



MONASH University

Information Technology

FIT2002

IT Project Management

Lecture 8

Project Quality and Procurement  
Management

# Video 1: Project Quality Management

## Learning Objectives

- Define project quality management and understand how quality relates to various aspects of IT projects
- Describe quality management planning and how quality and scope management are related

# What Is Project Quality?

- The International Organisation 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 management:** 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

Process: **Plan quality management**

Outputs: Quality management plan, process improvement plan, quality metrics, quality checklists, and project documents updates

## Executing

Process: **Perform quality assurance**

Outputs: Change requests, project management plan updates, project documents updates, and organizational process asset updates

## Monitoring and Controlling

Process: **Perform quality control**

Outputs: Quality control measurements, validated changes, validated deliverables, work performance information, change requests, project management plan updates, project documents updates, and organizational process asset updates

Project Start

Project Finish

# 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** – a technique that helps identify which variables have the most influence on the overall outcome of a process

# 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

# Video 2: Project Quality Management

## Learning Objectives

- Discuss the importance of quality assurance
- Summarise the contributions of noteworthy quality experts to modern quality management



# 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. **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 organisation
- 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

# 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 organisations 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 organisation
  - Provides minimum requirements needed for an organisation to meet its quality certification standards
  - Helps organisations around the world reduce costs and improve customer satisfaction
- ISO offer standards to provide a framework for the assessment of software processes
- See [www.iso.org](http://www.iso.org) for more information

# Improving Information Technology Project Quality

- Several suggestions for improving quality for IT projects include:
  - Establish **leadership** that promotes quality
  - Understand the **cost of quality**
  - Focus on **organisational 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](http://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



# Organisational Influences, Workplace Factors, and Quality

- Study by DeMarco and Lister showed that organizational issues had a much greater influence on programmer productivity than the technical environment or programming languages
- Study found no correlation between productivity and programming language, years of experience, or salary.
- A dedicated workspace and a quiet work environment were key factors to improving programmer productivity

# Maturity Models

- **Maturity models** are frameworks for helping organisations 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 organisations with the essential elements of effective processes
  - CMMI levels, from lowest to highest, are:  
Incomplete → Performed → Managed → Defined → Quantitatively Managed → Optimizing

# PMI's Maturity Model

- PMI released the Organisational Project Management Maturity Model (OPM3) in December 2003
- Help organizations assess and improve their project management capabilities
- Addresses standards for excellence in project, program, and portfolio management best practices and explains the capabilities necessary to achieve those best practices

# Video 3: Project Quality Management

## Learning Objectives

- Understand the tools and techniques for quality control, such as the Seven Basic Tools of Quality, statistical sampling, Six Sigma, and testing

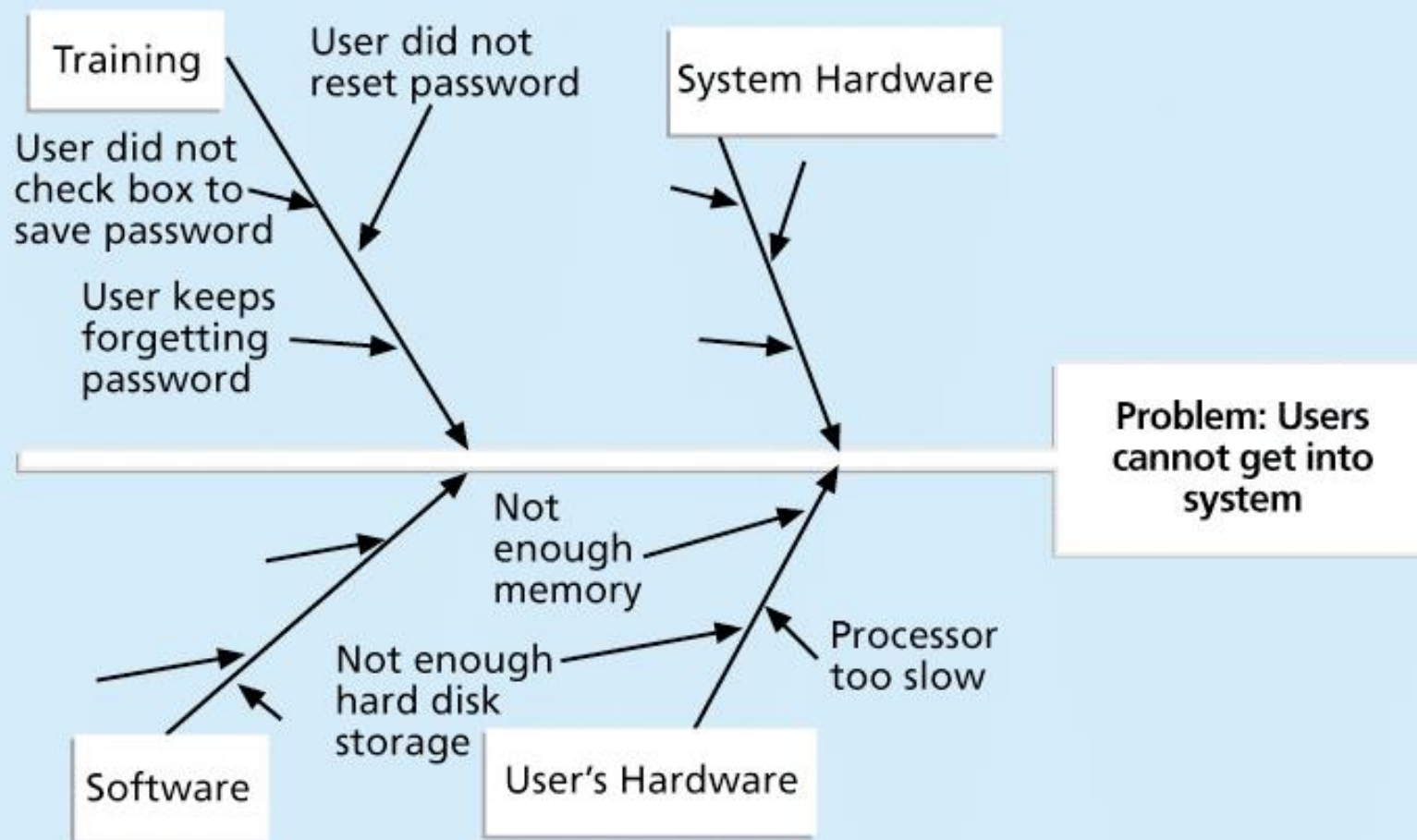
# Controlling Quality

- 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

# 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

# Sample Cause-and-Effect Diagram

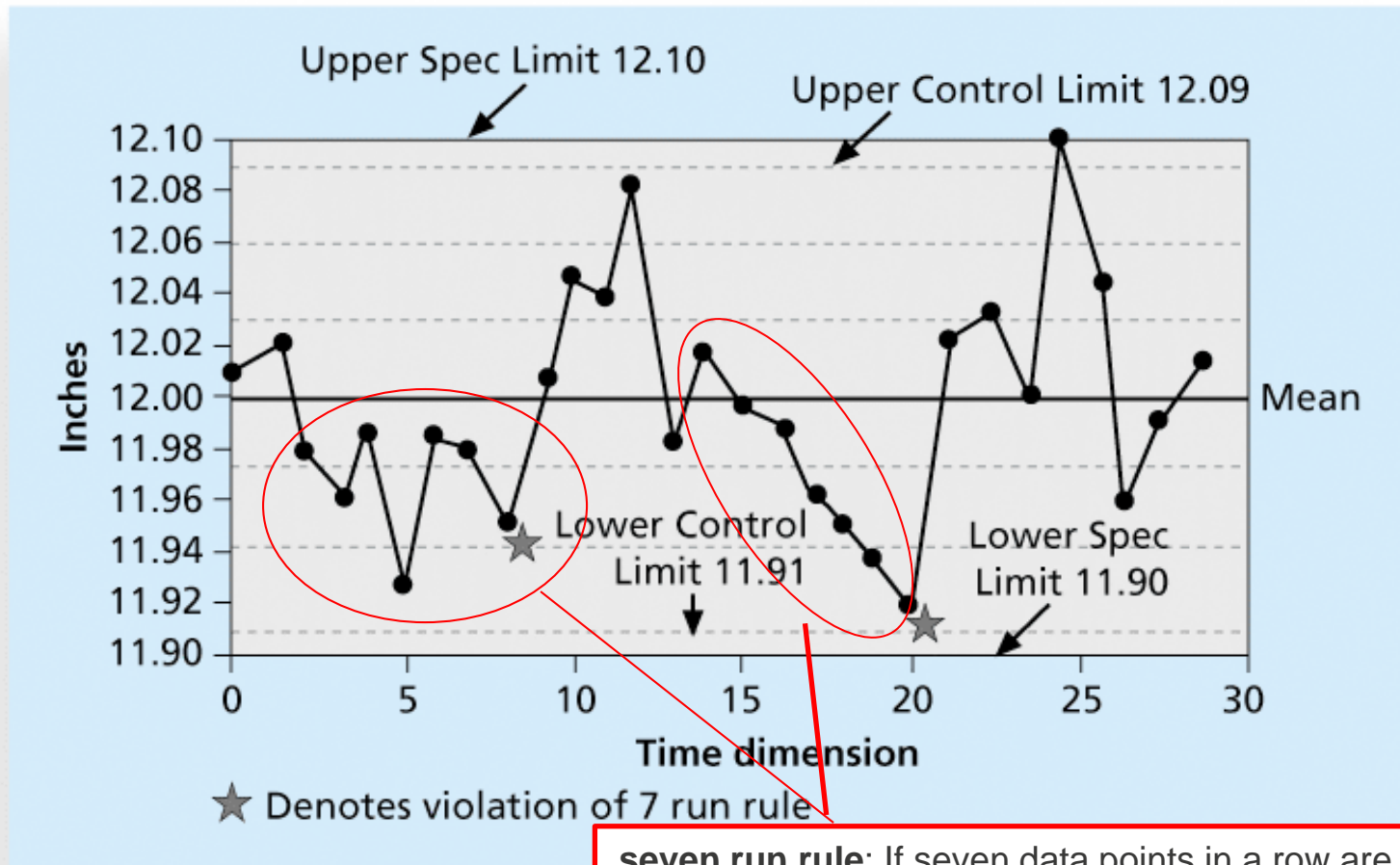


# Quality Control Charts

- 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 these events and adjust the process to correct or eliminate them



# Sample Quality Control Chart



**seven run rule:** 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

# Check sheet

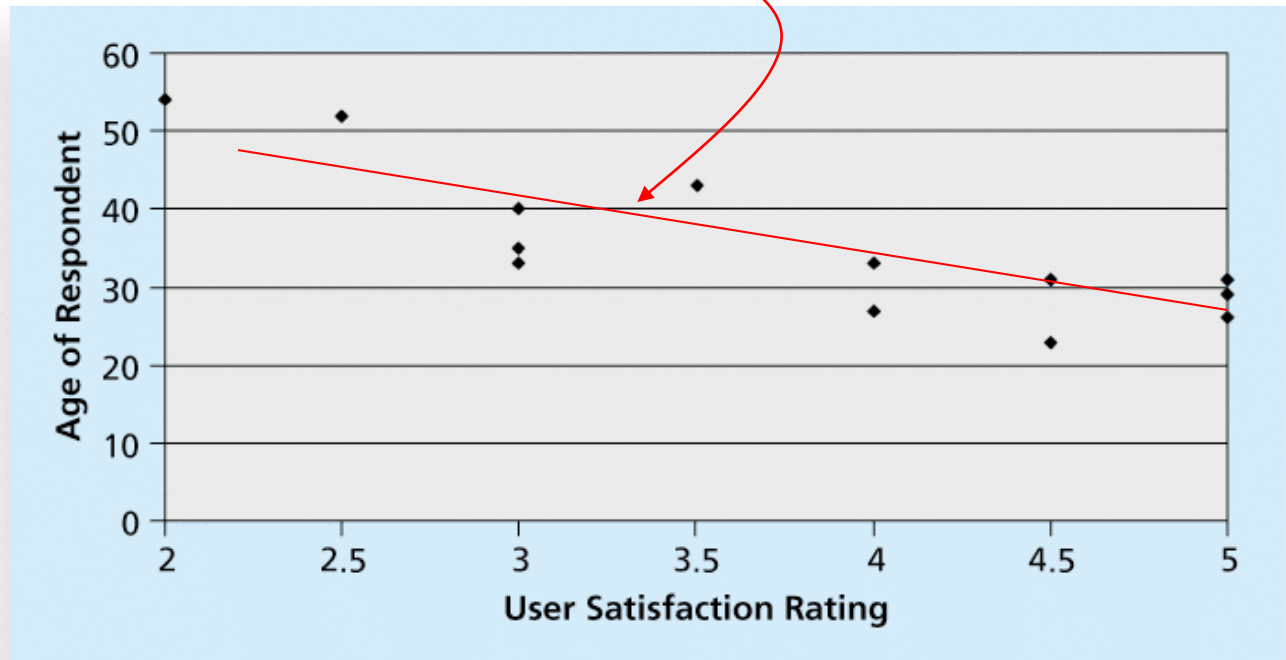
- A check sheet is used to collect and analyse data
- It is sometimes called a tally sheet or checklist, depending on its format
- This information might be useful in improving the process for handling complaints

In this example, most complaints arrive via text message, and there are more complaints on Monday and Tuesday than on other days of the week

Source	System Complaints by Day							Total
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	
Email								12
Text								29
Phone call								8
Total	11	10	8	6	7	3	4	49

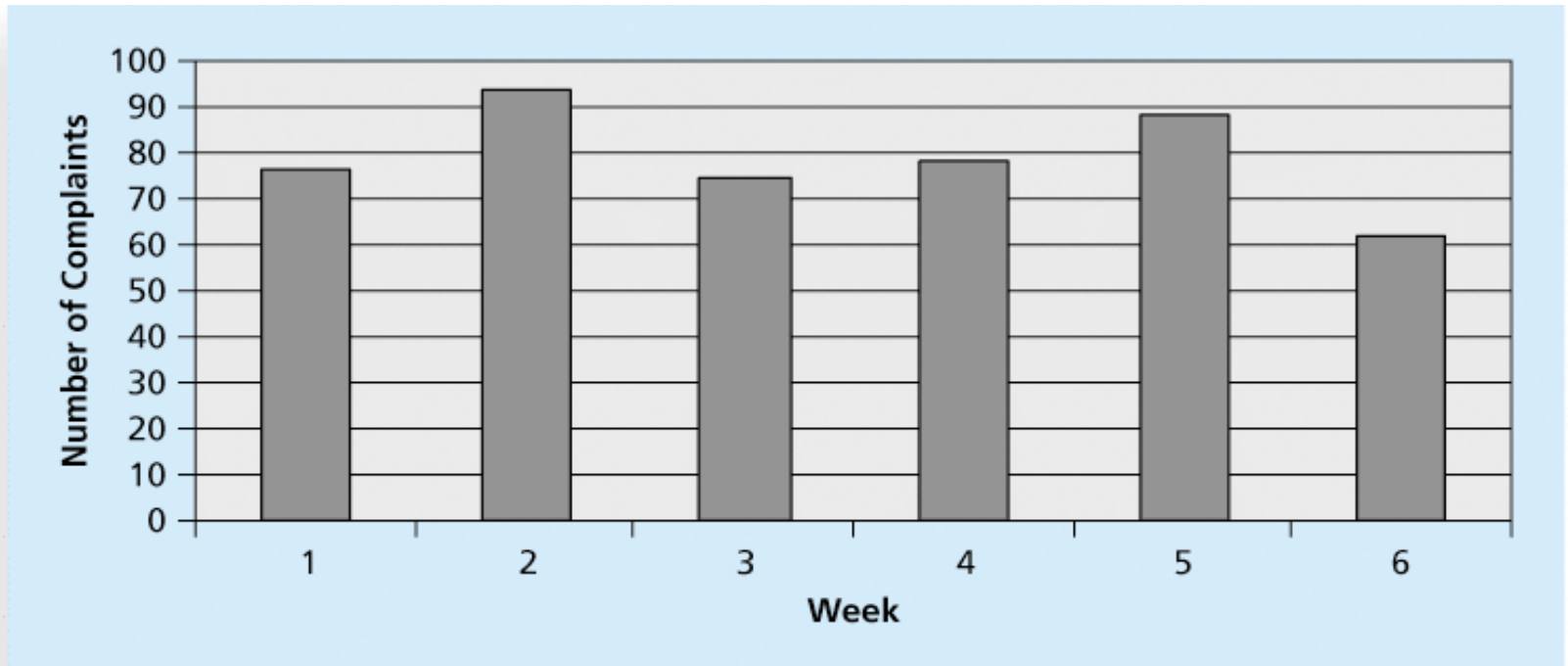
# Scatter diagram

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



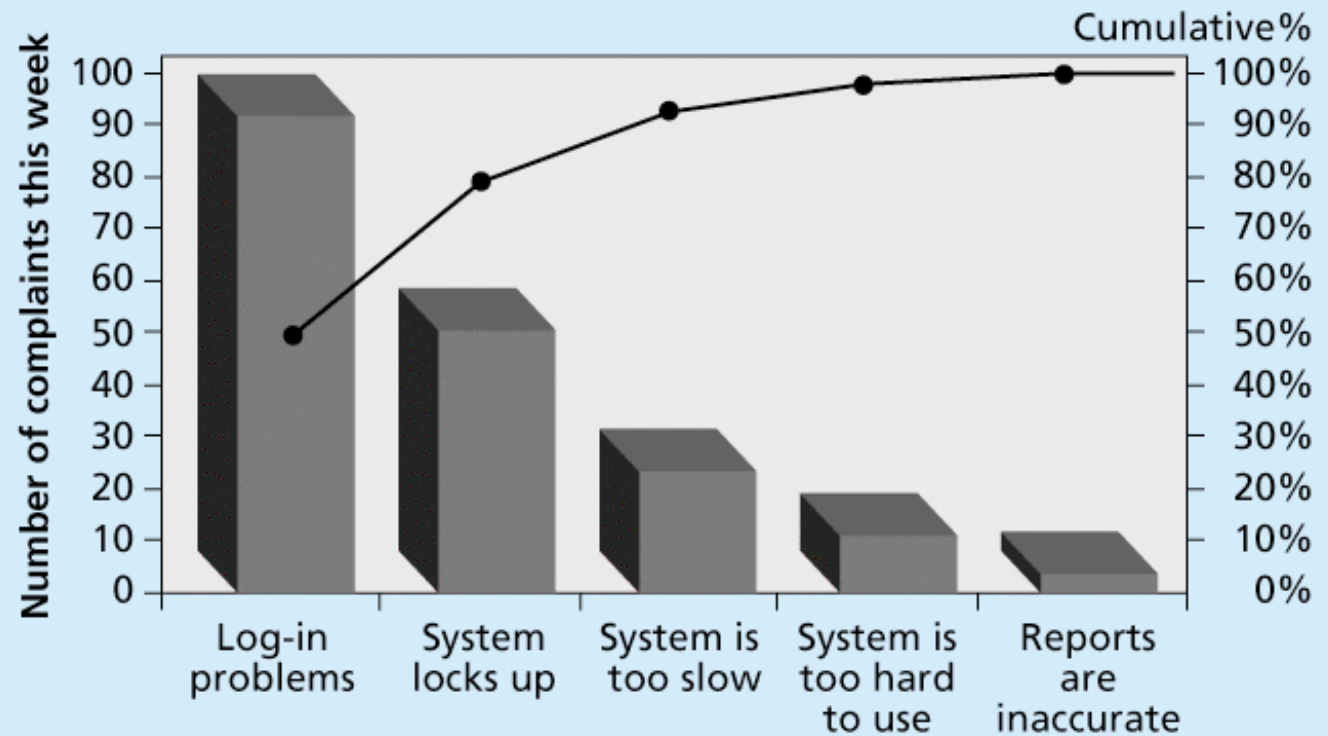
# Histograms

- 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



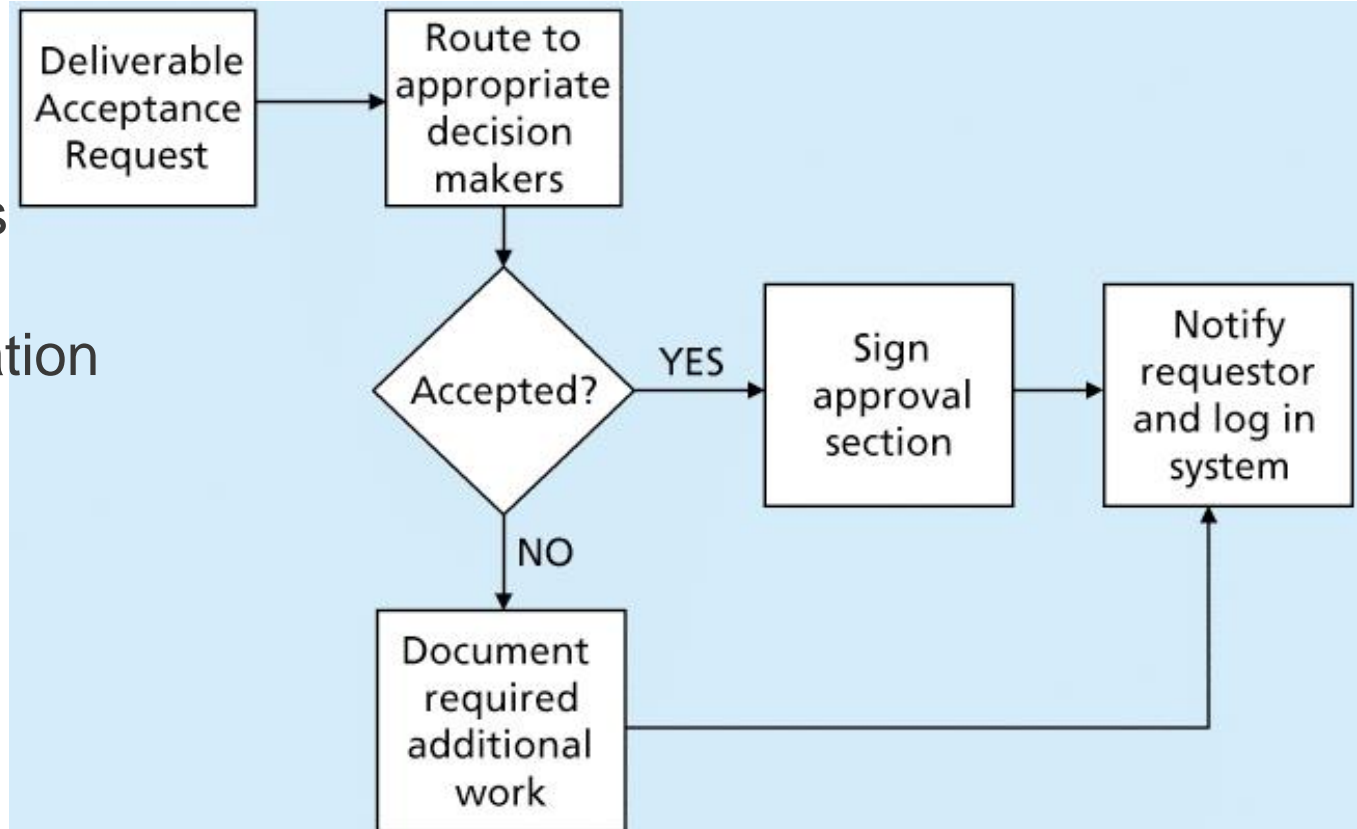
# Pareto Charts

- 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



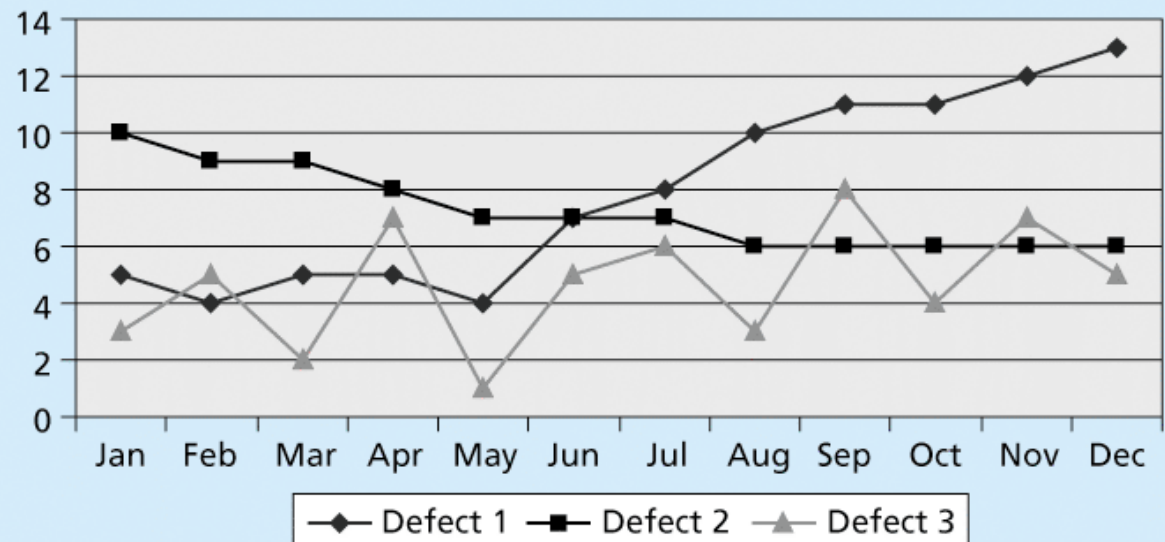
# Flowcharts

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



# Run Charts

- In addition to flowcharts, run charts are also used for stratification, a technique that shows data from a variety of sources to see if a pattern emerges
- A **run chart** displays the history and pattern of variation of a process over time.
- 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
- The size of a sample depends on how representative you want the sample to be
- Sample size formula:



DESIRED CERTAINTY	CERTAINTY FACTOR
95%	1.960
90%	1.645
80%	1.281

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

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



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

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

# DMAIC

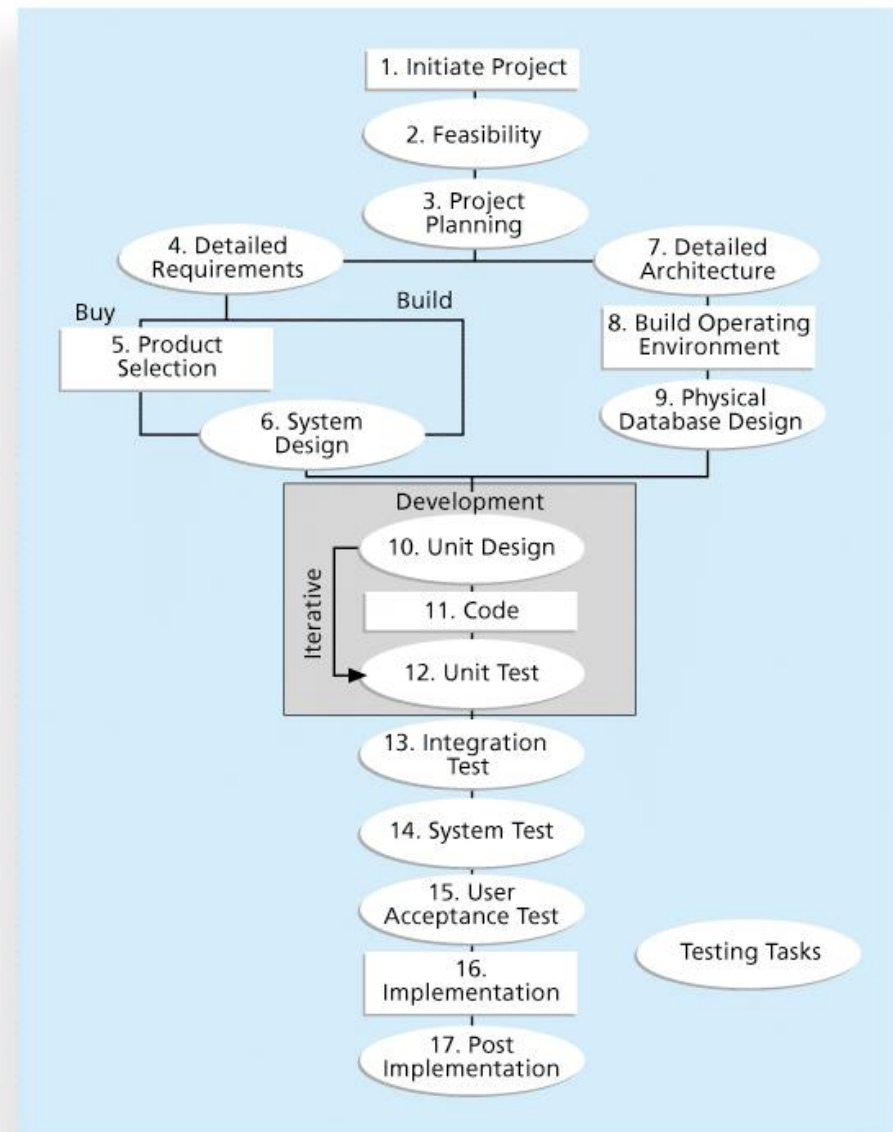
- **DMAIC** is a systematic, closed-loop process for continued improvement that is scientific and fact based
- DMAIC stands for:
  - **Define:** Define the problem/opportunity, process, and customer requirements
  - **Measure:** Define measures, then collect, compile, and display data
  - **Analyse:** Scrutinise 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

# 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

# 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

# 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

# Video 4: Project Procurement Management

## Learning Objectives

- Understand the importance of project procurement management and the increasing use of outsourcing for information technology (IT) projects
- Describe the work involved in planning procurements for projects, including determining the proper type of contract to use and preparing a procurement management plan

# Importance of Project Procurement Management

- **Procurement** means acquiring goods and/or services from an outside source
- Other terms include purchasing and outsourcing
- Experts predict that global spending on computer software and services will continue to grow
- People continue to debate whether offshore outsourcing helps their own country or not



# IT Outsourcing Market Continues to Grow

- Australian companies are transferring a lot of work abroad, especially in the areas of IT infrastructure, application development and maintenance, and innovation processes
- India, China, and the Philippines are the preferred locations for outsourcing
- Besides cost savings, a shortage of qualified personnel are reasons for global outsourcing of IT services

# Why Outsource?

- To access skills and technologies
- To reduce both fixed and recurrent costs
- To allow the client organisation to focus on its core business
- To provide flexibility
- To increase accountability

# Project Procurement Management Processes

- **Project procurement management:** Acquiring goods and services for a project from outside the performing organisation
- Processes include:
  - **Planning procurement management:** Determining what to procure and when and how to do it
  - **Conducting procurements:** Obtaining seller responses, selecting sellers, and awarding contracts
  - **Controlling procurements:** Managing relationships with sellers, monitoring contract performance, and making changes as needed
  - **Closing procurements:** Completing and settling each contract or agreement, including resolving of any open items

# Project Procurement Management Summary

## Planning

Process: **Plan procurement management**

Outputs: Procurement management plan, procurement statements of work, procurement documents, source selection criteria, make-or-buy decisions, change requests, project documents updates

## Executing

Process: **Conduct procurements**

Outputs: Selected sellers, agreements, resource calendars, change requests, project management plan updates, project documents updates

## Monitoring and Controlling

Process: **Control procurements**

Outputs: Work performance information, change requests, project management plan updates, project documents updates, organizational process assets updates

## Closing

Process: **Close procurements**

Outputs: Closed procurements, organizational process assets updates

Project Start

Project Finish

# Planning Procurement Management

- Identifying which project needs can best be met by using products or services outside the organisation
- Important decision – Make-or-buy decision
- If there is no need to buy any products or services from outside the organisation, then there is no need to perform any of the other procurement management processes
- Procurement Management Plan:
  - Describes how the procurement processes will be managed, from developing documentation for making outside purchases or acquisitions to contract closure
  - Contents varies based on project needs

# Contracts

- A **contract** is a mutually binding agreement that obligates the seller to provide the specified products or services and obligates the buyer to pay for them
- Contracts can clarify responsibilities and sharpen focus on key deliverables of a project
- Because contracts are legally binding, there is more accountability for delivering the work as stated in the contract

# Types of Contracts

- Different types of contracts can be used in different situations:
  - **Fixed price or lump sum** contracts: Involve a fixed total price for a well-defined product or service
    - Firm-fixed-price (**FFP**), fixed-price incentive fee (**FPI**), Fixed-price with economic price adjustment (**FP-EPA**)
  - **Cost reimbursable** contracts: Involve payment to the seller for direct and indirect costs
  - **Time and material** contracts: Hybrid of both fixed price and cost reimbursable contracts, often used by consultants
  - **Unit price** contracts: Require the buyer to pay the seller a predetermined amount per unit of service
- A single contract can actually include all four of these categories, if it makes sense for that particular procurement

# Point of Total Assumption

- The **Point of Total Assumption (PTA)** is the cost at which the contractor assumes total responsibility for each additional dollar of contract cost
- Contractors do not want to reach the point of total assumption, because it hurts them financially, so they have an incentive to prevent cost overruns
- The PTA is calculated with the following formula:

$$\text{PTA} = (\text{ceiling price} - \text{target price}) / \text{government share} + \text{target cost}$$

Ceiling price = \$1,250

Target price = \$1,100

Target cost = \$1,000

Government share: 75%

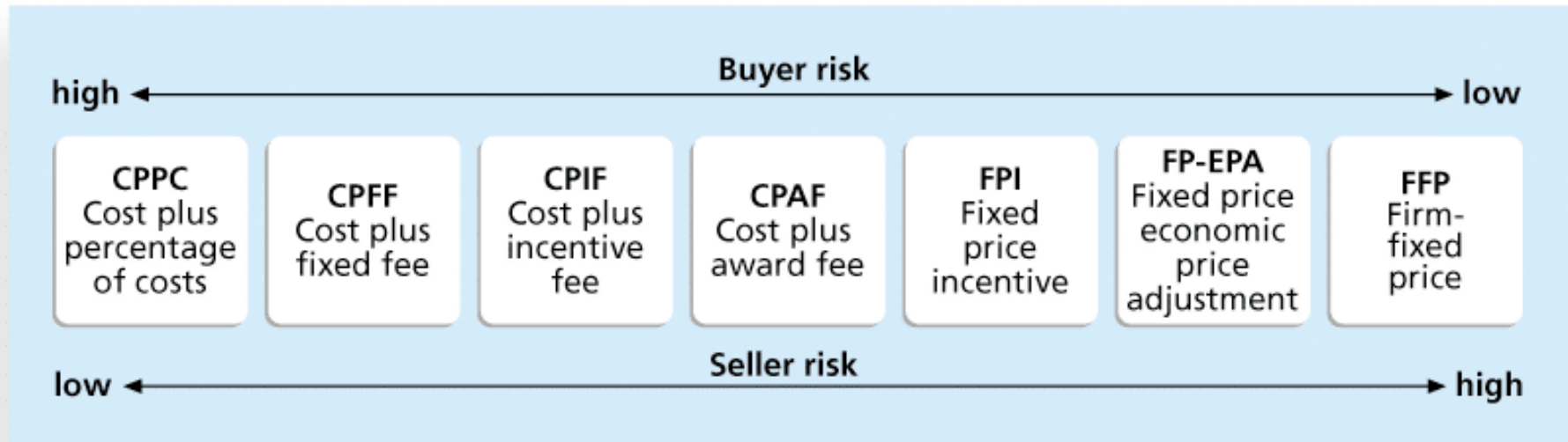
$$\text{PTA} = (\$1,250 - \$1,100) / 0.75 + \$1,000 = \$1,200$$



# Cost Reimbursable Contracts

- **Cost plus incentive fee (CPIF):** The buyer pays the supplier for allowable performance costs plus a predetermined fee and an incentive bonus
- **Cost plus fixed fee (CPFF):** The buyer pays the supplier for allowable performance costs plus a fixed fee payment usually based on a percentage of estimated costs
- **Cost plus percentage of costs (CPPC):** The buyer pays the supplier for allowable performance costs plus a predetermined percentage based on total costs. This is the least desirable type of contract from the buyer's perspective.

# Contract Types Versus Risk



# Contract Clauses

- Contracts should include specific clauses to take into account issues unique to the project
- Can require various educational or work experience for different pay rights
- A **termination clause** is a contract clause that allows the buyer or supplier to end the contract

# Video 5: Project Procurement Management

## Learning Objectives

- Discuss statement of work, source selection criteria, and make-or-buy analysis
- Discuss how to conduct procurements and strategies for obtaining seller responses, selecting sellers, and awarding contracts
- Understand the process of controlling procurements by managing procurement relationships and monitoring contract performance

# Tools and Techniques for Planning Purchases and Acquisitions

- Expert judgment
- Market research
- **Make-or-buy analysis:** General management technique used to determine whether an organisation should make or perform a particular product or service inside the organisation or buy from someone else

# Make-or-Buy Example

- Assume you can lease an item you need for a project for \$800/day. To purchase the item, the cost is \$12,000 plus a daily operational cost of \$400/day
- How long will it take for the purchase cost to be the same as the lease cost?

Solution:

Let  $d$  = the number of days you need the piece of equipment

$$800d = \$12,000 + 400d$$

$$400d = 12,000 \rightarrow d = 30$$

=> If you need the item for more than 30 days, it is more economical to purchase

# Contract Statement of Work (SOW)

- A **statement of work** is a description of the work required for the procurement
- If a SOW is used as part of a contract to describe only the work required for that particular contract, it is called a **contract statement of work**
- A SOW is a type of scope statement
- A good SOW gives bidders a better understanding of the buyer's expectations

# Statement of Work (SOW) Template

## Statement of Work (SOW)

- I. **Scope of Work:** Describe the work to be done in detail. Specify the hardware and software involved and the exact nature of the work.
- II. **Location of Work:** Describe where the work must be performed. Specify the location of hardware and software and where the people must perform the work.
- III. **Period of Performance:** Specify when the work is expected to start and end, working hours, number of hours that can be billed per week, where the work must be performed, and related schedule information.
- IV. **Deliverables Schedule:** List specific deliverables, describe them in detail, and specify when they are due.
- V. **Applicable Standards:** Specify any company or industry-specific standards that are relevant to performing the work.
- VI. **Acceptance Criteria:** Describe how the buyer organization will determine if the work is acceptable.
- VII. **Special Requirements:** Specify any special requirements such as hardware or software certifications, minimum degree or experience level of personnel, travel requirements, and so on.



# Procurement Documents

- **Request for Proposals:** Used to solicit proposals from prospective sellers
  - A **proposal** is a document prepared by a seller when there are different approaches for meeting buyer needs
- **Requests for Quotes:** Used to solicit quotes or bids from prospective suppliers
  - A **bid**, also called a tender or quote (short for quotation), is a document prepared by sellers providing pricing for standard items that have been clearly defined by the buyer

# Source Selection Criteria

- Source selection – evaluating proposals or bids from sellers, choosing the best one, negotiating the contract, and awarding the contract
- It's important to prepare some form of evaluation criteria, preferably before issuing a formal RFP or RFQ
- Beware of proposals that look good on paper; be sure to evaluate factors, such as past performance and management approach
- Can require a technical presentation as part of a proposal

# Conducting Procurements

- Organisations can advertise to procure goods and services in several ways:
  - Approaching the preferred vendor
  - Approaching several potential vendors
  - Advertising to anyone interested
- Sending appropriate documentation to potential sellers
- Obtaining proposals or bids
- A bidders' conference can help clarify the buyer's expectations
- Shortlisted sellers may be asked to prepare a best and final offer (BAFO).
- Selecting a seller
- Awarding a contract

# Controlling Procurements

- Ensures that the seller's performance meets contractual requirements
- Contracts are legal relationships, so it is important that legal and contracting professionals be involved in writing and administering contracts
- It is critical that project managers and team members watch for **constructive change orders**, which are oral or written acts or omissions by someone with actual or apparent authority that can be construed to have the same effect as a written change order

# Change Control in Contracts

- Changes to any part of the project need to be reviewed, approved, and documented by the same people in the same way that the original part of the plan was approved
- Evaluation of any change should include an impact analysis.
- Changes must be documented in writing.
- Project managers and teams should stay closely involved to make sure the new system will meet business needs
- Have backup plans
- Use tools and techniques, such as a contract change control system, buyer-conducted performance reviews, inspections and audits

# Closing Procurements

- Contract closure involves completing and settling contracts and resolving any open items
- The project team should:
  - ▶ Determine if all work was completed correctly and satisfactorily
  - ▶ Update records to reflect final results
  - ▶ Archive information for future use – using records management system
- Procurement audits identify lessons learned
- The contract itself should include requirements for formal acceptance and closure