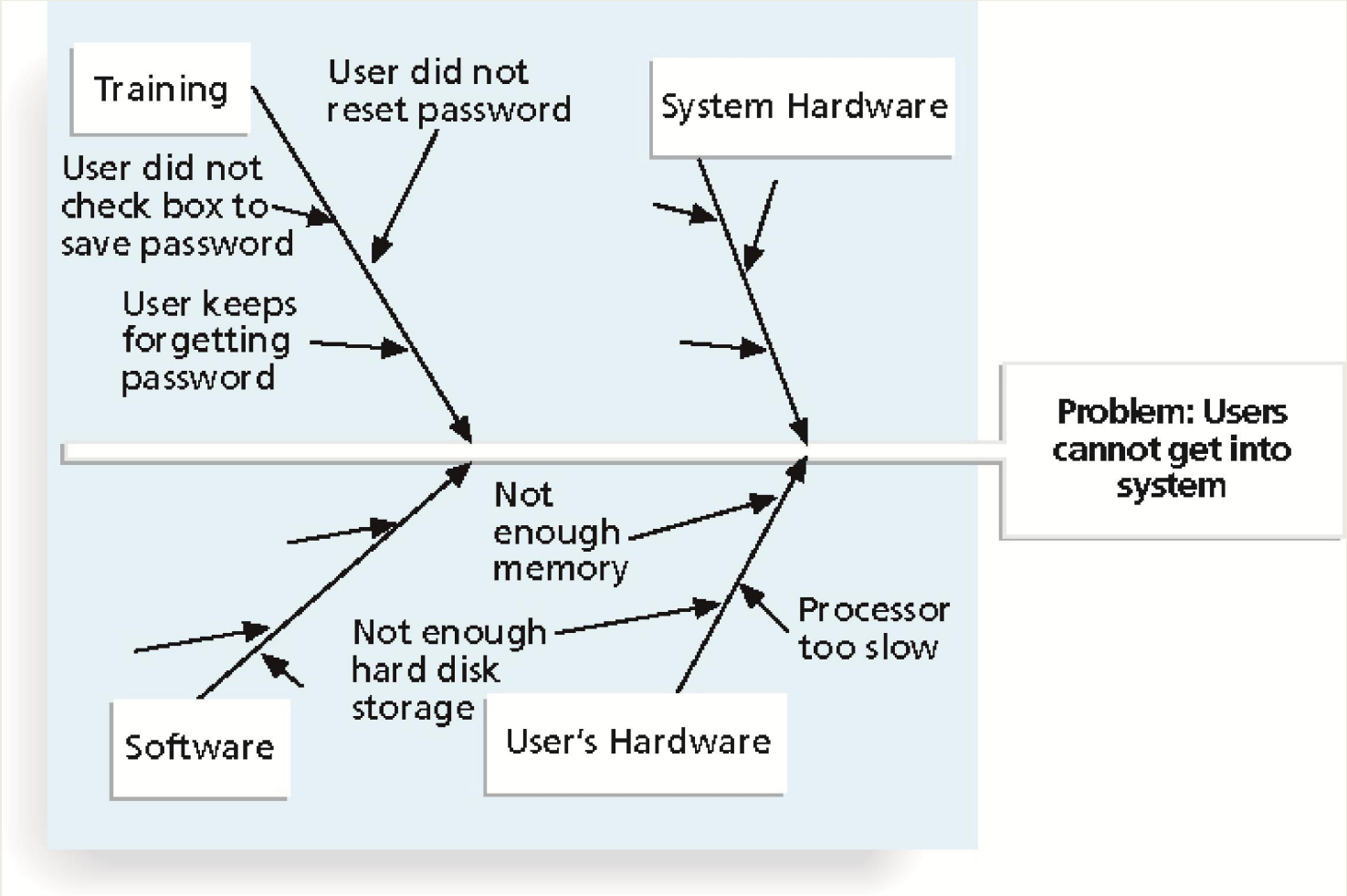
1) Cause-and-Effect Diagrams

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 repeated ask the question "Why" to peel away the layers of symptoms that can lead to the root cause

1) Cause-and-Effect Diagrams (Continued)



2) Quality Control Charts

A **control chart** is a graphic display of data that illustrates the results of a process over time

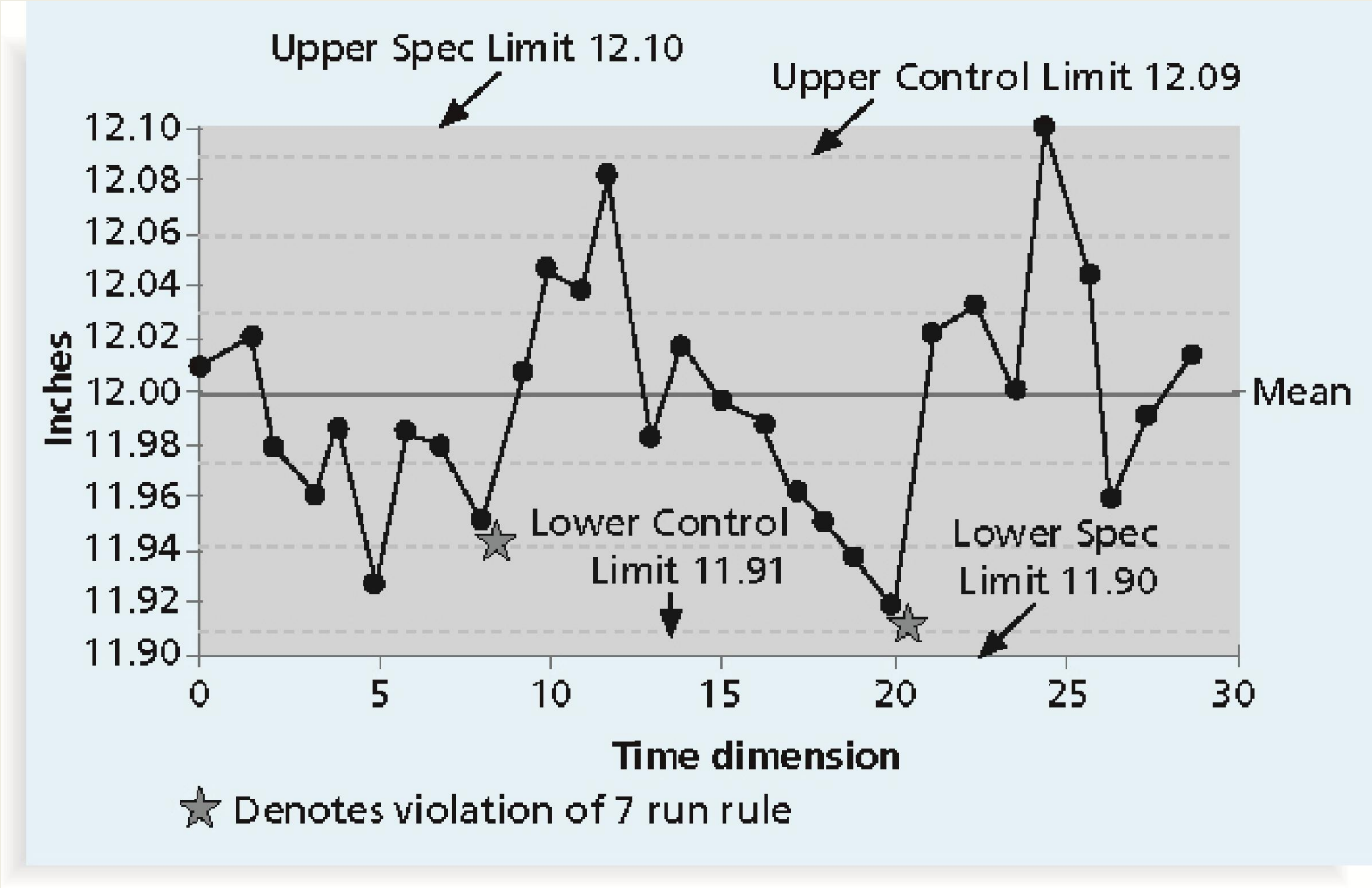
The main use of control charts is to **prevent** defects, rather than to detect or reject them

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

2) Quality Control Charts (Continued)



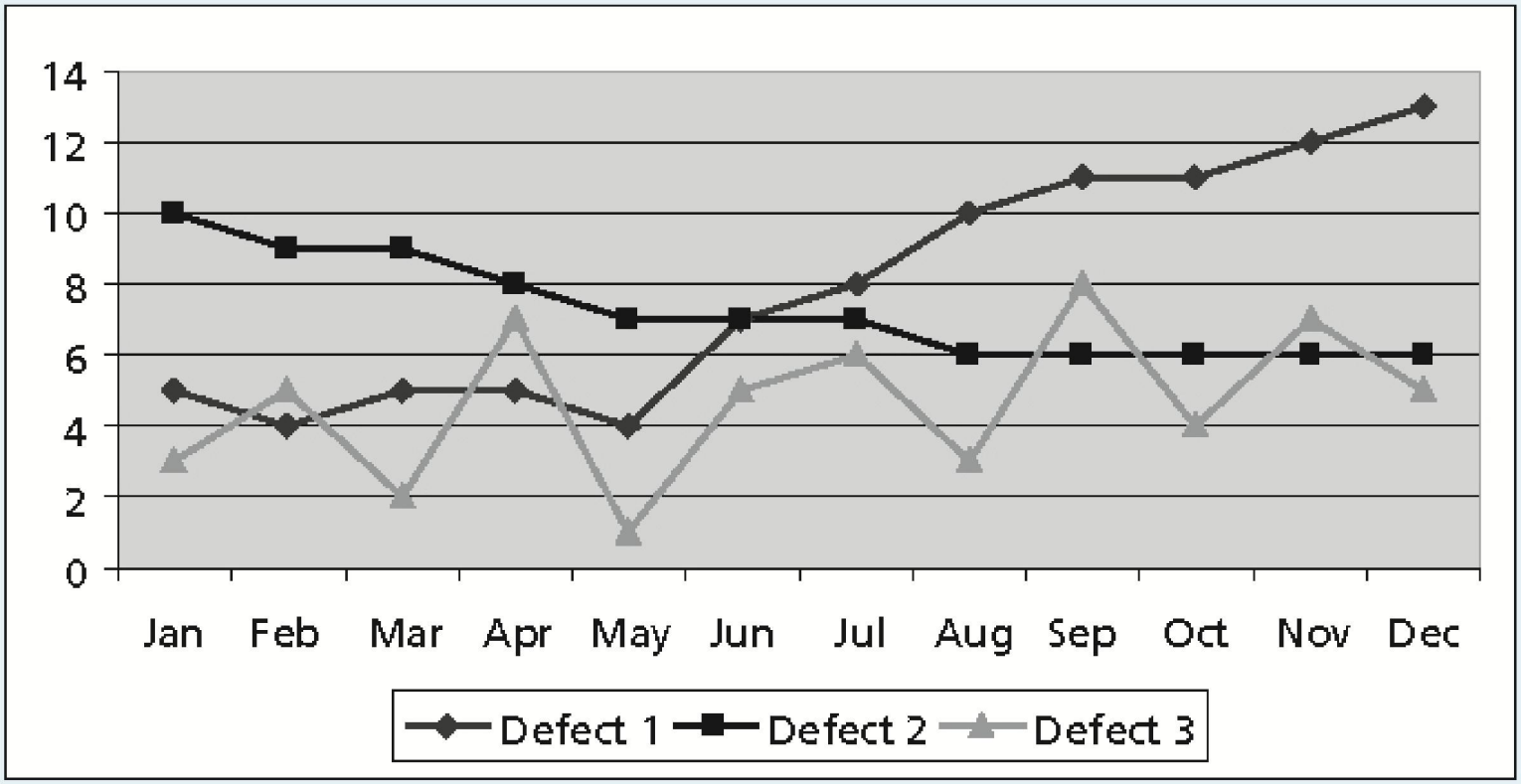
3) Run Chart

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

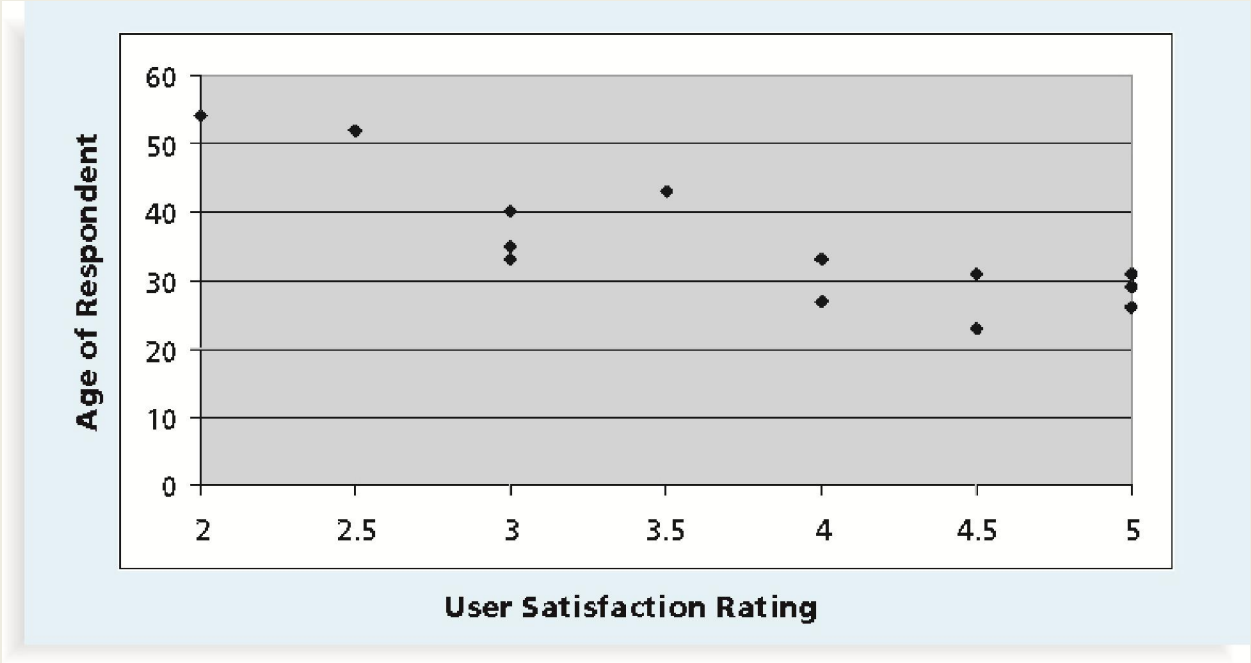
3) Run Chart (Continued)



4) Scatter Diagram

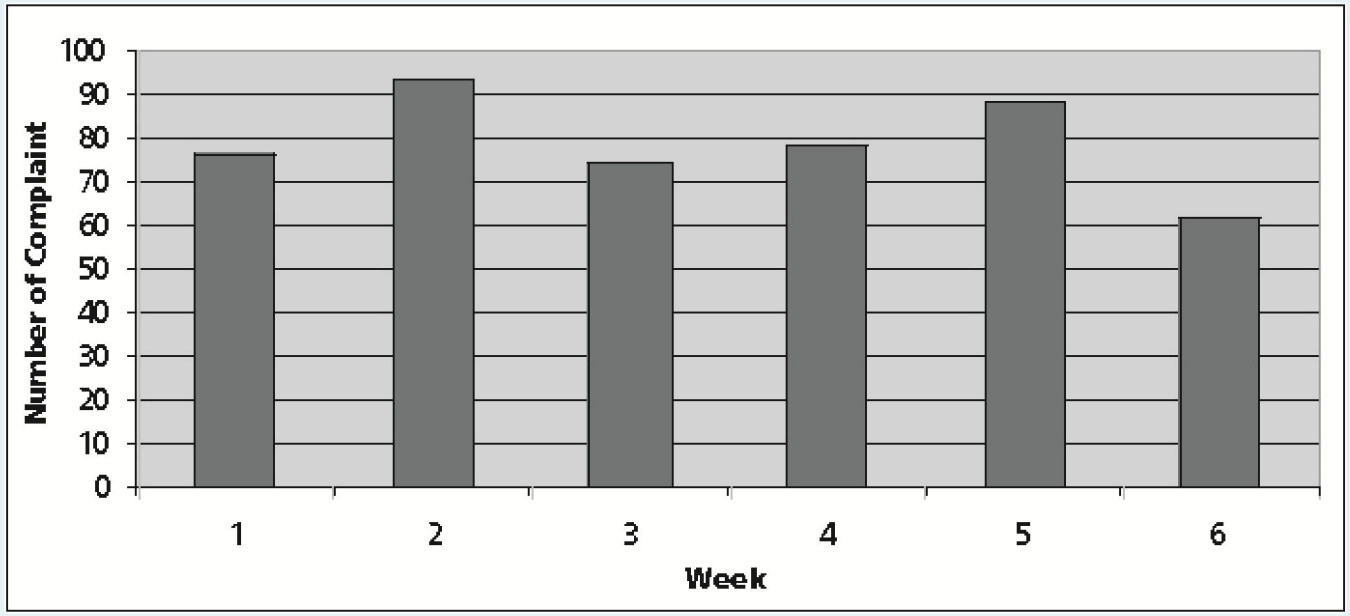
A **scatter diagram** helps to show if there is a relationship between two variables

The closer data points are to a diagonal line, the more closely the two variables are related



5) Histograms

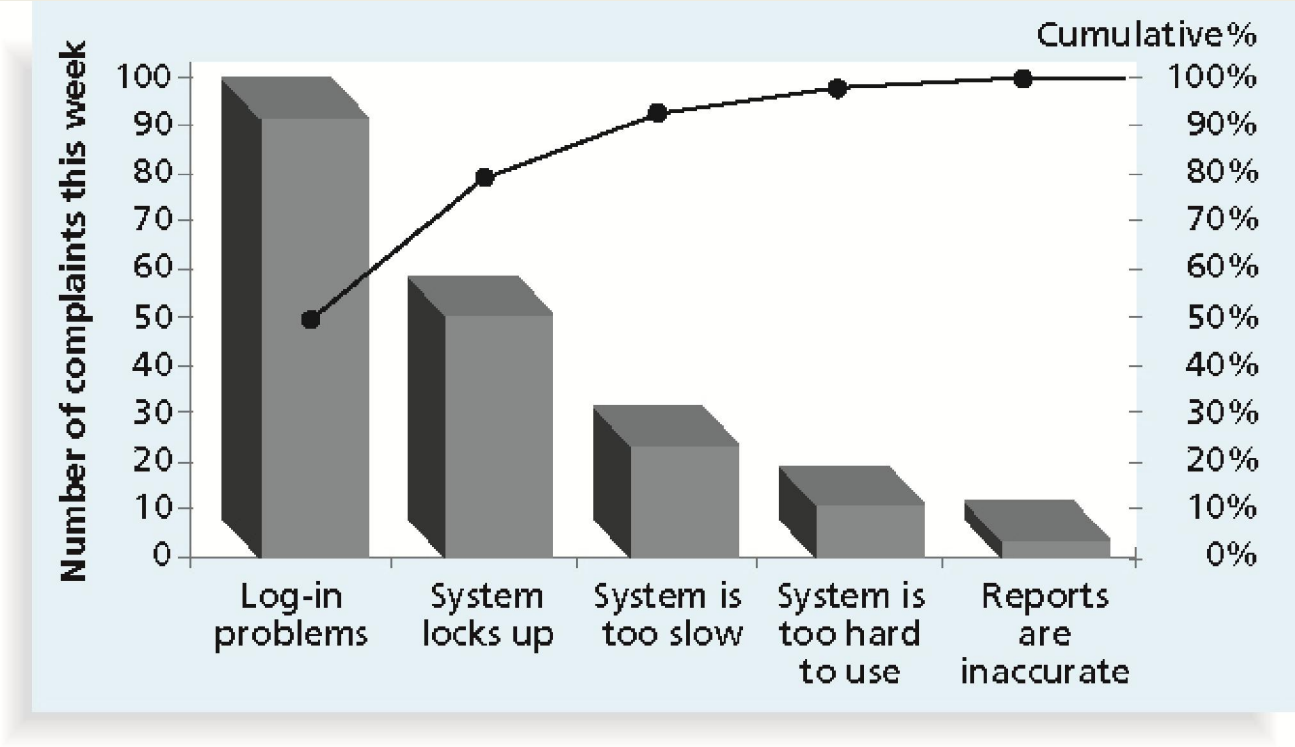
- A **histogram** is a bar graph of a distribution of variables
- Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency



6) Pareto Charts

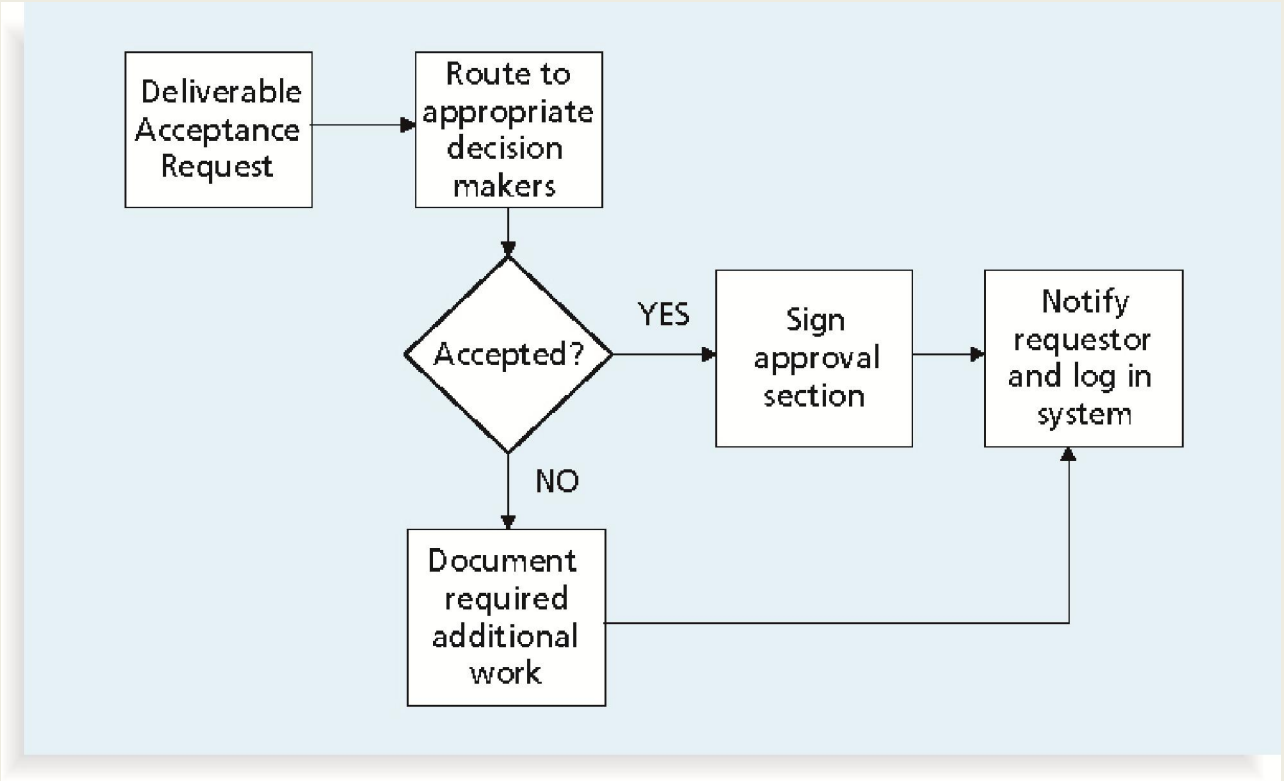
A **Pareto chart** is a histogram that can help you identify and prioritize problem areas

Pareto analysis is also called the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes



7) Flowcharts

Flowcharts are graphic displays of the logic and flow of processes that help you analyze how problems occur and how processes can be improved
They show activities, decision points, and the order of how information is processed



Statistical Sampling

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:

Sample size = .25 X (certainty factor/acceptable error)^2

Be sure to consult with an expert when using statistical analysis

Commonly Used Certainty Factors

Desired Certainty	Certainty Factor
95%	1.960
90%	1.645
80%	1.281

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.

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

Six Sigma (DMAIC)

DMAIC is a systematic, closed-loop process for continued improvement that is scientific and fact based

DMAIC stands for:

Define: define the problem/opportunity, process, and customer requirements
Measure: define measures, 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

How Is Six Sigma Quality Control Unique?

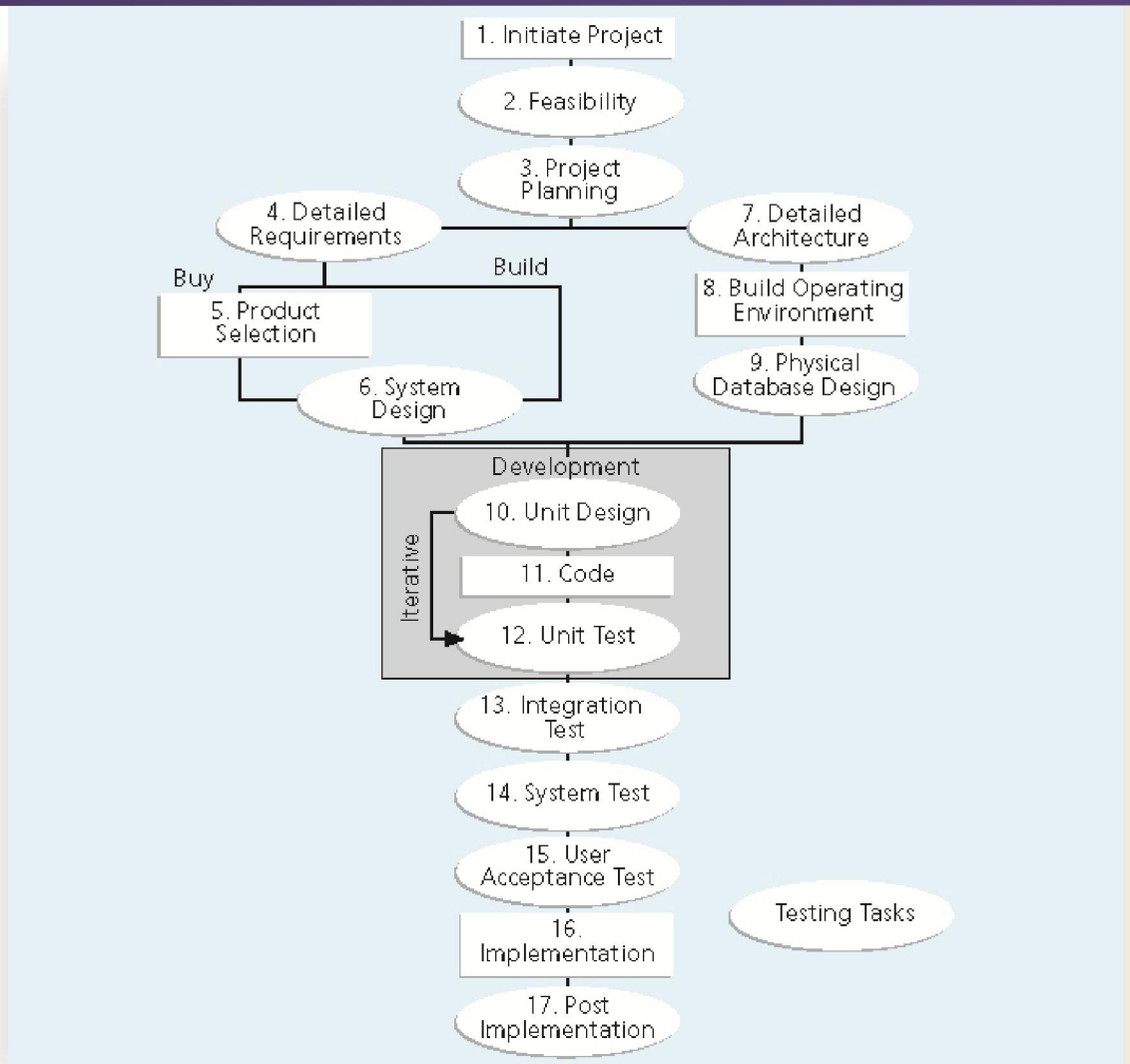
- It requires an organization-wide commitment
- Training follows the "Belt" system
- Six Sigma organizations have the ability and willingness to adopt contrary objectives, such as reducing errors and getting things done faster
- It is an operating philosophy that is customer focused and strives to drive out waste, raise levels of quality, and improve financial performance at *breakthrough* levels

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

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

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

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

Leadership

As Joseph M. Juran said in 1945, **"It is most important that top management be quality-minded. In the absence of sincere manifestation of interest at the top, little will happen below."***

A large percentage of quality problems are associated with management, not technical issues

*American Society for Quality (ASQ), *(www.asqc.org/about/history/juran.html*).

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 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

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

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

CMMI Levels

CMMI levels, from lowest to highest, are:

0. Incomplete
1. Performed
2. Managed
3. Defined
4. Quantitatively Managed
5. Optimizing

Companies may not get to bid on government projects unless they have a CMMI Level 3

Any questions?

You can download the slides in following link (My Billboard section):

http://www.malaysianexpert.com.my/UL/Profile.aspx?MID=1

HW6: Research on Six Sigma and its relationship to Project Quality Management

The purpose of this assignment is to help familiarize you with the concept of **Six Sigma**.

Read at least 3 articles and view related web sites. *Make sure the articles have an author and date and were **written in 2010 or 2011***.

Write a brief report summarizing the following:

- What you learned about Six Sigma
- How Six Sigma can affect project quality management
- How can you use Six Sigma in your group project
- What are the best practices in Six Sigma