Principles of Project Management
(Course Code N2650)

Student Notebook
ERC 2.0

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Figure 2-6: Organizational Structure Influences on Projects

Figure 3-1: The Plan-Do-Check-Act Cycle

Figure 3-2: Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

Figure 3-11: Process Groups Interact in a Project
Course Description

Principles of Project Management

Duration: 4.5 days

Purpose

This course is designed to provide project managers, novice or experienced, with project management skills required for certification in the PM discipline. Structured to match a project’s life cycle, this 4.5-day classroom course covers detailed topics of the basic concepts of project management, including initiating projects, planning projects, controlling projects, executing projects, and closing projects. Those who attend the class improve their management skills and abilities to define the project scope, create a workable project plan, and manage within the budget and schedule.

The course consists of classroom instructor-led lecture and discussion, which is reinforced with team and individual exercises, and case study assignments with student feedback that is critiqued by the instructor and the other student teams.

Audience

This course is designed for qualified IT professionals, marketing personnel, and staff support in any industry that will be actively involved in a project.

Prerequisites

No prerequisite is required for taking this course.

Objectives

After completing this course, you should be able to:

• Use project management skills across your organization
• Build a performing organization and project team
• Identify and validate project requirements
• Establish project estimates and project schedules
• Develop Work Breakdown Structures (WBS)
• Create project plans
- Execute overall integrated change control
- Control project execution processes
- Terminate a project with an appropriate closure strategy
- Perform your role as project manager

**Certification Program**

This course can be applied towards the PMI PMP Recertification:

- Professional Development Unit (PDU) credit: 36.0
- PMP Professional Development Activity Program Number: 1107-000N2650
- PMP Professional Development Activity Program Title: Principles of Project Management

**PMBOK areas covered:**

- Project Integration Management
- Project Scope Management
- Project Time Management
- Project Cost Management
- Project Quality Management
- Project Human Resource Management
- Project Communications Management
- Project Risk Management
- Project Procurement Management

**Curriculum Relationship**

Courses that follow this course:

- N2651 Project Leadership and Team Building (4 days)
- N2652 Financial Management for Project Managers (2 days)
- N2653 Contracting for Project Managers (4.5 days)
- N2654 Project Risk Management (3 days)
- N2658 Project Cost and Schedule Management (3 days)
- N2670 Applying Project Management Principles (4.5 days)

Other professional Project Management courses:

- N2666 Quality Management for Project Managers (3 days)
• N2667 Requirements Definition and Management (3 days)
• N2668 Managing Projects in Software Development (2 days)
• N2672 PMP Examination Preparation (2 days)
• N2677 Leading Complex Projects Workshop (3.5 days)

Project Staff and Managers
• N2659 Project Management Concepts (2 days)
• N2662 Executive Workshop on Project Management (1.5 days)
• N2676 Working on a Project (1 day)
Agenda

Day 1

Unit 1 - Introduction to Principles of Project Management
The Bridge Game
Unit 2 - Project Management Basics
Unit 3 - Initiating Processes
Unit 4 - Defining the Project
Team Exercise 4-1: Establish Goals and Objectives
Unit 5 - Planning Processes
Unit 6 - Organizing the Team
Team Exercise 6-1: Team Charter

Day 2

Unit 7 - Identifying and Validating Requirements
Unit 8 - Building the Work Breakdown Structure (WBS)
Team Exercise 8-1: Build a WBS
Unit 9 - Risk Management
Team Exercise 9-1: Risk Management

Day 3

Unit 10 - Establishing a Project Estimate
Team Exercise 10-1: Estimating
Unit 11 - Create a Project Schedule
Team Exercise 11-1: Precedence Diagramming Method
Team Exercise 11-2: Scheduling
Unit 12 - Executing, Monitoring and Controlling Processes

Day 4

Unit 13 - Integrated Change Control
Team Exercise 13-1: Integrated Change Control
Unit 14 - Quality Management
Unit 15 - Cost Management
Team Exercise 15-1: Earned Value Management
Unit 16 - Procurement Management
Team Exercise 16-1: Establishing Relationships Using Contracts

Day 5

Discussion of Exercise 16-1 Results
Unit 17 - Project Reviews

Team Exercise 17-1: Conducting an Independent Peer Review
Discussion of Exercise 17-1 Results
Unit 18 - Closing Processes
Unit 19 - Managing Project Teams
Unit 20 - Wrap Up
End of Class Exam
Unit 1. Introduction

What This Unit is About

This unit provides an overview of the course, its objectives, and structure.

What You Should Be Able to Do

After completing this course, you should be able to:

- Build a performing organization and project team
- Identify and validate project requirements
- Develop Work Breakdown Structures (WBS)
- Establish project estimates and project schedules
- Create project plans
- Manage overall change control
- Control project execution processes
- Terminate a project with a close-out strategy
- Perform your role as a project manager
- Describe the nine Project Management Institute (PMI®) knowledge areas

How You Will Check Your Progress

Accountability:

- Class Discussion
- Project Simulation
- Case Study and Team Exercises

References

Notes:
Introduction to Principles of Project Management

Unit 1

Notes:
Administrative Information

- Location information:
  - Emergency phone number
  - Local emergency exit procedures
  - Floor layout
  - Fax number

- Class time: 8:30 a.m. - 5:00 p.m.
- Student notebook and handouts
- Attendance expectations
- Examination on the last day

Start on time = End on time

Information Flow

Notes:
Notes:

We recommend that the Principles of Project Management course be the first course in the sequence. The next six courses are listed in a suggested sequence but can be taken in any order, with the exception of the Applying Project Management Principles course which should be taken only after completing at least 4 of the Core courses.
Additional PM Curriculum Offerings

**Project Manager**

- PM® Examination Preparation (N2672)
- Leading Complex Projects Workshop (N2677)
- Quality Management for Project Managers (N2666)
- Requirements Definition & Management (N2667)
- Managing Software Development Projects (N2668)

(Can be taken at any point, as needed to prep for the PM® exam)

**Project Team Members and Managers**

- Project Management Concepts (N2659)
- Working on a Project (N2676)

**Executives and Senior Managers**

- Executive Workshop on Project Management (N2662)

**General Audience**

- PM Skills and Knowledge Self-Assessment (N2699)

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Figure 1-5. Additional PM Curriculum Offerings

**Notes:**
Course Objectives

We will show you how to:

- Build a performing organization and project team
- Identify and validate project requirements
- Develop Work Breakdown Structures (WBS)
- Establish project estimates and project schedules
- Create project plans
- Manage overall change control
- Control project execution processes
- Terminate a project with a close-out strategy
- Perform your role as a project manager
- Describe the nine Project Management Institute (PMI®) knowledge areas

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Notes:
### Agenda (1 of 2)

#### Day 1:
- Unit 1 - Introduction to Principles of Project Management
  - The Bridge Game
- Unit 2 - Project Management Basics
- Unit 3 - Initiating Processes
- Unit 4 - Defining the Project
  - Team Exercise 4-1: Establish Goals and Objectives
- Unit 5 - Planning Processes
- Unit 6 - Organizing the Team
  - Team Exercise 6-1: Team Charter

#### Day 2:
- Unit 7 - Identifying and Validating Requirements
- Unit 8 - Building the Work Breakdown Structure (WBS)
  - Team Exercise 8-1: Build a WBS
- Unit 9 - Risk Management
  - Team Exercise 9-1: Risk Management

#### Day 3:
- Unit 10 - Establishing a Project Estimate
  - Team Exercise 10-1: Estimating
- Unit 11 - Creating a Project Schedule
  - Team Exercise 11-1: Precedence Diagramming Method
  - Team Exercise 11-2: Scheduling
- Unit 12 - Executing Processes & Monitoring and Controlling Processes

### Notes:
Agenda (2 of 2)

Day 4:
- Unit 13 - Integrated Change Control
  Team Exercise 13-1: Integrated Change Control
- Unit 14 - Quality Management
- Unit 15 - Cost Management
  Team Exercise 15-1: Earned Value Management
- Unit 16 - Procurement Management
  Team Exercise 16-1: Establishing Relationships Using Contracts

Day 5:
- Unit 17 - Project Reviews
  Team Exercise 17-1: Conducting an Independent Peer Review
- Unit 18 - Closing Processes
- Unit 19 - Managing Project Teams
- Unit 20 - Wrap-up
  End of Class Exam

Notes:
PMI® Nine Knowledge Areas

- The Project Management Institute (PMI®) has identified and documented a core body of project management knowledge consisting of:
  - Integration Management
  - Scope Management
  - Time Management
  - Cost Management
  - Quality Management
  - Human Resource Management
  - Communication Management
  - Risk Management
  - Procurement Management
Class Exercises

- Student:
  - Team Exercises
  - Individual Exercises
  - Case Study

- Instructor:
  - Facilitation
  - Explanation

Figure 1-10. Class Exercises

Notes:
Case Study

RestEasy Hotels

Have I got an opportunity for you!

Previous Project Manager

Notes:
Meet Your Classmates

- Name
- Company name
- Years in your organization
- Experience in project management
- Current assignment
- Who is your customer
- Your expectations for the class

Notes:
Bridge Game

Notes:
Unit 2. Project Management Basics

What This Unit is About

This unit discusses the basics about project management. It defines key terms, introduces the project life cycle, and identifies project processes and their interrelationships. In addition, it describes the roles and responsibilities of the project manager, the value of a project manager, and the characteristics of a good project manager.

What You Should Be Able to Do

After completing this unit, you should be able to:

- Define project, program, project management, and project manager
- Describe the project life cycle model
- List project processes and their interrelationships
- Differentiate between types of organizational structures
- Describe the roles and responsibilities of a project manager
- State the value of a project manager
- Identify the characteristics of a good project manager

How You Will Check Your Progress

Accountability:

- Class discussion

References

Figure 2-1. Project Management Basics

Notes:
Unit Objectives

After completing this unit, you should be able to:

- State basic project management definitions, like a project, program, project management, project portfolio management, and project manager
- Describe the project life cycle model
- List project processes and their interrelationships
- Describe the roles and responsibilities of a project manager
- State the value of a project manager
- Identify the characteristics of a good project manager

Notes:
## Basic Project Management Definitions (1 of 3)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>A project is a temporary endeavor undertaken to create a unique product, service, or result. Temporary means that every project has a definite beginning and a definite end. The end is reached when the project's objectives have been achieved, or when it becomes clear that the project objectives will not or cannot be met and the project is terminated.</td>
</tr>
<tr>
<td>Subproject</td>
<td>A subproject is a set of work units assigned to a single project organizational unit to divide the project into more manageable components.</td>
</tr>
<tr>
<td>Program</td>
<td>A program is a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually.</td>
</tr>
</tbody>
</table>

**Notes:**
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project management</td>
<td>Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. (From PMI®)</td>
</tr>
<tr>
<td>Portfolio Management</td>
<td>The centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic business objectives. (From PMI®)</td>
</tr>
<tr>
<td>Portfolio</td>
<td>A collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives. (From PMI®)</td>
</tr>
<tr>
<td>Progressive Elaboration</td>
<td>Continuously improving and detailing a plan as more detailed and specific information and more accurate estimates become available as the project progresses, and thereby producing more accurate and complete plans that result from the successive iterations of the planning process. (From PMI®)</td>
</tr>
</tbody>
</table>
## Basic Project Management Definitions (3 of 3)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management Office (PMO)</td>
<td>An organizational body or entity assigned various responsibilities related to the centralized and coordinated management of those projects under its domain. (From PMI®)</td>
</tr>
</tbody>
</table>
| Sponsor               | A sponsor is an individual or an organization that has the authority to perform, delegate, or ensure completion of the following project commitments:  
✓ Formalization of an agreement with the delivery organization  
✓ Approval to proceed with the start of the project or of a phase  
✓ Acceptance of the deliverables from the project  
✓ Spending for the cost or price, or both, of the project as specified in the agreement |
Project Life Cycle Model

Notes:
Typical Activities by Phase

**Concept**
- Gather data
- Identify need
- Establish:
  - Goals, objectives
  - Basic economics, feasibility
  - Stakeholders
  - Risk level
  - Strategy
  - Potential team
- Estimate resources
- Identify alternatives
- Present proposal
- Obtain approval for next phase

**Develop**
- Appoint key team members
- Conduct studies
- Develop scope baseline:
  - End products
  - Quality standards
  - Resources
  - Activities
- Establish:
  - Master plan
  - Budget, cash flow
  - WBS
  - Policies and procedures
- Assess risks
- Confirm justification
- Present project belief
- Establish approval process

**Execute**
- Set up:
  - Organization
  - Communication
  - Motivate team
  - Detail technical requirements
  - Establish:
    - Work packages
    - Information control system
  - Procure goods / services
  - Execute work package
  - Direct/monitor/forecast/control:
    - Scope
    - Quality
    - Time
    - Cost
  - Resolve problems

**Finish**
- Finalize products
- Review and accept
- Settle final accounts
- Transfer product responsibility
- Evaluate project
- Document results
- Release/redirect resources
- Reassign project team

Figure 2-7. Typical Activities by Phase

Notes:
Project Management Processes

- Projects are composed of processes
- A process is a series of actions bringing about a result
- Project management processes describe, organize, and complete the work of the project
- Product-oriented processes address the specification and creation of the project product
- Project management processes and product-oriented processes overlap one another and interact throughout the life of the project
Plan-Do-Check-Act Cycle

Plan, Do, Check, Act is a cycle of activities designed to drive continuous improvement. Initially implemented in manufacturing, it has broad applicability in business. First developed by Walter Shewhart, it was popularized by Edwards Deming.

Notes:
Project Management Process Groups

Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

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Process Groups Interact in a Project

Figure 2-11. Process Groups Interact in a Project

Notes:
Projects Are Like Small Businesses

Projects = Small Businesses...Just as with a small business, the best solution to problems is prevention. Potential problems can relate to any of the following:

- Customer expectations
- Customer capabilities
- Mutual understanding of requirements
- Scope change
- Risk management
- Quality
- Inaccurate estimates
- Ongoing support needs
- Resource availability
- Project startup
- Clear roles and responsibilities
- Management involvement
- Change control
- Loss of key personnel

Notes:
Definition of a Project Manager

A project manager acts as the single point of contact on the project

- A project manager is the individual responsible for:
  - **Planning** and **organizing** the work
  - **Managing** the day-to-day activities of a project
  - **Delivering** the project deliverables to the client
  - **Identifying** potential stakeholders

**Notes:**
Single Point of Contact

Figure 2-14. Single Point of Contact

Notes:
Project Stakeholders - Who Are They and Why Are They Important?

- **Project Stakeholders** - Persons and organizations such as customers, sponsors, performing organization and the public, that are actively involved in the project, or whose interests may be positively or negatively affected by execution or completion of the project; they may also exert influence over the project and its deliverables.

- **Stakeholder analysis** - Provides an important input for your approach to managing a project, to:
  - Identify the range of interests that needs to be taken into consideration in planning the project.
  - Develop the vision and change process in a way that generates the greatest support.
  - Set up your communication strategy and plan.

- **Know your “stakeholder groups”**
  - Their profile, their concerns, their expectations, and the channels by which they can be reached.

---

**Notes:**
Project Manager's Value

- A project manager enhances the probability that a project will:
  - Produce quality products
  - Stay on schedule
  - Complete within budget
  - Satisfy the client's requirements
  - Lead to follow-on business
  - Achieve success
Key Competencies of a Successful Project Manager (1 of 3)

- **Long-range perspective**: An individual's tendency to consider long-term implications and possibilities when acting or making decisions

- **Risk-taking, venturesomeness**: An individual's tendency to try new ideas and take action in the face of potential risks

- **Clarification of goals**: An individual's ability to define and clarify project and individual goals

- **Innovation and creativity**: An individual's ability to apply imaginative thinking and generate original ideas and thoughts regarding business issues

- **Participative problem solving**: The extent to which an individual solicits and applies the ideas and knowledge of others in solving problems

- **Systematic thinking and planning**: An individual's ability to apply a systematic approach to thinking through issues and planning team and individual activities

---

Notes:
Key Competencies of a Successful Project Manager (2 of 3)

- **Strategic inquiry:** An individual's tendency to sort through and handle complex or conflicting information and to prioritize issues and alternatives
- **Political awareness:** An individual's ability to develop and maintain a sensitivity to personal and organizational relationships and to their ramifications for a project
- **Team member facilitation:** An individual's demonstrated ability to coach and develop project team members
- **Team development:** An individual's ability to develop teamwork and improve the coordinated functioning of project team members
- **Assertiveness:** An individual's tendency to assert himself or herself and hold to a direction he or she sets
- **Feedback to team members:** An individual's demonstrated ability to provide timely, appropriate, and accurate feedback to team members

**Notes:**
Key Competencies of a Successful Project Manager (3 of 3)

- **Relations with functional managers**: An assessment of the individual's ability to establish and maintain positive, constructive relationships with functional managers.

- **Standards of performance**: The extent to which the individual clearly sets, maintains, and pursues high standards of performance.

- **Drive**: The level of urgency expressed by the individual in pursuing work efforts.

- **Goal pressure**: The extent to which an individual exerts pressure toward achieving goals; note that excessive goal pressure can also be a negative trait.

- **Delegation (permissiveness)**: An individual's ability to assign work appropriately to subordinates or team members, within the context of providing a consistent amount of task direction and guidance; note that too much delegation without an appropriate amount of structure can be negative (permissiveness).

- **Recognizing performance**: An individual's demonstrated tendency to recognize the performance of team members in an appropriate manner.

---

**Notes:**
Key Messages for Unit 2

- A project is a small business that aligns with strategic imperatives and has clear objectives, budgets, schedules, and deliverables
- Project management is a full-time job
- Project managers must know the project life cycle, project processes, and their roles in performing activities in different life cycle phases
- Project managers must realize the complexity of the environment and be prepared to deal with various conflicts
- The role of project manager is the key to the success of a project
- Most projects fail because of a lack of project management and people management, not because of technical reasons

Notes:
Unit 3. Initiating Processes

What This Unit is About

This unit discusses the activities performed in the group of initiating processes.

What You Should Be Able to Do

After completing this unit, you should be able to:

- List the activities included in initiating processes
- State the aims of initiating processes

How You Will Check Your Progress

Accountability:

- Class Discussion

References

Figure 3-1. Initiating Processes

Notes:
Unit Objectives

After completing this unit, you should be able to:
- List the activities included in Initiating processes
- State the aims of Initiating processes

Notes:
**Project Management Process Group**

![Diagram of Project Management Process Groups](image)

**Figure 3-2.** Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle


**Notes:**
Initiating Process Group

- Initiating Process Group consists of the processes that facilitate the formal authorization to start a new project or a project phase
  - The output defines the:
    - Project's purpose
    - Identifies objectives
    - Authorizes the project manager to start the project
- Includes the project management processes of:
  - Develop the Project Charter
  - Develop the Preliminary Project Scope Statement (Project Definition)

Notes:
Initiating Processes Activities

- Initiating processes activities include:
  - Project notification
  - Identifying and documenting business needs or requirements
  - Establishing project goals and objectives
  - Identifying and evaluating alternatives
  - Estimating resources the organization is willing to commit
  - Documenting initial assumptions and constraints
  - Presenting the project proposal
  - Obtaining approval for the project or next phase
  - Developing the preliminary project scope statement
Aims of Initiating Processes

- The aims of the initiating processes are to:
  - Create and define the project goals and objectives:
    - Specific
    - Measurable
    - Time-defined
  - Clearly define project scope and deliverables:
    - Size of the project
    - Budget and cost
    - Duration
  - Understand and verify client needs and expectations
  - Outline the team organization
  - Establish project evaluation criteria
  - Identify and assign the project manager

Notes:
Key Messages for Unit 3

- Initiating Process Group provides for the formal authorization to start a new project or a project phase
- The primary Outputs of the Initiating Processes are the Project Charter and Project Definition (preliminary project scope statement)

Notes:
Unit 4. Defining the Project

What This Unit is About

This unit discusses the differences between organizational structures and their influences on project management, describes the function of a Project Charter, and describes how to create a Project Definition document.

What You Should Be Able to Do

After completing this unit, you should be able to:
• Differentiate between organizational structures
• Describe the function of a Project Charter
• Describe how to create the Project Definition document

How You Will Check Your Progress

Accountability:
• Class Discussion
• Team Exercise 4-1: Establish Goals and Objectives

References

Defining the Project

Unit 4

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Differentiate between organizational structures
- Describe the function of a Project Charter
- Describe how to create the Project Definition document

Notes:
Project Management Process Group

Figure 4-3. Project Management Process Group

Notes:
Types of Organizational Structures

The three types of organizational structures are:

**Functional**
- President
- VP
- Marketing
- Purchasing
- Production

**Matrix**
- President
- VP
- Alpha Project
- Beta Project
- Charlie Project
- Support
- Clerical
- Team member

**Projectized**
- President
- VP
- Marketing
- Sales
- Support
- Clerical
- Team member

**Notes:**
# How Organizational Structures Influence Projects

<table>
<thead>
<tr>
<th>Organization Structure</th>
<th>Functional</th>
<th>Matrix</th>
<th>Projectized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Manager's Authority</td>
<td>Little or None</td>
<td>Limited</td>
<td>Moderate to High</td>
</tr>
<tr>
<td>Resource Availability</td>
<td>Little or None</td>
<td>Limited</td>
<td>Moderate to High</td>
</tr>
<tr>
<td>Project Manager's Role</td>
<td>Part-Time</td>
<td>Part-Time</td>
<td>Full-Time</td>
</tr>
<tr>
<td>Project Management Administrative Staff</td>
<td>Part-Time</td>
<td>Part-Time</td>
<td>Full-Time</td>
</tr>
</tbody>
</table>

**Notes:**

Figure 4-5. How Organizational Structures Influence Projects

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Project Charter

A project charter is a document that formally authorizes a project.

It is a document usually issued by an entity external to the project organization which provides the project manager with the authority to apply organizational resources to project activities

- A project charter:
  - Includes the business need that the project is to address
  - Includes the product description
  - Establishes the scope of the project
  - Names the project manager as the responsible and authorized party
  - Identifies the project deliverables, schedule, and budget
  - Is concise

When a project is under contract, the signed contract may serve as the project charter
Purpose of the Project Charter

The purpose of the Project Charter is to document the:

- Reasons for undertaking the project
- Objectives and constraints of the project
- Directions concerning the solution
- Identities of the main stakeholders

It should be issued by the project sponsor, and at a level appropriate to the needs of the project.
Project Definition

*Project Definition document:* Overview document that describes the shape of the project and includes the objectives and scope, the stakeholders and proposed organization with responsibilities, and the major risks associated with the project.

- **The purpose is to:**
  - Formalize the understanding of the Project Charter by the delivery organization
  - Provide the plan elements in order to control the planning and defining activities
  - Give an initial description of the project framework for the planning activities
  - Gather the fundamental characteristics of the project in a unique document

- **It is NOT:**
  - A Project Charter
  - A Team Charter
  - A Customer Contract

Figure 4-8. Project Definition

Notes:
## Project Definition Document Components

- Introduction and summary of the project
- Project objectives
- Project deliverables
- Key milestones
- Assumptions
- Risks
- Resource requirements
- Constraints
- Interrelated projects
- Acceptance criteria
- Signatures
- Reviews
- Communication plan
- Change management plan
- Financial analysis
- References

**Notes:**
Questions To Ask When Building a Project Definition Document (1 of 5)

Background and summary of project
- Where did this project come from?
- Why is it being done?
- What does the customer receive or not receive by project end?

Project objectives
- What is the target of the project?
- What problem should the project solve?
- What are the major components of work on the project?

Project deliverables
- What are the major products required to meet the objectives?
  - Customer deliverables
  - Project deliverables
  - Process deliverables

Notes:
Questions To Ask When Building a Project Definition Document (2 of 5)

Key milestones
- What major points in time are important to communicate?
- What major points in time are important to measure against?
- What are the bureaucratic milestones?

Assumptions
- What unknowns are being made into knowns?
- What are the operating rules and standards?

Risks
- What obstacles could jeopardize project success?
  - Cost
  - Schedule
  - Requirements
  - Quality
  - Customer satisfaction

Notes:
Questions To Ask When Building a Project Definition Document (3 of 5)

Key resource requirements
- What specialized resources are necessary to complete this project?
  - Staff
  - Material
  - Facilities

Constraints
- What issues are restricting this project?
  - Technology
  - Staff
  - Political

Interrelated projects
- What effects are there on other programs?
- What other projects are addressing related issues?
- What other projects have a potential impact on this project?

Notes:
Questions To Ask When Building a Project Definition Document (4 of 5)

Acceptance criteria
- What technical performance is required?
- What checkpoints are in place to ensure that the right product is being delivered in the right way?
- How is success measured?

Signatures
- What reviews are done? When?
- Who approves project reviews?

Reviews
- At what points are management reviews conducted? For what purpose?
- At what points are customer reviews conducted? For what purpose?
- At what points are informal (team, peer) reviews conducted? For what purpose?

Notes:
Questions To Ask When Building a Project Definition Document (5 of 5)

Communication plan
- How do team members communicate?
- How does the team communicate with the customer, stakeholders, and your management?
- What types of meetings are held? Frequency? Purpose?
- What types of reports are written? Frequency? Purpose?

Change management plan
- What process is followed when project change occurs?

Financial Analysis
- How does the project manager control budget and cost?

References
- Documents with title, date, and version that affect the scope definition

Notes:
Key Messages for Unit 4

- The structure of the performing organization often constrains the availability of or terms under which resources will become available for a project.

- A project charter gives the project manager the responsibility and the authority to apply organizational resources to project activities.

- The project definition document formalizes the understanding of the project charter by the delivery organization.

Notes:
Team Exercise 4-1: Establish Goals and Objectives

**Project:** RestEasy Hotels

- Read the handout and be prepared to present your findings to the class

Notes:
Unit 5. Planning Processes

What This Unit is About

This unit introduces you to project planning processes.

What You Should Be Able to Do

After completing this unit, you should be able to:

• List the activities included in Planning processes
• State the aims of Planning processes

How You Will Check Your Progress

Accountability:

• Class Discussion

References

Planning Processes

Unit 5

Notes:
Unit Objectives

After completing this unit, you should be able to:

- List the activities included in Planning processes
- State the aims of Planning processes

Notes:
Notes:
Planning Process Group

- Planning Process Group and its constituent processes and interactions to plan and manage a successful project for the organization
- The following list identifies the process the project team should address during the planning process to decide if they need to be done and, if so, by whom:

  - Develop Project Management Plan
  - Scope Planning
  - Scope Definition
  - Create WBS
  - Activity Definition
  - Activity Sequencing
  - Activity Resource Estimating
  - Activity Duration Estimating
  - Schedule Development
  - Cost Estimating
  - Cost Budgeting
  - Quality Planning
  - Human Resources Planning
  - Communications Planning
  - Risk Management Planning
  - Risk Identification
  - Qualitative Risk Analysis
  - Quantitative Risk Analysis
  - Risk Response Planning
  - Plan Purchases and Acquisitions
  - Plan Contracting

The multi-dimensional nature of project management causes repeated feedback loops for additional analysis.

Figure 5-4. Planning Process Group

Notes:
Planning Processes Activities

- Planning processes activities include:
  - Developing the project management plan
  - Identifying, defining, and maturing the project scope and project cost
  - Scheduling the project activities that occur within the project
  - Estimating the resources, work periods, and cost of resources needed to complete project activities
  - Establishing plans for handling risk, from risk management planning to risk response planning
  - Identifying relevant quality standards
  - Identifying and documenting project roles and responsibilities
  - Determining the information and communication needs of the project stakeholders
  - Determining what to purchase or acquire and determine when and how

Notes:
Aims of Planning Processes

- The aims of the planning processes are to:
  - Be used by the project management team to plan and manage a successful project for the organization
  - Help gather information from many sources with each having varying levels of completeness and confidence
  - Address the multidimensional nature of project management by providing for repeated feedback loops for additional analysis as new project information is discovered
  - Facilitate project planning across multiple processes

**Notes:**
Key Messages for Unit 5

- Project management team uses the Planning Process Group to plan and manage a successful project for the organization
- Planning Process Group facilitates project planning across multiple processes
- Significant changes occurring throughout the project life cycle trigger a need to revisit one or more of the planning processes and, possibly, some of the initiating processes

Notes:
Unit 6. Organizing the Team

What This Unit is About

This unit discusses teams, and describes how to build a project team. It also discusses the Team Charter.

What You Should Be Able to Do

After completing this unit, you should be able to:

• Define team development
• Describe how to build a project team
• Describe the function of a Team Charter

How You Will Check Your Progress

Accountability:

• Class Discussion
• Team Exercise 6-1: Team Charter

References

Organizing the Team

Unit 6

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Define team development
- Describe how to build a project team
- Describe the function of a Team Charter

Notes:
Project Management Process Groups

Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

Notes:
A Typical Project Team

Figure 6-4. A Typical Project Team

Notes:
What Is a Team?

A team is a group of individuals working toward a common goal

- Your team includes people from your organization, suppliers, clients, and the project sponsor, each of whom brings their own skills to the team
- As the project manager, you must ensure that the team members recognize the skills of the other team members and the ways in which team members depend on each other

Notes:
Definition of Team Development

Team development is a process that includes both enhancing the ability of stakeholders to contribute as individuals as well as enhancing the ability of the team to function as a team.

- Organizes a group of individuals associated in a joint action to commit to achieving common objectives
- Facilitates effective teamwork and team member satisfaction
- Creates an effective team that combines appropriate individual talents with a positive team spirit to achieve results
- Develops individual and group skills/competencies to enhance project performance
- Helps build and rebuild the project team based on the needs of the project

Notes:
# How to Develop a Team

| Plan the activity | - What team are you going to build?  
| - How do you plan to build it?  
| - When do you build the team?  
| - Who do you choose for the team?  
| - What is the team's mission? |

| Select appropriate team personnel | - Interview for the appropriate personnel:  
| - **Technical abilities**—knowledge, experience, and capability  
| - **Personal traits**—independence, self-reliance, goal-oriented, and teamwork |

| Build the team | - Organize the diverse group into a team.  
| - Make specific assignments.  
| - Clearly define roles and responsibilities. |

| Establish communication path | - Ensure meaningful information is communicated.  
| - Keep the information flowing in both directions.  
| - Conduct regularly scheduled status meetings and distribute meeting minutes. |

| Obtain team commitment | - Support the slow but important process of securing team commitment to the project. |

---

**Notes:**

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Creating a Team Charter

The team charter is a document that clearly defines the team’s mission, as well as:

- Sets the performance objectives for the team
- Establishes the roles and objectives of the team members
- Sets the expectations for the team to successfully complete the project
- Establishes the rules of engagement under which the team will operate
- Defines the administrative procedures to be followed

Signing Indicates Acceptance

Notes:
Components of a Team Charter

Team performance objectives
- Agreement and Commitment
- Sign-off on the performance objectives

Expectations of team members
- Openness
- Respect
- Commitment
- Behavior
- Timeliness

Team rules of engagement
- Protocol for meetings
- Protocol for discussion
- Protocol for decision making
- Administrative procedures

Notes:
Project Kickoff Orientation

The objectives of the project kickoff orientation are to:
- Initiate communications
- Develop understanding
- Gain agreement
- Establish PM role as a professional manager

Topics covered include:
- Contract and project description
- Technical overview
- Site implementation/services
- Measures of project success
- Site tour
- Orientation package for each team member

Notes:
Orientation Package

- Project contract and pointers to other important documentation
- Critical project success factors
- Project history and overview
- Project team roles and responsibilities
- Project organization, names, phone numbers, and e-mail addresses
- Project meetings
- Project team job descriptions
- Project communications
- Exception management procedure
- Client satisfaction and project quality procedures
- Status reporting
- Administrative facilities
- Health and safety procedures
- Documentation reference

Figure 6-11. Orientation Package

Notes:
What Is Communications Management?

Communications management includes all the processes required to collect, generate, disseminate, store, and dispose of project information.

- Effective communications management requires communications planning, the process to determine the information and communications needs of the stakeholders; communications planning includes:
  - Establishing appropriate communications links within a project
  - Creating the communications management plan, which describes the plans to meet the information and communications needs of the stakeholders
  - Creating a communications strategy, a set of principles, values and objectives that give coherence to a project communications plan

Identifying the informational needs of the stakeholders and determining a suitable means of meeting those needs is an important factor for project success.

Notes:
Communications Links Within a Project

Figure 6-13. Communications Links Within a Project

Notes:
Communications Management Plan

**Communications Management Plan** - The various communications requirements and your decisions about them are documented in the communications management plan.

The document that describes:
- The communications needs and expectations for the project
- How and in what format information is communicated
- When and where each communication is made
- Who is responsible for providing each type of communications

**Notes:**
Developing the Communications Management Plan

- Need to determine the project's communications requirements; to do this, you must first review:
  - Memos from the sponsor
  - The agreement
  - The project definition
  - The project decision structure
  - The organizational breakdown structure (OBS)
  - Any supplier agreements
  - The project procedures description

- Information needs of the various stakeholders should be carefully analyzed to determine the information that is provided and the sources of that information; information for this analysis can be gathered by:
  - Reviewing sponsor, supplier, and company organizational charts to determine official communications channels
  - Interviewing stakeholders to understand informal communications channels
  - Interviewing constituencies that might have a history with or knowledge of the sponsor or the delivery organization's management
  - Documenting the information requirements of each stakeholder group

Notes:
Set Up a Communications Strategy

- Communicate information to people as soon as you can
- Focus communications on stakeholders and line managers
- More emphasis on face-to-face communications as you approach implementation
- Create a feedback loop to check understanding and to give people the opportunity to voice concerns
- Keep messages clear and simple
- Provide stakeholders and line managers with sufficient information to explain how the project affects their areas
- Use risk management to educate and involve stakeholders (that is, expose them to the implications of options and involve them in the decision making)
- Encourage people to feel they can ask questions/voice concern without jeopardizing their position/future

Notes:
Key Messages for Unit 6

- Development as a team is critical to the project's ability to meet its objectives
- Team development on a project can be complicated when individual members are accountable to both a functional and project manager
- A team charter sets both broad performance objectives for the team and expectations for the project; performance objectives should be measurable
- Effective communications is essential to the success of the project

Notes:
Team Exercise 6-1: Team Charter

Project: RestEasy Hotels
- Read the handout
- As a Team prepare the Team Charter for the RestEasy Hotels Improvement Project Team
- Decide who the Project Manager is for each of the team exercises
- Be prepared to present your work to the class

Notes:
Unit 7. Identifying and Validating Requirements

What This Unit is About

This unit discusses the activities included in identifying and validating project requirements and how to define the baseline.

What You Should Be Able to Do

After completing this unit, you should be able to:

• Describe how to identify and validate project requirements
• Define performance measurement baselines
• Articulate the value of the baselines
• Describe pitfalls in defining requirements

How You Will Check Your Progress

Accountability:

• Class discussion

References

Figure 7-1. Identifying and Validating Requirements

Notes:
Unit Objectives

After completing this unit, you should be able to:
- Describe how to identify and validate project requirements
- Define performance measurement baselines
- Articulate the value of the baselines
- Describe pitfalls in defining requirements

Notes:
### Project Management Process Groups

![Diagram of Project Management Process Groups](image)

**Figure 7-3.** Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle


**Notes:**
Performance Measurement Baselines

- There should be a clear distinction between project plan and performance measurement baselines
- The performance measurement baselines usually change only intermittently, and then generally only in response to an approved scope of work or deliverable change
- Projects have three basic performance measurement baselines:
  - Requirements
  - Schedule
  - Budget
- Often referred to as the baseline

Notes:
**Requirements Baseline and Exclusion Definitions**

- **Needs**: Needs are activities, services, products, and deliverables that are useful, required, or desired.
- **Requirements**: A formally documented description of those sponsor’s needs that have to be addressed by the project.
- **Exclusions**: Statements of *not included* for the current project.
- **Specifications**: A detailed description of features that are to be implemented.
- **Baseline**: The reference data by which execution of project activities are planned and controlled; it consists of elements of the agreement and project management plans; once established, the baseline is under change control.
- **Deliverables**: A work product that must be delivered according to an agreement.

*Notes:*
Identify and Validate Requirements When . . .

- Developing a proposal
- Beginning a project
- Taking over a project already in process (revalidating)
- Reassessing the requirements of a project (mid-project)

Notes:
Process for Defining Customer Requirements

The process of defining requirements includes the following steps:

- Gather customer and stakeholder needs
- Categorize these needs into either requirements or exclusions
- Validate the requirements
- Use the validated requirements as the established requirements baseline for the project

Notes:
Gathering Needs

To gather needs:

- Read all project documentation, such as the contract, documents of understanding (DOU), statements of work, and any other documents that might also contain requirements
- Interview the sponsor
- Prioritize or quantify the answers the sponsor gives you to your questions; this analysis should help you determine the real needs for your project

Notes:
Identifying Customer Requirements

When identifying requirements, questions you might ask include:

- Why do you think we are doing this project?
- What is your role in the business and the project?
- How does this project affect your role?
- What functionality and deliverables do you need?
- Who are your stakeholders?
- What kind of financial impact does this project have on your organization?
- Can the existing infrastructure support your needs?
- What outside support is required?
- How do you define success?
- How long does it last?
- Are similar products already in development or operation?
- What is your completion criteria?

The next step in the requirements-gathering process is to categorize needs into either requirements or exclusions.

Notes:
Categorizing Needs Into Requirements and Exclusions

After you have gathered needs, categorize them into either requirements or exclusions. In effect, you are deciding to:

- Implement all the needs as requirements, because there are no new requirements that have been identified and all needs were in the original Project Definition
- Implement some of the needs now and wait to implement the others in a follow-on project. This approach gives you a graceful way to implement all the needs in an orderly manner without jeopardizing the original project
- Not implement any of the needs now. This approach might be appropriate if the needs are not technically feasible, or the customer is not willing to pay for them

*Documented requirements must be clear and concise, because they form the basis of your project plans*

Notes:
Transforming Needs into Requirements and Exclusions

Examine each identified need and determine if it should be included in your project. To make this decision, ask these questions:

- Is the need part of the original intent of the project?
- Is the need a new function or feature that was not included in the original intent of the project?
- Was the cost of delivering the need included in the original cost estimate?

*Each need that is not a requirement is an exclusion. Document the exclusions so that the sponsor and other stakeholders know what you and your team will not provide in the project.*

**Notes:**
Validating Requirements to Establish the Requirements Baseline

- Validation reviews help you understand if what is written really describes what each person needs.
- The key to the requirements process is validation of the requirements by all parties.
- Validation lets you know that everyone agrees with the requirements and that you can proceed with the project.
- You use validated requirements to establish the requirements baseline.

*Always validate documented requirements with the project sponsor, stakeholders, and project team.*

Notes:
Establishing the Requirements Baseline

The requirements baseline is the requirements document that has been approved by the sponsor, stakeholders, and key members of the project team.

- The baseline defines what the sponsor wants and what the project team has agreed to deliver.
- It is not changed unless the sponsor, stakeholders, and you, the project manager, approve of the change.
- Establishing a requirements baseline is one of the ways you control the scope of a project and avoid scope creep.
- Scope creep occurs when project requirements keep changing; when scope creep is out of control, you never finish a project; the schedule keeps moving out and the costs keep increasing.
- As a project manager, enforcing the requirements baseline is one of your most important tasks.

Notes:
Guidelines for Validating Requirements

- Use a Project Definition Document
- Be realistic when examining requirements
- State the requirements explicitly
- Clarify requirements by using nonverbal exhibits (graphics, models)
- Sort requirements into specifications and exclusions
- Obtain detailed descriptions of problems
- Have clients and project sponsors sign off on a requirements document
- Anticipate and manage change

Notes:
Why It Is Important to Establish a Requirements Baseline

**The Requirements Baseline—**
- Incorporates the original requirements for a project plus or minus approved changes
- Serves as the basis for managing requirements
- Must be signed and approved
- Helps serve as the basis of ensuring that the project is complete
- Sets measurement criteria, helps control the project
- Defines the scope of the project, ensures clarity of scope before detail planning begins

Everyone has to understand that future changes must be agreed to by the sponsor, stakeholders, and you before the changes are made.

**Notes:**
Some Common Pitfalls of Requirements Gathering

- **Unclear requirements:** This is the most common source of difficulty. The more unique a project, the greater the risk of unclear or imprecise requirements
  - Requirements are dynamic and ever-changing because they are defined in relation to their environment
  - You must guide the process and work closely with the sponsor to identify clear requirements

- **Premature solutions:** Coming up with answers before asking all the right questions can result in a premature and incorrect solution offering

- **Lack of clarity about who the sponsor is:** You might find yourself on a project that has conflicting needs. In this instance, your first job is to find out who the sponsor is

- **Biases:** When analyzing requirements, avoid inadvertently altering requirements to reflect one person's biases, rather than the needs of the sponsor

*The requirements-gathering process is iterative; it is important to redo the process and ask a lot of questions*

Notes:
Key Messages for Unit 7 (1 of 2)

- Always do requirements identification, analysis, and validation
- Ensure that you ask the right questions to understand where your project fits in management's business strategy
- Use a systematic approach
- State requirements explicitly, have project staff and the client/project sponsor sign off
- Consider requirements definition between the project team and client/project sponsor
- Know the differences among requirements, specifications, exclusions, and baselines

Notes:
Key Messages for Unit 7 (2 of 2)

- Issues occur that require management and resolution and may result in change
- Performance measurement baselines are essential to controlling the evolution of requirements
- As the project manager, assume responsibility for screening change requests, avoiding scope creep, and revising the baseline

Notes:
Unit 8. Developing a Work Breakdown Structure (WBS)

What This Unit is About

This unit introduces you to the Work Breakdown Structure (WBS). It defines what a WBS is, explains the value of a WBS, and describes the common formats of a WBS. In addition, the process for developing a WBS is presented.

What You Should Be Able to Do

After completing this unit, you should be able to:

• Define and describe the Work Breakdown Structure (WBS)
• Explain the value of WBS
• Describe work packages
• Describe the common WBS formats
• State how to build a WBS dictionary
• Develop a WBS following the fundamental procedures

How You Will Check Your Progress

Accountability:

• Class Discussion
• Team Exercise 8-1: Build a WBS

References

Developing a Work Breakdown Structure (WBS)

Unit 8

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Define and describe the Work Breakdown Structure (WBS)
- Explain the value of a WBS
- Describe work packages
- Describe the common WBS formats
- State how to build a WBS Dictionary
- Develop a WBS following the fundamental procedures

Notes:
Project Management Process Groups

Figure 8-3. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

Notes:
A **Work Breakdown Structure (WBS)** is a deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables; it organizes and defines the total scope of the project.

- Each descending level represents an increasingly detailed definition of the project work.
  - The planned work contained within the lowest-level WBS component, called **work packages**, can be scheduled, cost estimated, monitored, and controlled.
  - The deliverable orientation of the hierarchy includes internal and external deliverables.

- Work not defined in the WBS is outside the scope of the project.

**Note:** The WBS is the heart of the project manager's planning database.

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**Notes:**

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When Is a WBS Created?

The WBS is generated after the team understands the work products to be developed

- Development begins when deliverables are identified and agreed to by the sponsor
  - From this point in project planning, the project scope can be described in measurable and discrete work efforts
- The WBS is used throughout the project as a tool for communication, and it grows and develops with the project from the first day
  - If the project plan is revised, the WBS must also be revised

The approved detailed project scope statement and its associated WBS and WBS dictionary are the scope baseline for the project

Notes:
WBS Relationships

Figure 8-6. WBS Relationships

Notes:
The Value of the WBS

The WBS usually serves as a template for other projects and is used to establish a common understanding of project scope and as a baseline scope document; it provides:

- A single repository for the work elements of a project
- Assistance in creating a clear allocation of responsibilities for work, resources, and cost
- Assistance in identifying areas of risk
- A logical structure for cataloging all work elements
- A standard framework that can be used to develop similar projects, facilitating plan development, and allowing comparisons to be drawn after completion

The WBS is the foundation of the project in terms of planning, estimating, budgeting, funding, scheduling, status reporting, managing risks, measuring performance, and managing change; focuses attention on project objectives

Notes:
Work Package

**Work Package**: A deliverable or project work component at the lowest level of each branch of the work breakdown structure. It is the point at which the cost and schedule for the work can be readily estimated; work packages:

- Result in either an external deliverable or an internal deliverable
  - Internal deliverables are those used by the project
  - External deliverables are those provided to the client or sponsor
- Deliver distinct, identifiable products or results
- Have definitive, verifiable completion criteria
- Equal the sum of their direct activities at the next higher level
- Are clearly assignable as the sole responsibility of a single party, organizational unit, or individual

**Notes:**

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Figure 8-8. Work Package
WBS Formats

Indented List

1.1 xxxxxxxxxxxxx
   1.1.1 xxxxxxxx
   1.1.2 xxxxxxxx
   1.1.3 xxxxxxxx
   1.1.4 xxxxxxxx
   1.1.5 xxxxxxxx
1.2 xxxxxxxxxxxxx
   1.2.1 xxxxxxxx
   1.2.2 xxxxxxxx
1.3 xxxxxxxxxxxxx
1.4 xxxxxxxxxxxxx
   1.4.1 xxxxxxxx

Tree Structure

Project

Notes:
WBS View

![WBS Diagram]

Notes:
Standards for Building a WBS

Building packages:
- Think in terms of nouns for work products
- Ensure that each deliverable in the current baseline has its own work product
- Start at the highest level of the WBS
- Use a top-down approach to identify all the subwork products of each work product
- Create a WBS down to manageable work products

Building activities / tasks:
- Think in terms of verbs for what will be done
- Examine each work product identified in the WBS
- Identify all the activities and tasks needed to develop the work product
- Ensure each activity and task has its own completion criteria
- Ensure the activity meets its completion criteria if all the tasks and subtasks meet theirs

Notes:
Preparing a WBS Dictionary

Work Breakdown Structure Dictionary - A document that describes each component in the work breakdown structure (WBS)

- For each WBS component, the WBS dictionary includes:
  - Brief definition of the scope or statement of work
  - Defined deliverables
  - List of associated activities
  - List of milestones

- It may include:
  - Responsible organization
  - Start and end dates
  - Resources required
  - Estimate of cost
  - Charge number
  - Contract information
  - Quality requirements
  - Technical references to facilitate performance of the work

Notes:
WBS Development Guidelines

- At startup, gather all current baseline materials and project-related information, such as:
  - Project definition document
  - Statement of requirements
  - Technical proposals
  - Supplier proposals

- Conduct a workshop with key people

- Concentrate only on Level 2 or 3 of the WBS

- Use Post-it notes rather than a flipchart, white board, or PC planning tool

- Push responsibility down to those who will be responsible for the work package

- Document each work package, including its completion criteria

Notes:
Questions to Ask

Before building the WBS, ask the following high-level and general questions:

- How is the WBS maintained, stored, and distributed?
- Is a project planning tool be used?
- What numbering standards are used?
- How are project-related overhead costs handled?
- Must all work packages at the same level be comparable in size and importance?
- Must each branch be developed down to the same level?
- Can each of the lower-level work activities be assigned to an individual or organization for approximately 40 hours?
- Can each work activity be measured in terms of progress to completion?
- Is there buy-in from the organization or individual that is responsible for the work package or activity?

Notes:
Review / Validate WBS

1. Review results with all key team members and ensure buy-in from all parties
2. Ensure that the WBS covers all work packages and that ALL cost factors related to the project (direct and overhead) are included
3. Review how the WBS is used and maintained during the project
4. Review results from both top-down and bottom-up approaches

<table>
<thead>
<tr>
<th>Top-Down</th>
<th>Bottom-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a range of more than 10 activities at any level?</td>
<td>Can responsibility be assigned to an individual?</td>
</tr>
<tr>
<td>Are activities similar in duration and effort?</td>
<td>Can completion criteria be defined?</td>
</tr>
<tr>
<td>Can responsibility be assigned to the activities?</td>
<td>Can the work package be accurately estimated?</td>
</tr>
<tr>
<td>Are all the deliverables represented?</td>
<td>Is the work package a size that is manageable and controllable?</td>
</tr>
<tr>
<td>Are the project management activities complete?</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

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Key Messages for Unit 8

- As a cornerstone of feasible project planning, the WBS serves as an important tool for task analysis and project control
- The WBS identifies all tasks to accomplish the project
- When constructing a WBS, limit the level of detail to improve level control
- Levels of detail should be specified for task and assignment estimating and deliverables
- Use the WBS to modify and update the project plan as the project moves along
- The WBS focuses attention on project objectives, encourages detailed planning and documentation, clarifies responsibilities, and identifies specific work packages for estimating and assigning work
- Prepare a WBS dictionary to provide detailed background on each element in the WBS

Notes:
Team Exercise 8-1: Build a WBS

Project: RestEasy Hotels

1. Read the handout
2. Review any previous documents to identify relevant background information
3. Build a WBS that has no more than two major activities and for each activity three to five tasks
4. Be prepared to present your work to the class

Notes:
Unit 9. Risk Management

What This Unit is About

This unit covers procedures for monitoring and controlling project risk throughout the life cycle of the project. It details risk management processes and techniques. It concludes with a risk management team exercise.

What You Should Be Able to Do

After completing this unit, you should be able to:

- Define risk, risk event, risk probability, and impact of the event
- Identify two major types of risk
- Describe the processes included in risk management
- List the tools and techniques used to identify risk
- State what to consider when evaluating risk
- Describe the risk mitigation strategies
- State what to do to monitor risk
- Describe the project manager’s role in risk management
- Prioritize risks and create a risk mitigation plan

How You Will Check Your Progress

Accountability:

- Class Discussion
- Team Exercise 9-1: Risk Management

References

Risk Management

Unit 9

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Define risk, risk event, risk probability, and impact of the event
- Identify two major types of risk
- Describe the processes included in risk management
- List the tools and techniques used to identify risk
- State what to consider when evaluating risk
- Describe the risk response planning strategies
- State what to do to monitor and control risk
- Describe the project manager's role in risk management
- Prioritize risks and create a risk response plan

Notes:
Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

Notes:
Definition of Project Risk

**Project Risk** is an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective, such as time, cost, scope, or quality; a risk may have one or more causes and, if it occurs, one or more impacts.

- **Risk components include:**
  - **Event** - An event is what could happen, or the transformation from a risk to an actual event
  - **Probability** - Probability is how likely the event is to happen
  - **Impact** - Impact is to what degree an event could affect the project cost, schedule, or quality

**Notes:**
Major Risk Types

Business risk is a normal risk of doing business that involves various opportunities for profit or loss

Pure risk (insurable) is:
- A risk involving the probability or possibility of loss with no chance for gain
- The risk that should receive the greatest attention
- Risk that can be transferred to another party through:
  - Contracting
  - Using a warranty
  - Insurance

Notes:
Project Risk Management

Project Risk management is the systematic process of identifying, analyzing, and responding to project risk; it includes processes concerned with:

- Conducting risk management planning
- Identification
- Analysis
- Responses
- Monitoring and control on a project

The objectives are to:

- Increase the probability and impact of positive events
- Decrease the probability and impact of events adverse to the project

Notes:
Risk Management Processes

Figure 9-7. Risk Management Processes

Notes:
Benefits of Risk Management

Risk management:
- Protects cost, schedule, and specifications
- Maximizes the results of positive events
- Minimizes the consequences of adverse events
- Prevents surprises
- Focuses on building the right offering the first time
- Prevents management by crisis
- Prevents problems from occurring or, if they do occur, from escalating

Figure 9-8. Benefits of Risk Management

Notes:
When to Use Risk Management

Risk management is used throughout the project life cycle.

<table>
<thead>
<tr>
<th>Life Cycle Phase</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initiating Phase</strong></td>
<td></td>
</tr>
<tr>
<td>Initiating Processes</td>
<td>None</td>
</tr>
<tr>
<td><strong>Intermediate Phases</strong></td>
<td></td>
</tr>
<tr>
<td>Planning Processes</td>
<td>Risk Management Planning</td>
</tr>
<tr>
<td></td>
<td>Risk Identification</td>
</tr>
<tr>
<td></td>
<td>Qualitative Risk Analysis</td>
</tr>
<tr>
<td></td>
<td>Quantitative Risk Analysis</td>
</tr>
<tr>
<td></td>
<td>Risk Response Planning</td>
</tr>
<tr>
<td>Executing Processes</td>
<td>None</td>
</tr>
<tr>
<td>Monitoring &amp; Controlling Processes</td>
<td>Risk Monitoring and Control</td>
</tr>
<tr>
<td><strong>Final Phase</strong></td>
<td></td>
</tr>
<tr>
<td>Closing Processes</td>
<td>Lessons Learned</td>
</tr>
</tbody>
</table>

Notes:
Risk Management Planning - Step 1

Risk Management Planning - is the process of deciding how to approach, plan, and execute risk management activities for a project. It is important to plan for the risk management processes that follow to:

- Ensure that the level, type, and visibility of risk management are commensurate with both the risk and importance of the project to the organization
- Provide sufficient resources and time for risk management activities
- Establish an agreed upon basis for evaluating risk
- Identify and validate stakeholders’ risk policies and statements
- Generate the Risk Management plan

"Plan the Work and Work the Plan"

Notes:
Risk Identification - Step 2

Risk Identification - Is the process of determining which risks might affect the project and documenting their characteristics; in this step, the emphasis is, as stated, identification

- Locate the risks that affect the project
- Display internal and external risk sources
- Disclose the causes and effects of the risk
- Include appropriate subject matter experts, stakeholders, and outside experts
- Categorize risks: Project Management risks, organizational risks, external risks

Output of Risk Identification is the Risk Register

Risk Identification is an iterative process because new risks may become known as the project progresses through its life cycle

Notes:
Risk Identification Tools and Techniques

Some key tools and techniques to use to identify risks are:
- Run a risk identification workshop (cross section of the project's stakeholders)
- Documentation reviews
- Information gathering techniques
- Review the risk assessment checklists created by the organization
- Interview key members of the project team
- Examine sources of risk:
  - WBS
  - Cost estimates and duration estimates
  - Staffing plan
  - Procurement management plan
- Study lessons learned from previous projects
Qualitative Risk Analysis - Step 3

**Qualitative Risk Analysis** - Is the process of assessing the impact and likelihood of identified risks, and prioritizing the risks according to their potential impact on project objectives

- Estimate the probability that each identified risk event does or does not occur
- Determine the impact of the risk event (the amount at stake or what can be lost)
- Rank the risks based on the probability/impact
- Identify the risks that are managed (mitigated)

Evaluating risk reduces event outcome uncertainty

**Notes:**
Evaluation of Risk

When analyzing the risk, consider the:

- Probability of occurrence
- Magnitude of loss or impact of each identified risk event
- Severity of risk (Severity = Probability x Impact)

Evaluation factors include:

- Precedence (Has the risk occurred before?)
- Familiarity of operation (Has the work been undertaken before?)
- Resources and skills
- Time, cost, and quality
- Probability (What is the likelihood of the risk occurring?)
- Impact (What is the effect on the project or business?)

Notes:
Probability Measurements

The three probability categories most commonly used are:

- **Low** Has little potential to disrupt the schedule, increase cost, or degrade performance
- **Moderate** Has potential to disrupt the schedule, increase cost, or degrade performance
- **High** Likely to significantly disrupt the schedule, increase cost, or degrade performance

Notes:
Impact Analysis

The impact of the risk should be measured in terms of the cost to the project:

- Low
- Moderate
- High

The process steps of impact analysis include:
1. Structure the problems
2. Identify risk items
3. Define the combined risk effects of activities
4. Report the findings

Figure 9-16. Impact Analysis

Notes:
Risk Severity

Severity of a Risk Event = Risk Probability \times Impact of a Risk

A matrix is a tool to represent the combination of the probability and impact.

<table>
<thead>
<tr>
<th>Probability</th>
<th>Impact</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Notes:
Prioritization of Risks

- Prioritize risks to decide whether the risk events are worthy of attention
- Finalize prioritization of identified risks after the qualitative analysis has been conducted
- Identify your top 10 major risks
  - Develop mitigation strategies for each
  - Revise and review the top 10 on a regular basis
  - Use the top 10 as an agenda item for regular project meetings

Figure 9-18. Prioritization of Risks

Notes:
Practical Approach for Prioritizing Risks

- Rank analyzed risk events from highest to lowest
- Use quantitative rankings when possible; otherwise use qualitative rankings
- Separately rank risk events with similar severity
- Prioritize risk events as a team
- Do not plan risk response strategies as a part of this process

Notes:
Quantitative Risk Analysis - Step 4

Quantitative Risk Analysis - Is the process that aims to analyze numerically the probability of each risk and its consequence on project objectives, as well as the extent of overall project risk

- Calculate the severity (the risk exposure) based on the risk probability and impact determined during the Qualitative Risk Analysis step
- Prioritize the list of quantified risks
- Rank the risks based on the severity
- Identify the risks that will be managed (mitigated)

Performed on risks that have been prioritized by the Qualitative Risk Analysis process as potentially and substantially impacting the project’s competing demands

Notes:
Quantitative Risk Analysis Tools and Techniques

Some key tools and techniques to use to identify risks are:

- Data gathering and representation techniques
  - Interviewing - used to quantify the probability and impact of risks on the objectives of the project
  - Probability distributions - used to represent uncertainty in values (continuous) or uncertain events (discrete)
  - Expert judgment - use subject matter experts internal or external to the organization to validate data and techniques

- Quantitative risk analysis and modeling techniques
  - Sensitivity analysis - helps to determine which risks have the most potential impact on the project
  - Expected monetary value analysis - statistical concept that calculates the average outcome when the future includes scenarios that may or may not happen
  - Decision tree analysis - usually structured using a decision tree diagram that describes a situation under consideration and the implications of each of the available choices and possible
  - Modeling and simulation - translates the uncertainties specified at a detailed level of the project into their potential impact on project objectives

Notes:
Risk Response Planning - Step 5

**Risk Response Planning** - Is the process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives

- It includes the identification and assignment of individuals or parties to take responsibility for each agreed to and funded risk response
- Addresses the risks by their priority, inserting resources and activities into the budget, schedule, and project management plan, as needed
- Uses four classifications of response strategies:
  - Strategies for Negative Risks or Threats (Avoid, Transfer, Mitigate)
  - Strategies for Positive Risks or Opportunities (Exploit, Share, Enhance)
  - Strategies for Both Threats and Opportunities (Acceptance)
  - Contingent Response Strategy

*Notes:*
Practical Approach for Risk Response Planning Strategies to Mitigate Risk

- Work down prioritized risk listing for the risk analysis steps
- Consider risk classes to avoid duplication of effort
- Create various response alternatives
  - Assess alternatives and select preferred alternative for each risk or risk class
  - Incorporate selected alternatives into the risk management plan, other project plans, and the WBS
- Communicate decisions with appropriate stakeholders

Notes:
Risk Response Strategies (1 of 2)

Strategies for Negative Risks or Threats

- **Avoid** - Risk avoidance involves changing the project management plan to eliminate the threat posed by an adverse risk, to isolate the project objectives from the risk's impact, or to relax the objective that is in jeopardy
- **Transfer** - Risk transference requires shifting the negative impact of a threat, along with ownership of the response, to a third party
- **Mitigate** - Risk mitigation implies a reduction in the probability and/or impact of adverse risk event to an acceptable threshold

Strategies for Positive Risks or Opportunities

- **Exploit** - This strategy seeks to eliminate the uncertainty associated with a particular upside risk by making the opportunity definitely happen
- **Share** - Sharing a positive risk involves allocating ownership to a third party who is best able to capture the opportunity for the benefit of the project
- **Enhance** - Modifies the size of an opportunity by increasing probability and/or positive impacts and by identifying and maximizing key drivers of these positive-impact risks

Notes:
Risk Response Strategies (2 of 2)

Strategies for Both Threats and Opportunities

- **Acceptance** - Indicates that the project team has decided not to change the project management plan to deal with a risk or is unable to identify any other suitable response strategy.

Contingent Response Strategy

- **Risk Contingency Planning**: Prepare a plan of action in case the risk occurs.
- **Contingency Allowance or Risk Reserve** - The amount of money or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable to the organization (most usual acceptance response).

Notes:
Developing a Risk Response Planning Action Plan

The risk response planning action plan should include:

- Identified risks with their descriptions, the areas of the project affected, their causes, and how they may affect the project objectives
- Who owns and is responsible for managing which risks
- Results from the qualitative and quantitative risk analysis processes
- Agreed to response strategies for each risk in the risk plan
- Specific actions to implement the chosen response strategies
- Level of residual risk expected to be remaining after the strategy is implemented
- Budget and times for responses
- Contingency and fallback plans


Notes:
Risk Monitoring and Control - Step 6

**Risk Monitoring and Control:** Is the process of tracking identified risks, monitoring residual risks, identifying new risks, executing risk response plans, and evaluating their effectiveness throughout the project life cycle.

- Conduct checkpoint reviews by external specialists
- Identify new risks that might result from changes
- Implement the risk response plan if the risks occur

*Is an ongoing process for the life of the project; risk changes as the project matures, new risks develop, or anticipated risks disappear*

---

**Notes:**
Project Manager's Role in Risk Management

Ensure that risk management happens

- Involve your team and other stakeholders rather than doing it all yourself
- Incorporate risk management into the project management planning processes
- Choose the right risk management strategies (for example, containment or contingency) to fit each risk event
- Monitor and control risk on a regular basis
- Reassess risk after each risk event for probability, impacts, and new events
- Communicate effectively about risk to appropriate project stakeholders
- Make sure that the risk management plan is maintained

Take action!

Notes:
Key Message for Unit 9

- Risk management is essential to project success
- Use risk management to maximize the positive result and minimize the negative consequences
- Document risk management standards and procedures and review them with the project team on a regularly scheduled basis
- Take action to assess and control each risk item
- Review the outcome of each action formally
- Risk includes opportunities for gain as well as a potential for loss
- Risk management is a repetitive process done throughout the life cycle of the project

Risk can be managed

Notes:
Team Exercise 9-1: Risk Management

Project: RestEasy Hotels

Read the handout and answer the following questions:

1. Which risks could have been identified during project definition?

2. Assign a value (L/M/H) to each risk for impact and probability, and assess the resultant severity:
   - A value for likelihood (L = Low, M = Moderate H = High)
   - A value for impact (L = Low, M = Moderate H = High)
   - Order the risks in priority sequence of severity

3. How can the consequences of the highest severity risks be reduced?

Notes:
Unit 10. Establishing a Project Estimate

What This Unit is About

This unit introduces you to estimating processes. It explains essential estimating terms and estimating techniques. In addition, it discusses methods for estimating and outlines the steps for validating estimates.

What You Should Be Able to Do

After completing this unit, you should be able to:

• Define an estimate
• Determine what to estimate
• Define essential estimating terms
• Describe estimating processes to determine project cost and activity duration
• Explain various methods used in project estimating
• Define estimating unit (EU)
• Differentiate between cost estimating and cost budgeting
• Define contingency reserve and state how it is used
• Generate and validate an estimate

How You Will Check Your Progress

Accountability:

• Class Discussion
• Team Exercise 10-1: Estimating

References

Establishing a Project Estimate

Unit 10

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Define estimate
- Determine what to estimate
- Define essential estimating terms
- Describe estimating processes to determine project cost and activity duration
- Explain various methods used in project estimating
- Define estimating unit (EU)
- Differentiate between cost estimating and cost budgeting
- Define contingency reserve and state how it is used
- Generate and validate an estimate

Notes:
Project Management Process Groups

Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle


Notes:
Definition of Estimating

Estimating:

- Is the process of determining effort, duration, and costs for the elements in the WBS
- Is the process of identifying what resources are necessary for each work package
- Is the process of identifying the *should cost* for each project task and activity
- The following terms are key parts of estimating:
  - **Effort** is the number of labor units required to complete a task. It is usually measured in staff hours, or person-hours
  - **Level of effort (LOE)** describes the activities that are necessary to support a project that cannot be scheduled
  - **Duration** is the number of work periods, excluding holidays or other nonworking periods, required to complete an activity or other project element

Estimating is done as early in the project life cycle as possible and is normally repeated a number of times throughout the life of the project as changes in the project dictate

Notes:
What an Estimate Is

An estimate is:

- An assessment of the likely quantitative result
- Usually applied to effort, project cost factors (labor hours or money, or both) and the schedule (duration)
- Used with an indication of accuracy (for example, + n percent)
- Usually used with a modifier (for example, preliminary, conceptual, feasibility, or final)
- Completed at a level that is appropriate for the decisions being made with the data (for example, close-in estimates are more detailed than those for periods three to six months in the future)

An estimate is just that--an estimate. The only perfect estimate is the one done after the work is completed

Notes:
What an Estimate is NOT

An estimate is not:

- An accounting or marketing strategy
- A pricing approach, because the price might or might not accurately reflect the estimate
- An investment approach, because it is not worth taking a risk today to get business later
- A way to ensure sponsor satisfaction, such as arbitrarily reducing your estimate to meet some implied number (you must present reality)
- Software or tools
- Finding the fastest way (The schedule should not unduly influence the estimate--be realistic and honest)

Figure 10-6. What an Estimate Is NOT

Notes:
Items to Include in an Estimate

An estimate should include all of the following items:

- The scope of the work that is included in the estimate
- The assumptions that were used
- Resources, such as staff, facilities, and material; consider the duration
  - How quickly can the task be done with the skills available?
  - What skill level is required to do the job?
  - Project management should be included
- Expenses, both direct and indirect
- Risk and the cost of managing it to acceptable levels
- Documentation, which is critically important
  - If an estimate is not documented, it only exists within the head of one person
  - The written estimate must contain the assumptions made when the estimate was developed

Notes:
What To Do If Asked To Lower An Estimate

If you are asked to lower your estimate because the price is too high, what are your options?

To lower the price, you can
- Reduce the scope,
- Reduce risk and associated contingency
- Possibly reduce resource at the expense of schedule
- Management can decide to lower the profit margin

The degree of accuracy of an estimate depends on what phase of the development cycle you are in; in the concept phase, the estimate has a lower degree of accuracy than in the planning phase.

Notes:
Reasons for Estimating

Estimating enables project managers to:

- Determine and evaluate the estimated costs of a project before authorizing implementation
- Have a basis for tracking and managing project expenditures using activity-based costing or other methods
- Establish managerial baselines against which to measure expenditures during the execution of the project
- Have a tool for evaluating routine project decisions
- Establish resources required and the resulting schedule
- Provide fact-based information to support investment analysis
- Provide a basis for tracking progress

Many cost and schedule overruns can be traced back to a poorly developed estimate, but even when the overrun is the result of poor execution, a good estimate should have included allowances for this

Notes:
When to Estimate

Estimating is not a one-time effort; it is done many times throughout the project life cycle

- There are different points in a project when an estimate should be prepared, reviewed, or revised:
  - Create the estimate when building the project organizational work plans for the project
  - Update the estimate when finalizing the project plan with updated work plans
  - When determining whether to bid on an opportunity
  - When taking over a project to validate proposal estimates
  - When moving to the next phase of a project
  - When an assumption proves to be invalid
  - When the WBS changes to ascertain the effort and cost associated with the change
  - When there are authorized changes in resources, materials, or services

You must develop the WBS before preparing an estimate, even if it is only the preliminary version

Notes:
Estimating Process

Figure 10-11. Estimating Process

Notes:
Estimating Considerations

- When you prepare estimates, make sure you know the language used in estimating.

- Estimates vary, depending on whether the task is based on effort or duration.

- Key difference is elapsed time versus working time.

- Keep in mind that the time it takes to complete a task depends on both availability and productivity.

Notes:
Estimating Guidelines

Estimating enables you to determine effort and duration for the elements in the WBS. Some guidelines for preparing estimates are:

- Effort should be based on average skill
  - If team members or experts are assisting you in preparing an estimate, remind them to estimate based on average skill level; by using average skill level when estimating, it assures you that the task can still be completed as estimated
- Duration is based on utilization rate
- Cost is calculated based on an assumed labor rate resulting in a cost estimate

Notes:
### Essential Estimating Terms (1 of 2)

**Effort**

The number of labor units required to complete a task; it is usually measured in staff hours or person hours.

**Level of effort (LOE)**

This describes the activities that are necessary to support a project that cannot be scheduled; these activities, which are characterized by a uniform rate of activity, are difficult to measure in terms of discrete accomplishments but are usually measured in staff hours for the duration of the activity.

**Duration**

This is the number of work periods, excluding holidays or other nonworking periods, required to complete an activity or other project element; duration is usually expressed in work days or work weeks and there are two types of duration:

- **Contiguous duration** is work time that is not interrupted
- **Interruptible duration** is work time that might be interrupted

**Effort-based**

The task has a total amount of effort that must be completed in order to finish the task (This might also be referred to as *staff effort* and is usually expressed in person hours)

**Duration-based**

The duration is constant regardless of how many resources are assigned to the task.

---

**Notes:**
### Essential Estimating Terms (2 of 2)

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Is the time a staff person is available and willing to work (this is usually measured in work hours per day or working days)</td>
</tr>
<tr>
<td>Productivity</td>
<td>Is a relative measure of work in a time unit; different skill levels have different productivity rates and you must determine which productivity should be used for the estimate (the safest approach is to use an average productivity of 80%)</td>
</tr>
<tr>
<td>Utilization</td>
<td>Is the amount of time a full-time equivalent (FTE) can be used on a project; an FTE is not necessarily a specific individual but can be the combining of two or more individuals whose efforts equal one work day or a portion of a work day</td>
</tr>
<tr>
<td>Utilization factor</td>
<td>Describes the amount of time a full-time equivalent (FTE) can be used for the length of the project</td>
</tr>
<tr>
<td>Working time</td>
<td>Is the actual amount of time available for work. Usually measured in working hours/day, working hours/week, working hours/month (working time takes into account the working hours or time available for project team members)</td>
</tr>
<tr>
<td>Elapsed time</td>
<td>Is the total number of days over which the task occurs (this is also called calendar time, and is usually expressed in calendar days, weeks, or months)</td>
</tr>
</tbody>
</table>

**Notes:**
Estimating Formulas

Cost = (Effort/Productivity) x Unit Cost

Duration = (Effort/Productivity)/Availability

Notes:
Methods of Estimating

The most common estimating methods are:

- **Top-down estimating**: compares historical data with experience, this approach is based on collecting judgments, past experiences, and on evaluating past data concerning similar activities

- **Bottom-up estimating**: involves estimating the cost and duration of individual activities or work packages, which are summarized or combined, resulting in a project total

- **Analogous Estimating**: means using the actual cost of a previous, similar project as the basis for estimating the cost of the current project (also called analogy/comparison)

- **Parametric modeling**: uses specific measures to estimate the effort required to complete a task or to produce a work product

- **Expert judgment**: uses expertise provided by any individual or group with specialized knowledge

- **Vendor bid analysis**: provides sources for well-done cost proposals, for bids, and for reasonable price packages

Notes:
### Characteristics of the Types of Estimates

Different projects under different situations require the use of specific estimating methods; three common types of estimates are Rough Order of Magnitude (ROM), Budget, and Definitive.

<table>
<thead>
<tr>
<th>Type</th>
<th>Precision</th>
<th>When (phase)</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM</td>
<td>-25%+75%</td>
<td>Initial, Concept</td>
<td>Analogous, parametric, expert judgment, top-down</td>
</tr>
<tr>
<td>Budget</td>
<td>-10%+25%</td>
<td>Concept, Decision making, Response to proposals</td>
<td>Analogous, parametric, expert judgment</td>
</tr>
<tr>
<td>Definitive</td>
<td>-5%+10%</td>
<td>Plan, Proposal</td>
<td>Analogous, parametric, expert judgment, bottom-up, vendor bid</td>
</tr>
</tbody>
</table>

**Notes:**

Figure 10-18. Characteristics of the Types of Estimates
Estimating Type Descriptions

- ROM is a top-down approach used during the formation of the project for initial evaluation and during the concept phase
  - A high-level estimate based on analogy/comparison, parametric, or expert judgment using past experiences and past data for similar activities
  - Less costly and less accurate
- Budget is developed from more detailed project analysis
  - Budget is also called the design, control, or appropriation estimate
- Definitive is a bottom-up (task-by-task) approach prepared from well-defined data and specifications
  - An estimate of individual work items in hours
  - Project total is a rollup or summary of the individual work items
  - Size of individual work items drives cost and accuracy

Notes:
Estimating Units (EU)

- Estimating units (EUs) are specific units used to estimate the effort required to complete a particular task or to produce a particular work product.

- When estimating units, remember that:
  - An EU can apply to more than one task.
  - Each task must have at least one EU.
  - More EUs can be identified for a task, but more than three EUs per task is unwieldy.
  - EUs can be categorized into three types:
    - Count
    - Scaling factor
    - Fixed range

Notes:
Sample Usage of the Matrix

<table>
<thead>
<tr>
<th>Hours</th>
<th>Simple</th>
<th>Average</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>1</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Medium</td>
<td>3</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Large</td>
<td>7</td>
<td>10</td>
<td>16</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Frequency Matrix</th>
<th>Simple</th>
<th>Average</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Medium</td>
<td>5</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>Large</td>
<td>2</td>
<td>3</td>
<td>3</td>
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</table>

<table>
<thead>
<tr>
<th>Technical Effort</th>
<th>Simple</th>
<th>Average</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
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<td>Small</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Medium</td>
<td>15</td>
<td>140</td>
<td>84</td>
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<tr>
<td>Large</td>
<td>14</td>
<td>30</td>
<td>48</td>
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</tbody>
</table>

Total: 341

Fixed range

Notes:
### Bottom-Up Example

This bottom-up estimate example is derived from the work element up, aggregate reflecting the total project cost.

<table>
<thead>
<tr>
<th>WBS</th>
<th>Name</th>
<th>Cost</th>
<th>Sum</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Developing a training course</td>
<td></td>
<td></td>
<td>$65,250</td>
</tr>
<tr>
<td>1.1</td>
<td>Phase I-Planning and Design</td>
<td></td>
<td></td>
<td>$19,700</td>
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<tr>
<td>1.1.1</td>
<td>A-Gathering requirements</td>
<td>$6,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.2</td>
<td>B-Analyze tasks</td>
<td>$4,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.3</td>
<td>C-Define objectives</td>
<td>$3,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.4</td>
<td>D-Write high-level plan</td>
<td>$5,600</td>
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<tr>
<td>1.2</td>
<td>Phase II-Developing the Course</td>
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<td>1.2.1</td>
<td>A-Write content</td>
<td>$10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.2</td>
<td>B-Create media</td>
<td>$6,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.3</td>
<td>C-Review content</td>
<td>$6,400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.4</td>
<td>D-Edit content</td>
<td>$5,250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.5</td>
<td>E-Produce the course</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.5.1</td>
<td>i-Format the course</td>
<td>$2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.5.2</td>
<td>ii-Produce Student Notebooks</td>
<td>$3,750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.5.3</td>
<td>iii-Produce Instructor Guide</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Phase III-Pilot the Course</td>
<td></td>
<td>$8,400</td>
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<tr>
<td>1.3.1</td>
<td>A-Conduct the pilot</td>
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<tr>
<td>1.3.2</td>
<td>B-Evaluate the course</td>
<td>$520</td>
<td></td>
<td></td>
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<tr>
<td>1.3.3</td>
<td>C-Finalize the course</td>
<td>$5,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes:

Figure 10-22. Bottom-Up Example
Validating an Estimate

To validate an estimate:

- Review the definition of the project
- Use same information and assumptions as original estimate
- Focus on sources of data
- Compare standards from a similar project
- Review the estimating method to see whether it is appropriate
- Determine whether the estimate meets the objective
- Use different approaches to validate the estimate
- Ensure that all mitigation tasks are included in the estimate
- Pay extra attention to Big Ticket items

Validate all estimates before you consider them to be complete

Notes:
Rules of Estimating

When you estimate a project:
- Employ the most appropriate approach and the most accurate method
- Communicate the level of accuracy
- Involve the project team that are on board in the estimating process so that they can provide insight and can become vested in the process
- Use history as a base for estimates
- Apply standards when they are available
- Do not work to justify a predetermined result
- Do not undervalue estimates
- Recognize that estimating takes time
- Document the assumptions the estimate is based upon (This is a mandatory step in the process)

The rules of estimating focus on honesty; each rule is crucial to successful estimating.

Notes:
Questions about the Estimator

- **Who is doing the estimates?**
  - Is the person doing the work estimating his/her work effort?
    - Better estimate
    - Buy-in

- **Does the estimator have experience?**
  - Knowledge of the client's environment
  - Knowledge of the project
  - Knowledge of the tools to be used on the project:
    - Project management tools
    - Technical tools

- **What is the estimator's estimating history?**

- **Does the estimator estimate by task or by person?**

---

*Notes:*
Cost Estimating and Cost Budgeting

- One reason for creating a project budget estimate is to provide a basis for tracking and managing project costs; specific tasks within the estimating process are **cost estimating** and **cost budgeting**

  - **Cost estimating** - consists of determining the cost of all of the elements needed to complete the project
  
  - **Cost budgeting** - is the allocation of the determined cost estimates to individual project components so that those costs can be measured and managed as the project is executed

- When approved, the budget is placed under change control and is the basis for establishing the financial measurement baseline of the project

**Notes:**
**Terms Used within Cost Estimating and Cost Budgeting**

- **Costs** - are the funds a company spends to produce products or establish an infrastructure to provide services; examples are labor, raw materials, third-party software or hardware, and subcontracted work.

- **Direct costs** - are incurred for the benefit of a specific project; project managers can usually control direct costs.

- **Indirect costs** - are incurred for the joint benefit of multiple projects and are applied through an allocation process; project managers usually have less control over indirect costs and frequently overlook them.

- **Fixed costs** - occur regardless of the complexity of the project; an example of a fixed cost is plant maintenance.

- **Variable costs** - vary in relationship to related activities within the project; an example of a variable cost is the price of a piece of copper.

- **Brand costs** - are the expenditures made to manufacture, distribute, and support a product or offering; examples are warranty, software manufacturing, direct labor, and factory overhead.

**Notes:**
Questions to Ask When Cost Estimating

- When you are preparing a cost estimate, ask the following questions:
  - What are the differences between fixed and variable costs?
  - How do fixed and variable costs impact your project?
  - What is the difference between direct and indirect cost?
  - What are examples of costs you incur on projects?
  - What are the types of these incurred costs?
Key Messages for Unit 10

- Select the right method to do your estimates
- Base estimates on the current approved scope and baselines of the project
- Estimates should include an indication of accuracy (for example, ± percent)
- Change your estimates when there are authorized changes in scope, resources, materials, and services
- Document all assumptions used in developing the estimate
- Remember that estimates affect project schedule, cost, profit, and client satisfaction
- Validate and/or revalidate estimates throughout the life cycle

Remember an estimate is not a budget

Notes:
Team Exercise 10-1: Estimating

**Project:** RestEasy

1. Read the handout
2. Review any previous documents to identify necessary background information
3. Use the subtasks defined in the table to conduct your estimate and answer the questions

*Notes:*
Unit 11. Creating a Project Schedule

What This Unit is About

This unit covers project scheduling. It explains what a project schedule is and defines basic scheduling terminology. It identifies different techniques used to develop network diagrams and explains how to construct a network diagram. It defines terms used in the critical path method and explains how to do a forward pass, a backward pass, and how to identify the critical path. The unit concludes with a team scheduling exercise.

What You Should Be Able to Do

After completing this unit, you should be able to:

• State the purpose of a project schedule
• Define basic scheduling terminology
• Identify different types of network diagramming techniques used to develop network diagrams
• Explain the relationship between the WBS and a network logic diagram
• Explain how to construct a network logic diagram
• Define the terms used in the critical path method
• Describe how to do a forward pass, a backward pass, and how to identify the critical path
• State how to review a project schedule and adjust it to meet project objectives
• Use the network logic and scheduling approaches to develop a schedule

How You Will Check Your Progress

Accountability:

• Class Discussion
• Team Exercise 11-1: Precedence Diagram Method (PDM)
• Team Exercise 11-2: Scheduling
References

Creating a Project Schedule

Unit 11

Figure 11-1. Creating a Project Schedule

Notes:
Unit Objectives

After completing this unit, you should be able to:

- State the purpose of time management and a project schedule
- Define basic scheduling terminology
- Identify different types of network techniques used to develop network diagrams
- Explain the relationship between the WBS and a network diagram
- Explain how to construct a network diagram
- Define the terms used in the critical path method
- Describe how to do a forward and a backward pass and how to identify a critical path
- State how to review a project schedule and adjust it to meet project objectives
- Use the network logic and scheduling approaches to develop a schedule

Notes:
Project Management Process Groups

**Figure 3-2.** Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle


Notes:
What Is a Schedule?

A schedule is any plan structured on a time dimension, including a project management schedule, financial plan, operational schedule, and staff schedule.

A project management schedule is a road map of a project that states the duration and sequence of events and activities; more specifically, it states what is done, when it is done, and who is responsible.

- It is composed of estimates, work products, activities, and tasks from the WBS, and resource information.
- A schedule also contains the planned dates for performing activities and meeting milestones and defines how the current project interlocks with other projects.
- A project management schedule can be represented in a variety of ways; three of the most common are precedence diagram, Gantt chart, and milestone chart.

Schedules are key management tools for tracking and communicating the progress of a project.

Notes:
The Purpose of Scheduling

The project schedule is used to:

- Track the planned versus actual progress of your project and show your team and your sponsor how the project is progressing
- Evaluate the planned versus actual progress of your project, and determine whether to revise the project to meet major milestones and completion dates
- Determine whether to accept or reject a change based on how it affects the sequence of tasks, resources needed, staff responsibilities, major milestones and project completion date

Communicate the project’s status to all parties about issues such as:

- Whether the tasks and activities are likely to result in successful project completion
- When resources are needed for the project
- What the major milestones are and when they occur
- The critical path, the series of activities that determines the duration of the project

A schedule is the planned dates for performing activities and for meeting milestones

Notes:
### Basic Scheduling Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task</strong></td>
<td>A task is a subdivision or portion of an activity; it describes the lowest level of the WBS</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td>An activity is an element of work performed over a period of time within the project; it is a specific piece of work in the WBS which has a measured beginning and a measured end</td>
</tr>
<tr>
<td><strong>Event</strong></td>
<td>Specific points in time, starting and ending points of activities, typically represented by circled numbers in a schedule</td>
</tr>
<tr>
<td><strong>Milestone</strong></td>
<td>A milestone is an achievement or a significant event in the project or subproject, such as a major decision or completion of an important activity; it is an activity that has zero duration and zero resources</td>
</tr>
<tr>
<td><strong>Precedence relationship</strong></td>
<td>A precedence relationship is a dependency between two activities, or between a project activity and a milestone</td>
</tr>
<tr>
<td><strong>Precedence Diagramming Method (PDM)</strong></td>
<td>The precedence diagramming method (PDM) is a means of constructing a project network diagram using nodes to represent activities and connecting them with arrows to show the dependencies; also referred to as an activity-on-node (AON)</td>
</tr>
<tr>
<td><strong>Project Network Diagram</strong></td>
<td>A project network diagram is any schematic display of the dependencies among project activities</td>
</tr>
</tbody>
</table>

### Notes:

- Figure 11-6. Basic Scheduling Terminology
Including Level-of-Effort Tasks in the Schedule

You must include all project management and technical tasks in the schedule. Some of these are level-of-effort (LOE) tasks, which are activities that are not easily measured in terms of discrete accomplishments.

- LOE tasks that should be listed in the project schedule include, but are not limited to:
  - Change management
  - Risk management
  - Communications management
  - Vendor or customer liaison
  - Progress management
  - Contract management
  - Project management
  - Supplier agreement management
  - Technical environment management
  - Engineering management

These tasks consume resources and must be tracked.

Figure 11-7. Including Level-Of-Effort Tasks in the Schedule

Notes:
Typical Ways to Display Project Information

Figure 11-8. Typical Ways to Display Project Information

Notes:
Description of a Project Network Diagram

A project network diagram consists of a series of project activities arranged in a logical flow; is the basis for a project schedule and provides a consistent framework for planning, monitoring, and controlling the project; every work package from the WBS is represented in the network diagram, and only WBS work packages are represented there.

![Project Network Diagram](image)

Notes:

1. Start with activity 1.1 to 1.2.
2. Activity 1.2 must finish before 2.1 can start.
3. Activity 2.1 finishes before 2.2 can start.
4. Activity 2.2 finishes before 3.1 can start.
5. Activity 3.1 finishes before 3.2 can start.
6. Activity 3.2 finishes the project.
**Precedence Diagramming Method (PDM)**

**Precedence Diagramming Method (PDM)** - a schedule network diagramming technique in which schedule activities are represented by boxes (or nodes) and are graphically linked by one or more logical relationships to show the sequence in which the activities are to be performed.

The elements included in a project network diagram are:
- Intuitive start and end points
- Boxes that represent an activity at the work package level
- Arrows that denote data about the relationship between tasks
- Predecessors and successors

![Precedence Diagramming Method (PDM) Diagram](image)

**Notes:**
Guidelines for Creating a Project Network Diagram

- The project network diagram starts and ends with a task or milestone
- There are predecessors or successors for all activities--no danglers, or separate, unrelated tasks without connecting arrows
- The network logic must be kept up-to-date; project changes might mean relationship changes, and the project network diagram must reflect them
- There are no loops; circular relationships do not allow definition of an end date

In a PDM diagram:
- Activities are represented by boxes or nodes
- Activities are linked by one of three common types of precedence relationships
- The logical relationships of project activities are displayed
- A time line is drawn running from left (earlier) to right (later)
- The start and finish dates for each activity are shown

Notes:
Dependency Relationships in the Precedence Diagramming Method (PDM) (1 of 2)

Finish-to-Start (FS)

Start-to-Start (SS)

Finish-to-Finish (FF)

Start-to-Finish (SF)

Notes:
Definition: Lag and Lead time is a change of a relationship that directs a delay or acceleration in the successor task; both are formal ways to adjust the schedule.

Lag Time - is a delay imposed on the relationship between two activities.

Lead Time - is an acceleration of the successor activity.

Notes:
### Scheduling Terminology in the Critical Path Method (1 of 2)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early Start (ES)</strong></td>
<td>In the critical path method, the earliest possible point in time on which the uncompleted portions of a schedule activity (or the project) can start, based on the schedule network logic, the data date, and any schedule constraints</td>
</tr>
<tr>
<td><strong>Late Start (LS)</strong></td>
<td>In the critical path method, the latest possible point in time that a schedule activity may begin based upon the schedule network logic, the project completion date, and any constraints assigned to the schedule activities without violating a schedule constraint or delaying the project completion date</td>
</tr>
<tr>
<td><strong>Early Finish (EF)</strong></td>
<td>In the critical path method, the earliest possible point in time on which the uncompleted portions of a schedule activity (or the project) can finish, based on the schedule network logic, the data date, and any schedule constraints</td>
</tr>
<tr>
<td><strong>Late Finish (LF)</strong></td>
<td>In the critical path method, the latest possible point in time that a schedule activity may be completed based upon the schedule network logic, the project completion date, and any constraints assigned to the schedule activities without violating a schedule constraint or delaying the project completion date</td>
</tr>
</tbody>
</table>

**Notes:**
### Scheduling Terminology in the Critical Path Method (2 of 2)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Float (also known as slack or total float)</strong></td>
<td>The total amount of time that a schedule activity may be delayed from its early start date without delaying the project finish date, or violating a schedule constraint; calculated using the critical path method technique and determining the difference between the early finish dates and late finish dates.</td>
</tr>
<tr>
<td><strong>Free Float</strong></td>
<td>The amount of time that a schedule activity can be delayed without delaying the early start of any immediately following schedule activities.</td>
</tr>
<tr>
<td><strong>Critical Path</strong></td>
<td>The series of activities that determine the duration of the project; the critical path is usually defined as those activities with float less than or equal to a specified value, often zero; it is the longest path through the project.</td>
</tr>
<tr>
<td><strong>Critical Path Method (CPM)</strong></td>
<td>A schedule network analysis technique used to determine the amount of scheduling flexibility (the amount of float) on various logical network paths in the project schedule network, and to determine the minimum total project duration.</td>
</tr>
<tr>
<td><strong>Near-Critical Activity</strong></td>
<td>A schedule activity that has low total float; the concept of near-critical is equally applicable to a schedule activity or schedule network path.</td>
</tr>
</tbody>
</table>

Figure 11-15. Scheduling Terminology in the Critical Path Method (2 of 2)
Documenting the Values in Each Node When Creating a Precedence Diagram

The box below shows standard format for the nodes in a precedence diagram; the activity name, WBS number, and activity duration are placed in the middle of the box; four other values are placed in the corners of the box:

- The early start (ES), the earliest time the schedule activity can start
- The early finish (EF), the earliest time the schedule activity can finish
- The late start (LS), the latest time the schedule activity may begin without delaying project completion
- The late finish (LF), which is the latest time the schedule activity may be completed without delaying project completion

Notes:
How to Compute a Precedence Diagram Network Schedule (1 of 2)

- Identify all tasks from the WBS
- Establish a start activity or activities (generally, an activity with no predecessors)
- Identify all activities that can begin immediately
- Identify which activities can now start/end, as a result of the activities being started/completed
- Complete the process until all predecessors and successors have been identified
- Identify the activities that signify completion of the project
- Calculate the forward pass (when multiple dates must be passed forward, select the latest date)
- Determine the early finish date of the project

Notes:
How to Compute a Precedence Diagram Network Schedule (2 of 2)

- Calculate the backward pass (when multiple dates must be passed backward, select the earliest date)
- Perform float calculation
- Identify the critical path and near-critical activities
- Validate the correctness and completeness of the network
- Familiarize yourself with the network characteristics
- Verify that the work can be done with the resources in the time allowed
- Adjust the schedule as required to meet commitments
- Once the schedule is known, include Level of Effort tasks
- Once the schedule is known, add project management effort (full-time or part-time as needed)

Notes:
Calculating Start and Finish Dates as Part of the Critical Path Method (CPM)

Forward Pass:
- Early start
- Early finish

Backward Pass:
- Late start
- Late finish
- Float/Slack time

Forward pass is the calculation of the **early start** and **early finish** dates for the uncompleted portions of all network activities.

Backward pass is the calculation of **late start** dates and **late finish** dates for uncompleted portions of all network activities.

**Notes:**
Applying the Forward Pass

Steps for doing a forward pass:

1. Establish the project start date, which is the early start date for the first network activity

2. Add the duration of the activity to the start date to produce the early finish date for the first activity

3. Repeat the procedure from left to right, top to bottom of the network

- Calculations

\[
\text{ES} + \text{Duration} = \text{EF} \\
\text{EF} + \text{Lag} = \text{ES}_s
\]

**Note:** If an activity has multiple predecessors, choose the latest early finish date as the early start date of the successor

**Notes:**
Forward Pass Example

Figure 11-21. Forward Pass Example

Notes:
Steps for doing a backward pass:

1. Establish the project finish date using the last activity from the forward pass. Project finish date is the latest date for the last network activity in the backward pass.

2. Subtract the duration of the activity from the late finish date to produce the late start date for the activity.

3. Repeat the procedure from right to left, top to bottom of the network.

- Calculations

  \[ \text{LF} - \text{Duration} = \text{LS} \]
  \[ \text{LS} - \text{Lag} = \text{LF}_p \]

Note: If a predecessor has multiple successors, choose the earliest late start date as the late finish of the predecessor.

Notes:
Backward Pass Example

Notes:
## Float (Slack)

Free Float = ES (successor task) - EF (predecessor task)

Float = Late Finish - Early Finish

or

Float = Late Start - Early Start

*Float* > 0 indicates that time is available
*Float* = 0 indicates that the situation is critical
*Float* < 0 indicates that the project is behind/critically late

- **Notes:**

### Notes:

Free Float = ES (successor task) - EF (predecessor task)

Float = Late Finish - Early Finish

or

Float = Late Start - Early Start

- Float > 0 indicates that time is available
- Float = 0 indicates that the situation is critical
- Float < 0 indicates that the project is behind/critically late
Float Example

Total Float = LS - ES or LF - EF
Free Float = ES (Successor) - EF (Predecessor)

Notes:

Figure 11-25. Float Example
Critical Path

- Longest of all paths through the project
- Path with zero float time
- Minimum time to complete the project

**Notes:**
Individual Exercise 11-1: Precedence Diagramming Method

1. Calculate the forward and backward pass
2. Calculate the float for each path
3. Find the critical path

Notes:
Validating the Precedence Diagram

- Ensure that your network is complete and current:
  - Have you correctly identified your critical path?
  - Should any tasks with large amounts of float be rescheduled?
  - Are there any danglers?

- Become familiar with your network and analyze it:
  - What risks are on the critical path?
  - Is there a near-critical activity?
  - How much float is available?
  - What types of float exist on which tasks?

- Ensure that your objectives can be met:
  - Do you need to add any milestones?
  - Which tasks involve external deliverables?
  - Can the work be completed in the desired time frame?
  - Are deliveries made on time?

Notes:
How to Create a Schedule from a Precedence Diagram

Notes:
Before Finalizing the Schedule, Examine:

Roles
- Is there a complete set of roles for each task?
  - Action: Add roles where needed

Staff
- Who fills these roles?
  - Action: Assign staff

Skills
- Do the staff assigned possess the needed skills?
  - Action: Add or change people or reestimate the duration to allow time to improve skill levels

Availability
- When are people really available?
  - Action: Reschedule around non-available time
  - Action: Change utilization assumptions to adjust duration
  - Action: Add more staff

Notes:
If Your Schedule is Constrained by Time or Resources

If your schedule is constrained by time or resources, consider the following options:

- **Crash the schedule** - This means applying more resources to reduce the overall project duration; resources are usually applied to the activities with the least float until the desired project duration is achieved; crashing usually increases project cost and risk, but reduces overall project duration.

- **Fast-track the schedule** - This means compressing the project schedule by overlapping activities that normally would be done in sequence; fast-tracking might change the relationships among tasks and shorten the critical path; it usually increases project cost and risk, but reduces overall project duration.

- **Change the approach** - Changing your approach to the work might create a different set of interrelated activities with a shorter critical path, which might also require changing the WBS.

- **Re-evaluate dependencies** - Determine if any FS start relationships can be changed to FF relationships.

- **Revisit hard constraints** - If any of these hard constraints affect a task on the critical path, that task might start or end sooner.

- **Use float** - Consider using the float you have available to adjust the schedule.

---

**Notes:**
Key Messages for Unit 11 (1 of 2)

- Developing a realistic schedule is a time-consuming effort
- Most rescheduling is necessary due to:
  - Over allocation of resources
  - Longer schedule than required
- Adjusting the schedule might require:
  - Changing task start dates, task durations, or task resources
  - Adding tasks to the WBS and reflowing the steps that might be necessary
- Repeating the planning steps until a schedule that works is achieved is critical to project success

Notes:
Key Messages for Unit 11 (2 of 2)

- Many project management tools for scheduling are commercially available
- Project management tools can be used to help you identify the critical path, however:
  - Do not use tools blindly
  - Tools do not manage the project, you do
  - You are responsible for the success of the project, not the tool
- The project startup helps the project meet its objectives and helps the team work together to get the job done on time, within budget

Notes:
Team Exercise 11-2: Scheduling

Project: RestEasy Hotels

- Use the WBS your team created to do the following exercises:
  - Create a network diagram
  - Calculate the forward and backward pass
  - Find the critical path

Notes:
Unit 12. Executing Processes & Monitoring and Controlling Processes

What This Unit is About

This unit covers procedures for executing processes and monitoring and controlling throughout the life cycle of the project. It details the importance and purpose of project control, describes the components of project control, and describes procedures for monitoring and maintaining project control.

What You Should Be Able to Do

After completing this unit, you should be able to:

• List the activities in the executing processes and monitoring and controlling processes
• Describe the importance and the purpose of project control
• Explain what a project control book is and what it contains
• List the project control guidelines

How You Will Check Your Progress

Accountability:

• Class Discussion

References

Executing Processes & Monitoring and Controlling Processes

Unit 12

Notes:
Unit Objectives

After completing this unit, you should be able to:

- List the activities in the executing processes and monitoring and controlling processes
- Describe the importance and the purpose of project control
- Explain what a project control book is and what it contains
- List the project control guidelines

Notes:
Project Management Process Groups

Figure 12-3. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

Figure 12-3. Project Management Process Groups

Notes:
Executing Process Group

- Executing Process Group consists of the processes used to complete the work defined in the project management plan to accomplish the project's requirements
  - The following list identifies the processes the project manager should evaluate to determine which ones are required for the team's specific project:
    - Perform Quality Assurance
    - Acquire Project Team
    - Develop Project Team
    - Information Distribution
    - Request Seller Responses
    - Select Sellers

- This process group involves coordinating people and resources, as well as integrating and performing the activities of the project in accordance with the project management plan

Notes:
Activities in the executing processes include:

- Directing the various technical and organizational interfaces that exist in the project
- Applying planned, systematic quality activities
- Organizing and motivating the team
- Team Building
- Executing work packages
- Setting up the communication path
- Obtaining information, quotations, bids, offers, or proposals
- Reviewing offers
- Choosing from among potential sellers
- Negotiating a written contract with the seller
- Procuring goods and services

Notes:
Monitoring and Controlling Process Group

- Monitoring and Controlling Process Group consists of those processes performed to observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken, when necessary, to control the execution of the project.

- The following list identifies the processes the project manager should evaluate to determine which ones are required for the team’s specific project:

  - Monitor and Control Project Work
  - Integrated Change Control
  - Scope Verification
  - Scope Control
  - Schedule Control
  - Cost Control
  - Perform Quality Control
  - Manage Project Team
  - Performance Reporting
  - Manage Stakeholders
  - Risk Monitoring and Control
  - Contract Administration

- The key benefit of this Process Group is that project performance is observed and measured regularly to identify variances from the project management plan.

Figure 12-6. Monitoring and Controlling Process Group

Notes:
Monitoring and Controlling Processes Activities

Activities in the monitoring and controlling processes include:

- Controlling changes and recommending preventive action in anticipation of possible problems
  - Scope
  - Schedule
  - Cost
  - Quality
- Establishing control systems
- Monitoring the ongoing project activities against the project management plan and the project performance baseline
- Tracking team member performance
- Collecting and distributing performance information
- Managing communications
- Tracking, monitoring, and controlling risk
- Managing the contract and buyer/seller relationships

Notes:
Project Control Overview

Project control is a process repeated throughout the life cycle of a project.

The purpose of project control is to bring the project to completion on time, within budget, and to specifications by:

- Verifying the baseline established for the project
- Focusing on monitoring, analyzing, and comparing planned and actual results of project predictions
- Identifying variances that delay the achievement of objectives
- Conducting a timely adjustment to the plan and taking preventive actions

Notes:
Relationship Management Is Part of Project Control

Notes:
About the Project Control Book

The Project Control Book (PCB) is the repository for:
- The procedures used on the project
- The dynamic files, such as schedules and change logs, that contain the results of the procedures

The PCB provides:
- The basis for assessing conformance to standards
- The basis for reviews and audits of the project management system
- Up-to-date information on the progress of the project and reference documents of procedures

Notes:
Establish Standards Through Plans and Procedures for Collecting/Evaluating

**Standards**

**Project Management Plan:**

- Plans/Procedures
  - Project tracking and evaluation
  - Financial management
  - Reporting
  - Risk management
  - Supplier management
  - Quality management
  - Change management
  - Issue and problem management
  - Contract management
  - Organization and people management
  - Deliverables management
  - Schedule management
  - Data management
  - Communications plan

**Collecting/Evaluating**

**Project Control Book:**

- Results/Output

---

**Notes:**
PCB: A Living Document for Controlling/Evaluating

Notes:
Guidelines for Collecting and Evaluating Project Performance (1 of 2)

- Focus analysis on one cycle back and three cycles forward
  - Example: one week back, three weeks forward
- Identify work completed
  - Support people doing a good job (reward good performance)
- Evaluate work that is late starting or completing
  - What is the effect on schedule and budget?
  - What actions can you identify to mitigate these impacts?
  - Who should be responsible for any actions?
- Evaluate work that is starting
  - Ensure that owners know and agree that their work can start on time
  - Apply risk analysis techniques

Notes:
Guidelines for Collecting and Evaluating Project Performance (2 of 2)

Analyze progress in the areas of time, budget, technical performance, and objectives

- Evaluate work due for completion
  - Check with owners to ensure that work is on target
  - Evaluate trends and other data that supports the owners' opinions
- Provide updated estimates for task completion
- Conduct project reviews
- Communicate status regularly
- Track issue and problem resolution

Notes:
Tracking and Executing the Risk Management Plan (1 of 2)

The project manager and the team must:

- Implement and track the risk management plan
- Communicate the risk management plan status to the team members and other stakeholders; be sure the plan is made clear to the sponsor and to the reviewers during project reviews
- Review the risk triggers; Have any of the risks occurred?
- Reassess risk sources on a regular basis; are there new risks resulting from changes in the sponsor's technology, project, organization, or resources? If so, update the plan with the new risks
- Evaluate the defined risks to see if they are still possible, whether they have the same severity, and whether the tolerance is the same; Does the plan need to be updated? Does additional action need to be taken?

Notes:
Tracking and Executing the Risk Management Plan (2 of 2)

- Review the risk contingency reserve and ask whether the plans are still appropriate; Is any action required based on observed trends? Are backup strategies appropriate?
- Review risk response strategies to determine if they are still appropriate and to determine whether backup strategies should be used or if additional actions are required to implement the strategies; Does the plan need to be updated?
- As time passes, you might need to consider that some risks, previously considered non-issues, might become issues, while others, previously deemed significant, might become insignificant; Do you need to update the plan?
- If a risk event occurs, you might need to make appropriate changes to the work breakdown structure (WBS) and the schedule.
- Maintain current, accurate, and complete documentation, and disseminate it to the appropriate stakeholders, which can also serve as a record of lessons learned and actions taken, and as a means of communication.

Notes:
Evaluate: Compare Actual and Planned Performance Using Metrics

Metrics allow a project manager to monitor, communicate, and track progress and trends

- What is a metric?
  - It is planned
  - It spans the life of the project
  - It is trackable
  - It generates variance
  - It is understood by the client/project sponsor

- The project manager must:
  - Choose metrics appropriate to the specific project
  - Determine the preferred metrics of the client/project sponsor
  - Determine the preferred metrics of the internal organization

No standard metrics apply to all projects

Notes:
Examples of Metrics

Planned versus Actual

- Resource utilization
- Revenue
- Cost
- Work done
- Defects
- Task starts and finishes
- Hours actually expended
- Schedule (Completion of milestones)
- Technical control points
- Deliverables
- Quality trends
- Consumable resources used

What other metrics can be used?

Notes:
Key Messages for Unit 12

- Without project control, you are managing in chaos
- Use a project control book (PCB) to document project control activities
- The PCB is a living document that contains all project performance information
- Use the original plan, plus or minus approved changes (baseline), to control project performance
- Use appropriate metrics to communicate with the individuals or groups involved in the project
- Make sure you have the correct metrics for your project; they drive:
  - Communication
  - Analysis
  - Decision making

Notes:
Unit 13. Integrated Change Control

What This Unit is About

This unit discusses project integrated change control. It describes overall change management, its function, and benefits. The unit concludes with an integrated change control team exercise.

What You Should Be Able to Do

After completing this unit, you should be able to:

- Define change and integrated change control
- State why integrated change control is needed
- List the steps of change management
- Identify the elements in a change request form
- State the role of the project manager in integrated change control
- Apply change management principles

How You Will Check Your Progress

Accountability:

- Class Discussion
- Team Exercise 13-1: Integrated Change Control

References

Integrated Change Control

Unit 13

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Define change and Integrated Change Control
- State why Integrated Change Control is needed
- List the steps of Integrated Change Control
- Identify the elements in a change request form
- State the role of the project manager in Integrated Change Control
- Apply change management principles

Notes:
Project Management Process Group

Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle


Notes:
Definition of Change

A change:

- Is any deviation from a previously approved baseline
- Impacts a project's triple constraints:
  - Requirements
  - Schedule
  - Cost
- Can result from scope creep when a baseline is not defined comprehensively
- Can relate to either the work content or the management of the project

Figure 13-4. Definition of Change

Notes:
Figure 13-5. Origins of Change

Notes:

The project team must work to the same statement of work and deliverables.
Integrated Change Control

Integrated Change Control is:
- Concerned with influencing the factors that create changes to ensure that changes are agreed upon
- Determining that a change has occurred
- Managing the actual changes when and as they occur

Integrated Change Control requires:
- Maintaining the integrity of the performance baselines
- Ensuring that changes to the product scope are reflected in the definition of project scope
- Coordinating changes across knowledge areas

Integrated Change Control is performed from project inception through completion

Figure 13-6. Definition of Integrated Change Control

Notes:
Using an Integrated Change Control System

An Integrated Change Control System is a collection of formal, documented procedures that:

- Define the steps for making changes to the official project document
- Include the following:
  - Paperwork
  - Tracking systems
  - Approval levels necessary for authorizing changes
  - A change control board (CCB) responsible for approving or rejecting change requests
  - Procedures for handling changes that can be approved without review

Notes:
Projects Are Like Small Businesses

Projects = Small Businesses...Just as with a small business, the best solution to problems is prevention. Potential problems can relate to any of the following:

- Customer expectations
- Customer capabilities
- Mutual understanding of requirements
- Scope change
- Risk management
- Quality
- Inaccurate estimates
- Ongoing support needs
- Resource availability
- Project startup
- Clear roles and responsibilities
- Management involvement
- Change control
- Loss of key personnel

How many of these problems may have their origins in uncontrolled change?

Notes:
Why We Need Integrated Change Control

We need Integrated Change Control to:

- Ensure that the project is kept under control:
  - Scope, prevent scope creep
  - Schedule
  - Budget
  - Client satisfaction
- Reduce the number of project failures due to scope creep
- Ensure each request for change is assessed by key project players
- Allow each change to be accepted, rejected, or deferred by the appropriate authority
- Enable the orderly implementation of each accepted change
- Allow the impact of all changes to be understood and managed
- Allow small changes to be implemented with minimum effort

Notes:
Change Identification Process

Four steps in the Change Identification Process:
1. Identify the change
2. Clarify the scope
3. Estimate the complexity and the cost of investigating
4. Approve or reject

Integrated Change Control involves:
- Ensuring that the requested changes are beneficial
- Determining that a change has occurred
- Managing the actual change that has occurred

Notes:
Integrated Change Control Process

**Notes:**

- Identify change
- Clarify scope
- Estimate complexity/price of investigating
  - Document and communicate
  - Yes*
  - No
- Evaluate costs and benefits
- Identify impacts
  - Document and communicate
  - File
- Accept
  - Yes*
- Select alternative
  - Price
  - Accept
  - Yes*
  - No
  - No
  - Update appropriate documents
    - Implement
    - Document and communicate
    - File
  - Requirements/specs
  - Cost
  - Schedule

* Interface with supplier—supplier executes its change management process
Elements of a Change Request Form

A change request form contains:

- Change request number
- Date of the change request
- Name of the person requesting the change
- Description of the change
- Estimate of the price of investigation
- Statement of the change's effect on the project
- List of tasks and staff affected by the change
- Estimate of the cost of the change
- Signature of the authorized representatives
- Time limitation on implementing the change request
- Time limitation on investigation
- Authorization to proceed
  - Investigation
  - Implementation
- Effect on related projects

Notes:
Factors That Affect Change Requests

Figure 13-13. Factors That Affect Change Requests

Notes:
Change Control Board (CCB)

- The CCB is composed of people who are given authority to accept, reject, or defer changes.
- The authority and responsibility of the CCB must be well-defined and agreed upon in writing by the project's key stakeholders.
- Some large or complex projects might require multiple CCBs with different areas of responsibility.

Notes:
## Follow-Up Actions for Integrated Change Control

<table>
<thead>
<tr>
<th>Status of the change</th>
<th>Changes within the project scope</th>
<th>Changes outside the project scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>If accepted</td>
<td>● Plan incorporation into the system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Create new baselines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Modify the schedule and allocate resources</td>
<td></td>
</tr>
<tr>
<td>If rejected</td>
<td>Communicate and document the decision</td>
<td></td>
</tr>
<tr>
<td>If deferred</td>
<td>Direct the project team:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● To perform further analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● To consider alternatives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● To hold until a specified time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Direct the project team:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● To perform further analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● To consider alternatives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● To hold until a specified time</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

Follow-Up Actions for Integrated Change Control
Guidelines for Managing Integrated Change Control (1 of 2)

- Introduce integrated change control early in the project. Make it part of the project kickoff.
- Encourage the customer to fund a reasonable number of hours and/or dollars to be used to implement approved changes and to investigate change requests.
- Determine how changes are to be introduced and processed with a documented procedure that is part of the project management system.
- Use a change request form to document proposed changes.
- Ensure that changes are approved in writing by the authorized representatives.
- Update the baselines and all appropriate documentation after each change is approved.

Notes:
Guidelines for
Managing Integrated Change Control (2 of 2)

- Communicate the decision on each change request to all those who need to know, including the originator of the change request
- Early in the project, use the change control process to authorize a change that has no cost or schedule impact
  - The customer is much more agreeable to signing a change authorization if it does not cost them anything
  - By executing a no-cost change order, you and the customer have set a precedent as to how changes must be approved

Notes:
Project Manager's Role in Integrated Change Control

In Integrated Change Control, the project manager:

- Analyzes change requests
- Assesses the effects of the change:
  - Risk
  - Baseline
- Manages the scope
  - Accepts or rejects the change
- Revises baselines

Notes:
Configuration Management System

**Configuration Management System** - Is a subsystem of the overall project management system which serves as a collection of formal documented procedures used to apply technical and administrative direction and surveillance to:

- Identify and document the functional and physical characteristics of a product, result, service, or component
- Control any changes to such characteristics
- Record and report each change and its implementation status
- Support the audit of the products, results, or components to verify conformance to requirements

- It includes the documentation, tracking systems, and defined approval levels necessary for authorizing and controlling changes; in most application areas, the configuration management system includes the change control system

*Notes:*
Configuration Management Activities

Some configuration management activities included in the integrated change control process are:

- **Configuration Identification** - which provides the basis from which the configuration of products is defined and verified. Products and documents are labeled, changes are managed, and accountability is maintained.

- **Configuration Status Accounting** - Capturing, storing, and accessing configuration information needed to manage products and product information effectively.

- **Configuration Verification and Auditing** - Establishing that the performance and functional requirements defined in the configuration documentation have been met.

Notes:
Key Messages for Integrated Change Control

- Implement an appropriate integrated change control process
- Integrated change control is the responsibility of project managers, who need to evaluate the significance of changes throughout the project life cycle, make decisions, and communicate what is to be done
- Establish Change Control Boards composed of appropriate personnel, and ensure that their roles, responsibilities, and authority are defined and communicated
- The focus of the integrated change control process is the triple constraints: cost, schedule, and performance
- When incorporating changes, the impact on the triple constraints must be considered
- Integrated change control should be introduced early in the project
- Ensure that all changes are approved in writing by the authorized representative

Figure 13-21. Key Messages for Integrated Change Control

Notes:
Team Exercise 13-1: Integrated Change Control

Project: RestEasy Hotels

Read the handout and answer the following questions:

1. What might change as a result of this modification?
2. Which subprojects are impacted?
3. What impact does this have on:
   a. The overall project
   b. The benefit
   c. The budget
4. How should a decision be reached and who makes it?

Notes:
Unit 14. Quality Management

What This Unit is About

This unit discusses project quality management. It defines project quality management and key quality control terms, and discusses what it takes to achieve project quality. In addition, the relationship of project review to quality assurance is described.

What You Should Be Able to Do

After completing this unit, you should be able to:

- Define project quality management and state what it takes to achieve project quality
- Describe the major quality management processes

How You Will Check Your Progress

Accountability:

- Class Discussion

References

Quality Management

Unit 14

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Define project quality management and state what it takes to achieve project quality
- Describe the major quality management processes

Notes:
Project Management Process Groups

Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

Notes:
Definition of Project Quality Management

**Project Quality Management** processes include all the activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project satisfies the needs for which it was undertaken.

It implements the quality management system through the policy, procedures, and processes of quality planning, quality assurance, quality control, with continuous process improvement activities conducted throughout, as appropriate.

*Notes:*
Quality

Quality - Is the degree to which a set of inherent characteristics fulfills requirements (from PMI®)

Quality is the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs (from Lewis Ireland)

- Stated and implied needs are the inputs to developing project requirements
- A critical element of quality management in the context of a project is to turn the needs, wants, and expectations of stakeholders into requirements by performing a stakeholders analysis, performed as part of project scope management

Notes:
How to Achieve Quality

Quality becomes achievable when:

- A project quality management system that includes processes such as quality planning, quality assurance, and quality control is established
- Both the management of the project and the product of the project are addressed
- Customers' requirements are carefully managed and reviewed to meet customer satisfaction and the project schedule
- Project reviews are conducted

Notes:
**Project Quality Management Processes**

- **Quality Planning** - Is the process of identifying which quality standards are relevant to the project and determining how to satisfy them
  - Quality Planning is one of the key processes during the development of the project management plan and should be performed in parallel with the other project planning processes

- **Perform Quality Assurance (QA)** - Is the process of applying the planned, systematic quality activities to ensure that the project employs all processes needed to meet requirements
  - Quality Assurance provides an umbrella for another important quality activity, continuous process improvement

- **Perform Quality Control (QC)** - Is the process of monitoring specific project results to determine whether they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance
  - Quality Control should be performed throughout the project with quality standards which include project processes and product goals

**Notes:**
Goals of Quality Planning

- Identify which quality standards are relevant to the project and determine how to satisfy them
- Develop and document a quality management plan which:
  - Describes how the project management team will implement its quality policy, the project quality system
  - Provides input to the overall project plan
  - Must address quality control, quality assurance, and quality improvement for the project
- Develop very specific operational definitions (metrics), describing what something is and how it is to be measured by the quality control process
- Develop checklists to verify that a set of required steps has been performed

Quality is planned in, not inspected in

Notes:
Quality Management Plan

Quality Management Plan - Describes how the project management team implements the performing organization's quality policy

- Provides input to the overall project management plan and must address quality control (QC), quality assurance (QA), and continuous process improvement for the project
- Should include efforts at the front end of the project to ensure that the earlier decisions are correct

Notes:
Goals of Quality Assurance

- Project managers and the quality assurance group work together to ensure adherence to the defined management processes and procedures.

- Results of quality assurance reviews should be shared and discussed with project managers and teams, and reviewed periodically with senior project management.

- The project manager and QA resource should jointly obtain decisions and guidance from senior management on all unresolved noncompliance issues.

- Leads to taking actions to increase the effectiveness and efficiency of the project to provide added benefits to the project stakeholders (Quality Improvement).

Notes:
Continuous Improvement

- **Continuous Improvement (CI)** - Adopting new activities and eliminating those which are found to add little or no value
  - The goal is to increase effectiveness by reducing inefficiencies, frustrations, and waste (rework, time, effort, material, and so forth)
  - The Japanese term is Kaizen, which is taken from the words *Kai* meaning change and *zen* meaning good

- The **Plan-Do-Check-Act** cycle of activities is designed to drive continuous improvement and is the basis for quality improvement
  - The concept is simple to teach and understand:
    - Plan the work,
    - Carry out the plan,
    - Check on the result, and
    - Then take action to improve performance
  - Repeat the cycle to improve continuously

This cycle is linked by results with the results of one part of the cycle becoming the input to another part of the cycle

---

**Notes:**
Quality Audits Help Ensure Quality

- A **quality audit** is a structured, **independent review** to determine whether project activities comply with the organizational and project policies, processes, and procedures
  - Objective of a quality audit is to identify inefficient and ineffective policies, processes, and procedures in use on the project
  - The subsequent effort to correct these deficiencies should result in a reduced cost of quality and an increase in the percentage of acceptance of the product or service by the customer or sponsor within the performing organization
- Quality audits confirm the implementation of approved change requests, corrective actions, defect repairs, and preventive action

Additional Project reviews include:
- Estimate review
- Project plan review
- Ongoing project review
- Project completion review
- Special review

Figure 14-12. Quality Audits Help Ensure Quality

**Notes:**
Quality Audit Summary Example

<table>
<thead>
<tr>
<th>CLASS A:</th>
<th>Under control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor problems might exist, but the project manager has an effective plan for resolution; no major existing potential problems have been identified</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLASS B:</th>
<th>Currently under control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing or potential problems must be resolved to avoid deterioration</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLASS C:</th>
<th>Significant problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrective plans required immediately. Probably will exceed estimates or budgets; aggressive management action essential to regain control</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLASS D:</th>
<th>Major problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definite financial impact, serious problems with client acceptance, or negative impact on client's business.; thorough management evaluation required; executive call on client</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Quality Control Overview

- Quality control is performed throughout all phases of the project life cycle.
- Quality control is usually conducted by a quality control department or by other kinds of control groups that have been given the responsibilities.
- Results include both product results, such as deliverables, and management results, such as cost and schedule performance.
- Project management teams should have a working knowledge of statistical quality control, especially sampling and probability, to help them evaluate quality control outputs.

Notes:
Goals of Quality Control

- Quality improvement
- Rework actions to bring defective or nonconforming items into compliance with requirements or specifications
- Completed checklists which become part of the project's records
- Process adjustments, which involve immediate corrective or preventive action as a result of quality control measurements

Notes:
Cost of Quality

Cost of quality is the total cost of all efforts to achieve product or service quality which includes all work to ensure conformance to the requirements as well as all work resulting from nonconformance to the requirements.

- **Prevention and appraisal costs** (cost of conformance) include costs for quality planning, quality control (QC), and quality assurance to ensure compliance to requirements (that is, training, QC systems, etc.).

- **Failure costs** (cost of non-conformance) include costs to rework products, components, or processes that are non-compliant, costs of warranty work, waste, and loss of reputation.

Cost of a quality system is often viewed as a negative cost because errors in work have been traditionally accepted as a cost of doing business.

**Notes:**
Quality and People in Project Management (1 of 2)

- Management defines type and amount of work
- The employee can only assume responsibility for meeting the requirements of completing the work when the employee:
  - Knows what's expected to meet the specifications
  - Knows how to perform the functions to meet the specifications
  - Has adequate tools to perform the function
  - Is able to measure the performance during the process
  - Is able to adjust the process to match the desired outcome
- Project quality team consists of:
  - Senior Management
  - Project Manager
  - Project Staff
  - Customer
  - Vendors, suppliers, and contractors
  - Regulatory Agencies

Notes:
Quality and People in Project Management (2 of 2)

- Project Manager has the ultimate responsibility for Quality Control and Quality Assurance
- Customer sets the requirement for acceptable quality level
- Reviews and Audits:
  - Management reviews determine the status, progress made, problems, and solutions
  - Peer reviews determine whether proposed or completed work meets the requirements
  - Competency center reviews are used to validate documentation, studies, and proposed technical solutions to problems
  - Fitness reviews and audits determine the fitness of a product or part of a project (addresses specific issues)
- The collection of quantitative data for statistical analysis is the basis for proactive management by FACT rather than by EXCEPTION
  - Management by exception lets errors and defects happen before management intervention

Figure 14-18. Quality and People in Project Management (2 of 2)

Notes:
Key Messages for Unit 14

- Quality is planned in, not inspected in
- The development and maintenance of a project quality team facilitates work that is performed appropriately and that conforms to the customer's requirements
- The use of tools is essential to the execution of quality programs; these tools assist and support the project manager in the identification of deviations from standards
- Cost of Quality includes the cost of conformance and the cost of nonconformance
- The Plan-Do-Check-Act cycle of activities is designed to drive continuous improvement and is the basis for quality improvement

Notes:
Unit 15. Cost Management

What This Unit is About

This unit covers procedures for monitoring and maintaining project cost throughout the life cycle of the project. It details cost management processes and techniques. It concludes with an earned value management team exercise.

What You Should Be Able to Do

After completing this unit, you should be able to:

- Explain what cost control does
- Define earned value management (EVM)
- Identify the three fundamental elements of earned value management
- Define earned value management analysis terminology
- List the causes of variances
- Calculate earned value

How You Will Check Your Progress

Accountability:

- Class Discussion
- Team Exercise 15-1: Earned Value Management

References


Cost Management

Unit 15

Figure 15-1. Cost Management

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Explain what cost control does
- Explain the role and value of earned value management (EVM) methodology
- Apply EVM performance measurement technique, earned value technique (EVT)

Notes:
Notes:
Cost Budgeting

Cost Budgeting - Is the process of aggregating the estimated costs of individual activities or work packages to establish a total cost baseline for measuring project performance.

Cost baseline - Is a time-phased budget that is used as a basis against which to measure, monitor, and control overall cost performance on the project.

- It is developed by summing estimated costs by period and is usually displayed in the form of an S-curve.
- It is a component of the project management plan.

Notes:
Cost Control and What it Does

Cost control - The process of influencing the factors that create variances, and controlling changes to the project budget

Project cost control includes:

- Influencing the factors that create changes to the cost baseline to ensure that changes are agreed upon as they occur
- Ensuring requested changes are agreed upon
- Managing the actual changes when and as they occur
- Assuring that potential cost overruns do not exceed the authorized funding
- Monitoring cost performance to detect and understand variances from the cost baseline
- Recording all appropriate changes accurately against the cost baseline
- Preventing incorrect, inappropriate, or unapproved charges from being included in the reported cost or resource usage
- Informing appropriate stakeholders of approved changes
- Acting to bring expected cost overruns within acceptable limits

Searches out the whys of both positive and negative variances

Notes:
The Role of Earned Value Management

**Earned Value Management (EVM)** - Is a management methodology for integrating scope, schedule, and resources, and for objectively measuring project performance and progress; performance is measured by determining the budgeted cost of work performed (earned value) and comparing it to the actual cost of work performed (actual cost); progress is measured by comparing the earned value to the budgeted cost of work scheduled (planned value)

- EVM has proven itself to be one of the most effective performance measurement and feedback tools for managing projects
  - It enables managers to close the loop in the *Plan, Do, Check, Act* cycle
  - EVM provides organizations with the methodology needed to integrate the management of project scope, schedule, and cost
  - EVM has been called *management with the lights on* because it can help clearly and objectively illuminate where a project is and where it is going—compared to where it was supposed to be and where it was supposed to be going
  - EVM uses the fundamental principle that patterns and trends in the past can be good predictors of the future

---

**Notes:**

---
Why Consider Earned Value Management (EVM)?

- Feedback is critical to the success of any project; timely and targeted feedback can enable project managers to identify problems early and make adjustments that can keep a project on time and on budget.

- Earned Value Management:
  - Allows for objective assessment of variance
  - Allows for common understanding of the amount of work that actually has been done on the project
  - Is incorporated in all the major modern project management software packages
  - Is consistent for all project managers
  - Allows for point-in-time analysis
  - Allows for forecast of future performance
  - Can be done at the work element, summary, or project level

Figure 15-7. Why Consider Earned Value Management (EVM)?

Notes:
**Earned Value Management Analysis**

**Earned Value Management (EVM) Analysis** - Uses performance management techniques to help assess the magnitude of any variances that invariably occur.

- One technique used is called **earned value technique (EVT)** which compares the cumulative value of the budgeted cost of work performed (earned at the original) allocated budget amount to both the budgeted cost of work scheduled (planned) and to the actual cost or work performed (actual).

- An important part of **cost control** is to determine the cause of a variance, the magnitude of the variance, and to decide if the variance requires corrective action.

- **EVT** uses the **cost baseline** contained in the project management plan to assess project progress and the magnitude of any variations that occur.

- **EVT** involves developing these key values for each schedule activity, work package, or control account:
  - Planned Value (PV)
  - Earned Value (EV)
  - Actual Cost (AC)
  - Estimate to Complete (ETC)
  - Estimate at Completion (EAC)

---

**Notes:**
Earned Value Management (EVM) Can Answer

EVM can play a crucial role in answering management questions that are critical to the success of every project, such as:

- Are we ahead of or behind schedule? (SV)
- How efficiently are we using our time? (SPI)
- When is the project likely to be completed? (EACt)
- Are we under or over our budget? (CV)
- How efficiently are we using our resources? (CPI)
- How efficiently must we use our remaining resources? (TCPI)
- What is the entire project likely to cost? (EAC)
- How much are we under or over budget? (VAC)
- What is the remaining work likely to cost? (ETC)

Notes:
### Basic EVM Elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned Value (PV)</td>
<td>The physical work scheduled, plus the authorized budget to accomplish the scheduled work; allows the PM to tell whether the project is in trouble by comparing PV to EV and/or AC; what was the planned spending for a given period of time?</td>
</tr>
<tr>
<td>Earned Value (EV)</td>
<td>The physical work accomplished plus the authorized budget for this work; the sum of the approved cost estimates for activities completed during a given period; what work has been completed and what measurement is used to establish the accomplished value of those items?</td>
</tr>
<tr>
<td>Actual Cost (AC)</td>
<td>Total costs incurred that must relate to whatever cost was budgeted within the planned value and earned value in accomplishing work during a given time period; represents the actual cost of performing the work; what has been completed and what is the actual cost of those items?</td>
</tr>
<tr>
<td>Budget at Completion (BAC)</td>
<td>The sum of the total budgets for the project; Project baseline cost; what is the project's budget?</td>
</tr>
</tbody>
</table>

**Notes:**
## EVM Performance Measures (1 of 3)

### Schedule Analysis and Forecasting

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule Variance (SV)</td>
<td>Any difference between the scheduled completion of any activity and the actual completion of that activity; how far off, from a financial point of view, is the project from the schedule?</td>
</tr>
<tr>
<td>Schedule Performance Index (SPI)</td>
<td>The schedule efficiency ratio of earned value accomplished against the planned value; compares work performed to work scheduled; how well is the project performing in relation to how well it is expected to perform?</td>
</tr>
<tr>
<td>Time Estimate at Completion (EAC&lt;sub&gt;t&lt;/sub&gt;)</td>
<td>The rough estimate of when the project will be completed, if current trends continue, compared to when it was originally supposed to be completed; schedule efficiency ratio of earned value accomplished against the planned value; when are we likely to finish the work?</td>
</tr>
<tr>
<td>Percent Complete (PC)</td>
<td>An estimate, expressed as a percent, of the amount of work that has been completed on an activity or a group of activities; how much of the project has been completed?</td>
</tr>
</tbody>
</table>

### Notes:

---

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## EVM Performance Measures (2 of 3)

### Cost Analysis and Forecasting

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Variance (CV)</strong></td>
<td>Any difference between the budgeted cost of an activity and the actual cost of the activity; how far off from the scheduled cost of things to be completed is the actual amount spent on the project?</td>
</tr>
<tr>
<td><strong>Cost Performance Index (CPI)</strong></td>
<td>Cost efficiency ratio of earned value to actual cost; Compares actual cost with budgeted cost; what is the efficiency at which tasks are getting done from a financial point of view?</td>
</tr>
<tr>
<td><strong>To-Complete Performance Index (TCPI)</strong></td>
<td>From this point forward, the efficiency that must be achieved in order to complete the remaining work with the expected remaining money; tells the PM the efficiency level at which the team must work; how efficient must the project team be to finish the remaining work within the budget?</td>
</tr>
</tbody>
</table>

### Notes:

Figure 15-12. EVM Performance Measures (2 of 3)
## EVM Performance Measures (3 of 3)

### Cost Analysis and Forecasting

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate at Completion (EAC)</td>
<td>The expected total cost of an activity, a group of activities, or the project when the defined scope of work has been completed; what is the total project expected to cost?</td>
</tr>
<tr>
<td>Variance at Completion (VAC)</td>
<td>The difference between the total budget assigned to a project, otherwise known as budget at completion and the total estimate at completion (EAC); it represents the amount of expected overrun or under run; how much will we be under or over budget?</td>
</tr>
<tr>
<td>Estimate to Complete (ETC)</td>
<td>The expected additional cost needed to complete an activity, a group of activities, or the project; what is the estimate of additional funds needed to complete the project?</td>
</tr>
<tr>
<td>Percent Spent (PS)</td>
<td>An estimate, expressed as a percent, of how much of the budget at completion you have used to date; how much of the budget at completion has been used to date?</td>
</tr>
</tbody>
</table>

### Notes:

---
Graphic Performance Management Report

Notes:
# Formulas Used to Help Forecast Project Performance

<table>
<thead>
<tr>
<th>Terms</th>
<th>Formula</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate to Complete</td>
<td>ETC = EAC-AC</td>
<td>Expected labor dollars required to complete</td>
</tr>
<tr>
<td>Estimate at Completion</td>
<td>EAC = BAC/CPI</td>
<td>Expected total project cost</td>
</tr>
<tr>
<td>Time Estimate at Completion</td>
<td>EAC(_t) = \frac{(BAC/\text{SPI})}{(BAC/\text{Months})}</td>
<td>Expected completion time</td>
</tr>
<tr>
<td>Variance at Completion</td>
<td>VAC = BAC-EAC</td>
<td>Expected total cost overrun</td>
</tr>
<tr>
<td>Schedule Variance</td>
<td>SV = EV-PV</td>
<td>Difference between the planned and actual work completed</td>
</tr>
<tr>
<td>Cost Variance</td>
<td>CV = EV-AC</td>
<td>Difference between the value of work and actual amount spent</td>
</tr>
<tr>
<td>Cost Performance Index</td>
<td>CPI = EV/AC</td>
<td>Efficiency Index, ratio of budgeted to actual cost</td>
</tr>
<tr>
<td>To Complete Performance Index</td>
<td>TCPI = \frac{BAC-EV}{BAC-AC}</td>
<td>Required efficiency level to complete within budget</td>
</tr>
<tr>
<td>Schedule Performance Index</td>
<td>SPI = EV/PV</td>
<td>Ratio of work performed to work scheduled</td>
</tr>
<tr>
<td>Percent Complete</td>
<td>PC = EV/BAC</td>
<td>% of actual work completed</td>
</tr>
<tr>
<td>Percent Spent</td>
<td>PS = AC/BAC</td>
<td>% of Actual cost spent</td>
</tr>
</tbody>
</table>

---

**Notes:**
EVM Example (1 of 2)

RestEasy Hotel Validation of Project Requirements Activities

- Your team is working on the validation of the RestEasy project requirements
- Assume you have a project with the planned budget or BAC of $2,500,400
- You scheduled your first month budget for the validation of the project requirements activities of $26,496 (PV)
- At the end of the first month, your project actually spent $28,040; this is the total cost and expense incurred for the first month activities up to a specified date (AC)
- You add up all the tasks for the validation of the project requirements activities and determine your EV for the first month to be $22,496

- What is the efficiency at which tasks are getting done from a financial point of view? (CPI)
- How far off from the scheduled cost of things to be completed is the actual amount spent on the project? (CV)
- How well is the project performing in relation to how well it is expected to perform? (SPI)
- How far off is the schedule from a financial point of view? (SV)
- How much of the budget at completion has been used to date? (PS)
- How much of the project is completed? (PC)
- How efficient must the team be to complete the remaining work within the budget? (TCPI)

Notes:
EVM Example (2 of 2)

RestEasy Hotel Validation of Project Requirements Activities

- BAC = $2,500,400
- Actual Cost (AC) = $28,040
- Planned Value (PV) = $26,496
- Earned Value (EV) = $22,496

<table>
<thead>
<tr>
<th>Term</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPI</td>
<td></td>
</tr>
<tr>
<td>CV</td>
<td></td>
</tr>
<tr>
<td>SPI</td>
<td></td>
</tr>
<tr>
<td>SV</td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td></td>
</tr>
<tr>
<td>PC</td>
<td></td>
</tr>
<tr>
<td>TCPI</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Key Messages for Unit 15

- Earned Value Management (EVM) is a key measurement of project health
- Understand what the numbers mean; they are more than the formula
- Use the original plan, plus or minus approved changes (baseline), to control project performance
- Use appropriate metrics to communicate with the individuals or groups involved in the project
- Use EVM as a strategy and technique to track and control the project
- Multiple related metrics are required to do a meaningful analysis

Notes:
Team Exercise 15-1: Earned Value

**Project:** RestEasy Hotels

**Subproject:** Developing a training course

- Read carefully and answer the following questions in the Exercise section for Exercise 15-1

**Notes:**
Unit 16. Procurement Management

What This Unit is About

This unit discusses the basic principles of project procurement management. It details the contract administration process and provides guidelines for contract management. It also describes the responsibilities of the project manager in contract control.

What You Should Be Able to Do

After completing this unit, you should be able to:

• Define contract
• State the prerequisites for contract management
• Describe the guidelines for contract management
• Describe the responsibility of the project manager in contract control

How You Will Check Your Progress

Accountability:

• Class Discussion
• Exercise 16-1: Establishing Relationships Using Contracts

References

Procurement Management

Unit 16
Unit Objectives

After completing this unit, you should be able to:

- Define contract
- State the prerequisites for contract management
- Describe the guidelines for contract management
- Describe the responsibility of the project manager in contract control

Notes:
Project Management Process Groups

Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle


Notes:
Definitions

Contract
- An agreement that establishes an enforceable legal relationship between two parties
- A mutual exchange of promises

Elements of a contract
- Agreement (offer/acceptance)
- Competent parties
- Mutual consideration
- Legal purpose

Contract management
- Contract management is a strategic management discipline employed by both buyers and sellers whose objectives are to manage customer and supplier expectations

Notes:
Why Is a Contract Necessary?

The contract defines each party’s commitment to the project by establishing:

- Rights and obligations of buyer and seller
- Completion criteria, agreed to by both buyer and seller
- Basis for pricing
- Basis of settlement of any future disputes

An agreement that is enforceable

- By law
- By internal escalation

A good contract should:

- Share risks fairly
- Motivate each party
- Balance the interests of the parties involved
- Prevent surprises
- Prevent individual actions from constraining a company

Figure 16-5. Why Is a Contract Necessary?

Notes:
Purpose of a Contract

To establish a business relationship based on . . .

Understanding → Agreement → Confidence

Notes:
Project Procurement Management is discussed from the perspective of the BUYER in the buyer-seller relationship.
## Contract Management Process from Buyer's and Seller's Perspective

<table>
<thead>
<tr>
<th>Party</th>
<th>Preaward</th>
<th>Award</th>
<th>Postaward</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buyer</td>
<td>Plan Purchases and Acquisitions</td>
<td>Request Seller Responses</td>
<td>Select Sellers</td>
</tr>
<tr>
<td></td>
<td>Plan Contracting</td>
<td></td>
<td>Contract Administration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Contract Closure or Termination</td>
</tr>
<tr>
<td>Seller</td>
<td>Presales Activity</td>
<td>Bid/no-bid Decision Making</td>
<td>Contract Negotiation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bid or Proposal Presentation</td>
<td>Contract Administration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Contract Closure or Termination</td>
</tr>
</tbody>
</table>

**Notes:**
Major Contract Types (1 of 2)

Understanding the difference among common contract types is important because each type poses a different risk for the buyer versus seller.

Fixed Price or Lump Sum
- Firm-fixed-price (FFP)
  - The buyer pays the seller a set amount, regardless of the seller's costs
- Fixed-price-incentive fee (FPIF)
  - The buyer pays the seller a set amount, and the seller may earn an additional amount if defined performance criteria are met

Notes:
Major Contract Types (2 of 2)

Understanding the difference among common contract types is important because each type poses a different risk for the buyer versus seller.

Cost reimbursement and Time and Materials (T&M)

- Cost-Plus-Fee (CPF) or Cost-Plus-Percentage of Cost (CPPC)
  - The buyer reimburses the seller for the seller's allowable costs plus a fee calculated as an agreed-upon percentage of the costs.
- Cost-plus-fixed fee (CPFF)
  - The buyer reimburses the seller for the seller's allowable costs plus a fixed amount of profit (fee).
- Cost-plus-incentive fee (CPIF)
  - The buyer reimburses the seller for the seller's allowable costs plus an additional amount if defined performance criteria are met.
- Time-and-materials (T&M)
  - The buyer reimburses the seller for labor expended (negotiated price/unit of time) and cost of materials provided.
- Level-of-effort (LOE)
  - Is generally characterized by a uniform level of activity over a specific period of time for a negotiated price.

Notes:
Statement of Work (SOW)

A narrative description of products or services to be supplied under CONTRACT

Example of SOW components:

<table>
<thead>
<tr>
<th>Introduction/ applicable documents/ key assumptions</th>
<th>Responsibilities, products and services, and tasks' completion criteria</th>
<th>Schedule</th>
<th>Project completion/ acceptance criteria</th>
<th>Charges/ terms and conditions/ miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Introduction, listing of all documents referenced in the SOW (exact title, number, revision level, and date), key assumptions</td>
<td>- Description of responsibilities, products and services, and completion criteria</td>
<td>- Dates that products and services shall/will be delivered</td>
<td>- Clearly establishes when the work is completed and accepted</td>
<td>- Type of contract • Payment schedule • Terms and conditions • Standards • Travel • Shipping • Appendixes</td>
</tr>
</tbody>
</table>

Notes:
Major Contract Payment Approaches

Notes:
Three Primary Roles in the Contract Management Process

- Project manager
- Procurement/contracts team
- Client/project sponsor or supplier

Roles and responsibilities may be distributed by business unit, geography, or country, based on resources, skills, or experience

Notes:
What the Project Manager Should Do

During the project, you must ensure that:

- The project remains within the scope, timeframe, and costs of the original contract
- The contract is amended to support a project change that reflects new requirements
- The contract is amended when unforeseen circumstances require a supplier to increase resources in order to meet the original requirements
- All special terms and conditions (Ts and Cs) in the client's and supplier's contracts are being managed

Notes:
Guidelines for Managing Contracts (1 of 2)

- Confirm whether the change requests received require changes to the contract
- Establish and manage the contract change process
- Negotiate contract changes with the client and with suppliers
- Monitor performance of the client and suppliers against the agreed-upon responsibilities and inform all parties of any failure to meet agreed-upon dates, resources, commitments, and deliveries
- Maintain the financial progress record of the project by recording and managing project costs

Notes:
Guidelines for Managing Contracts (2 of 2)

- Secure the client's formal approval of any agreed-upon acceptance tests in the contract
- Control all assets made available to others in the project, that is, client and suppliers
- Reconcile delivery of all deliverables under the contract
- Reconcile billing and payment of suppliers
- Secure agreement of suppliers that they have received all money due to them

Notes:
Key Message for Unit 16 (1 of 2)

- A contract is a mutually binding agreement that obligates the seller to provide the specified product and obligates the buyer to pay for it.

- The purpose of a contract is to establish a business relationship based on understanding, agreement, and confidence.

- Secure the client's agreement that the project is completed and the supplier has delivered all that it contracted to deliver.

- Ensure return to the suppliers of all assets made available from others during the project.

- A contract system should be established to support contract management.

- The contract administration process can be extensive, long, and involve the entire project.

Notes:
Key Message for Unit 16 (2 of 2)

- The phases of the contract management process are:
  - Preaward
  - Award
  - Postaward

- There are three primary roles in the contract management process:
  - Project manager
  - Procurement/contracts team
  - Client/project sponsor or supplier

Notes:
Team Exercises 16-1: Establishing Relationships Using Contracts

Project: RestEasy Hotels

Read the handout and answer the following questions:

1. What are the major disconnects contained in the materials?
2. What specific risks should be identified on this project?
3. What specific recommendations (contractual or otherwise) do you have for the project manager?

Notes:
Unit 17. Project Reviews

What This Unit is About

This unit introduces project management reviews and describes their importance to managing a project.

What You Should Be Able to Do

After completing this unit, you should be able to:

• Describe how to arrange and prepare for the appropriate project management reviews

• Use project management reviews to help ensure that a project is progressing on schedule, within budget, and meeting the requirements

How You Will Check Your Progress

Accountability:

• Class Discussion

• Exercise 17-1: Conducting an Independent Project Peer Review

References

Project Reviews

Unit 17

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Describe how to arrange and prepare for the appropriate project management reviews
- Use project management reviews to help ensure that a project is progressing on schedule, within budget, and meeting the requirements

Figure 17-2. Unit Objectives

Notes:
Project Management Process Groups

Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

Notes:
Why Conduct Project Management Reviews?

Project management reviews provide opportunities for you to report project schedule and budget status, highlight project accomplishments, identify problems, escalate issues, and elicit management support.

- The main purpose of a project management review is to provide general guidance to you as the project manager with an objective assessment of a project's health.

- The main tasks are to:
  - Review progress and achievements to date.
  - Review plans and authorize the project to proceed to the next Project Management Review.
  - Confirm the continued viability of the project.
  - Review project control and assurance activities and reports.
  - Review risks and issues making decisions and communicating results.

Reviews should be conducted by an independent group of skilled reviewers outside of the project who can view the project objectively.

Notes:
Different Types of Project Management Reviews (1 of 2)

Different types of project management reviews are held based upon the timing of the review; project review types are:

- **Contract readiness review** - Some organizations hold this type of review within two to eight weeks after the contract is signed
- **Periodic review** - Some organizations hold this type of review every three to six months
- **Completion review** - This is a project management review that is completed at the end of the project
- **Special review** - This type of review is held when there appears to be a serious problem or when the project manager has reason to request one, such as where there has been a project management turnover
- **Compliance review** - This review ensures that policies and procedures are being followed by the project and identifies improvements that can be made to procedures
  - Compliance reviews might be conducted by an organization, external to the project, by the sponsor, or by an outside body

Neglect always carries a high cost, Project Reviews should be mandatory

Figure 17-5. Different Types of Project Management Reviews (1 of 2)
Different Types of Project Management Reviews (2 of 2)

- **Deliverable review** - This is a review of a deliverable or key component
  - The review is held before the deliverable or key component is released to the sponsor to ensure that no open items remain and that delivery is appropriate

- **Business reviews** - This type of review focuses on financial and business exposures

- **Project management reviews** - This is a review that focuses on the planning and control aspects of the project

- **Technical reviews** - Technical reviews focus on the technical aspects of the project, including work products, deliverables, and subcontractor reviews
  - This review covers areas such as traceability of requirements, architecture, and technology competitiveness

As the project manager, you must not rely totally on prescribed reviews but should exercise judgment in determining which reviews are necessary and when they should be held to make the project a success

Notes:
Topics You Should Cover in a Project Management Review (1 of 2)

Prior to the review, you should make arrangements with the review team leader to set the schedule for the review

- Typical activities to plan for a smooth review include:
  - The project manager's presentation
  - Interviews with key project members (including subcontractors)
  - Interviews with key customer project team members and project sponsor
  - Project documentation analysis
  - Review debrief with the project manager

- In the typical project management review, you have an opportunity to present your view of the project at the beginning of the review

- You should cover the topics on the next slide in the overview

Include project review activities in the project management plan

Notes:
Topics You Should Cover in a Project Management Review (2 of 2)

**Project overview** - This is where you can orient the review team to your project scope, objectives, major milestones, customer organization, project staffing (including subcontractors), and planning baselines

**Highlight project accomplishments** - This is a great opportunity for you to describe all the good things that are happening on your project

**Give an overview of the project management processes you are following** - This is where you can describe the plans you have created and are using to track your project and what tools and methodologies you are using on the project

**Identify project-related risks and problems** - This is your list of the risks and problems with the actions that you are taking to mitigate the risks and solve those problems; also, report the results of any earlier project management reviews or solution or deliverable reviews and the status of their associated action plans

**Provide an objective assessment of the health of the project** - Here you get to tell the reviewers how you think the project is going; be objective.; keep in mind they are going to talk to several other people and go through your documentation; they are not just going to take your word for it

Following your presentation, the reviewers will want to see your plans and status reports and talk to the other members of your team

Notes:
Key Questions To Answer

- In the project review process, the key question is, Where are you? The reviewers want to understand where you are today
- There is also a need to look forward, to predict the future
- You can do both of these by using the earned value (EV) indicators to determine where you are relative to the budget and the schedule today and where you will be at the end of the project

The following key questions help to determine the health of a project

Where should the project be?
How much has been done?
How much has it cost?
How much will it take to finish?
What will it cost when it is done?

Notes:
Project Management Review Tasks

- Review project documentation, especially the Project Control Book (PCB)
- Review cost data
- Review schedule data
- Review risk plan
- Review change control log
- Interview selected team members and the client/project sponsor
- Analyze the information collected
- Prepare a report of findings and recommendations

Notes:
Key Messages for Unit 17

- The main purpose of a project management review is to provide general guidance to you as the project manager with an objective assessment of a project's health.

- Reviews should be conducted by an independent group of skilled reviewers outside of the project who can view the project objectively.

- Include project review activities in the project management plan.

- Project management reviews are a great opportunity to:
  - Show your peers what you are doing, to learn something, and to get some help where you need it.
  - Get some support to help you solve problems you might have that cannot be solved any other way.

- Preparing for the project management review takes time:
  - All of that work needs to be done anyway, and the project review just forces it to be done sooner.

Notes:
Exercise 17-1: Conducting an Independent Project Peer Review

Exercise 17-1
- Conducting an Independent Project Peer Review

Notes:
Unit 18. Closing Processes

What This Unit is About

This unit discusses project closure and describes the closing process activities.

What You Should Be Able to Do

After completing this unit, you should be able to:

- Explain the process for project closure
- Describe the closure phase activities
- Describe how to implement project closeout

How You Will Check Your Progress

Accountability:

- Class Discussion

References


Closing Processes

Unit 18

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Explain the process for project closure
- Describe the closure phase activities
- Describe how to implement project closure
- Develop lessons learned for future projects

Notes:
Project Management Process Groups

Figure 3-2. Project Management Process Groups Mapped to the Plan-Do-Check-Act Cycle

Notes:
Administrative Closure Procedure

**Administrative Closure Procedure** - Details all the activities, interactions, and related roles and responsibilities of the project team members and other stakeholders involved in executing the administrative closure procedures for the project

- Project closure is a process, a set of activities and tasks, that is executed to bring the project to successful completion
- Project closure planning should start at the beginning of the project
- A project administrative closure plan should be included in the project control book
- The project closure should be planned, budgeted, and scheduled
- The project closure should involve the same group of people involved in project startup
- Project closure must be done because it provides a lasting impression on your customers and stakeholders

*Project closure begins on day one of the project*

**Notes:**
Project Closure Activities

Project closure activities include:

- Develop a transition plan
  - Deliver the solution to the client
- Conduct administrative closure
  - Complete all documents associated with project measurement
  - Gather all information about the project and formalize project closure
- Close client/sponsor activity
- Close contracts
  - Complete and terminate all contracts
  - Resolve all open issues
- Implement the closeout plan
- Compiling and disseminating Lessons Learned
- Sign the completion documentation

Notes:
Contract Closure Procedure

Contract Closure Procedure - Includes all activities and interactions needed to settle and close any contract agreement established for the project, as well as define those related activities supporting the formal administrative closure of the project.

- Contract closure procedure involves:
  - Product verification - Has all work been completed correctly and satisfactorily?
  - Administrative closure - Updating of contract records to reflect final results and archiving that information for future use.

Contract terms and conditions might also prescribe specifications for closing the contract which would need to be made part of the procedure.

Notes:
Design for Project Closure

Project closure should be planned, budgeted, and scheduled

Notes:
Close the Project Resources

Figure 18-8. Close the Project Resources

Notes:
Project Completion Workshops (1 of 2)

You can hold two different completion workshops, one for the team and one for the client. They serve the purpose of:

- Confirming that all deliverables were received
- Recognizing the contribution made by individuals
- Publicizing the success of the project
- Marking and recording the formal end of the project
- Ensuring that experience gained and lessons learned from the project are incorporated into your organization's standards

Notes:
Project Completion Workshops (2 of 2)

- Measuring and recording project objectives:
  - Function
  - Quality
  - Performance
  - Cost
  - Schedule
  - Identifying end-of-project housekeeping activities
  - Lessons learned

Figure 18-10. Project Completion Workshops (2 of 2)

Notes:
Lessons Learned

Lessons Learned - the learning gained from the process of performing the project. Lessons learned may be identified at any point

- Timely
- Relevant
- In context
- Detailed
- Intellectual capital

Project managers have a professional obligation to conduct lessons learned sessions for all projects

Notes:
Project Manager's Responsibilities

- Assess the terms of agreement and the completion of all commitments
- Release the technical environment
- Obtain sponsor feedback
- Assess the lessons learned
- Close out the sponsor agreement
- Submit the intellectual capital

Notes:
Key Messages for Unit 18 (1 of 2)

- Administrative Closure is a process and must be carefully planned, budgeted, and scheduled just like any other phase of the project life cycle.
- Include a project closure plan in the project control book.
- Involve the same group of people in the project closure as were involved in project startup, where possible.
- Project closure begins on day one of the project.

Notes:
Key Messages for Unit 18 (2 of 2)

- Closure is essential to ensure that:
  - Formal acceptance of the project is made by the Client/project sponsor
  - Various project records are completed
  - Completion criteria are met for the final revision and issuance of documentation
  - Essential project documentation is retained
  - Lessons-learned are documented
  - Warranty is transferred, where applicable

Figure 18-14. Key Messages for Unit 18 (2 of 2)
Unit 19. Managing Project Teams

What This Unit is About

This unit discusses some basics of managing project teams.

What You Should Be Able to Do

After completing this unit, you should be able to:

• Identify behaviors that encourage team building
• Develop strategies for overcoming barriers to team performance
• Relate the benefits of teams to their organizations

How You Will Check Your Progress

Accountability:

• Class Discussion

Reference

Managing Project Teams

Unit 19

Figure 19-1. Managing Project Teams

Notes:
Unit Objectives

After completing this unit, you should be able to:

- Relate the benefits of teams to their organizations
- Identify behaviors that encourage team development and team performance
- Develop strategies for overcoming barriers to team performance

Notes:
Definition of a Team

A small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable

From Katzenbach and Smith 1994

A group of people is not a team. A team is a group of people with a high degree of interdependence geared toward the achievement of a goal or completion of a task...it is not a group for administrative convenience

From Glenn Parker 1990

All groups do not qualify as teams. A team is a group of people who work interdependently, who are committed to common goals, and who produce high quality results....it is not a group for administrative purposes

From Vijay Verma 1997

Notes:
What Is a Team?

- Ideal team size is 8 to 10 members
- Complementary skills include:
  - Technical or functional
  - Problem-solving
  - Decision-making skills
  - Interpersonal skills
- Emphasize the team's common goal by:
  - Defining a meaningful purpose that sets the tone and inspires the team
  - Developing a team charter
  - Translating broad directives into specific and measurable performance goals
  - Committing to a common approach for how they will work together
- Mutual accountability
  - Versus boss accountability, group must have the "we hold ourselves accountable" attitude
  - Underpinnings of commitment and trust

Source: Katzenbach and Smith 1994
Benefits of Working in Teams

- Research shows that 6 of 10 full-time employees prefer working as part of a team rather than solo

- **Benefits of working in teams can include (in decreasing order of importance)—**
  - Lower stress
  - Increased work quality
  - Improved attitude about work
  - Increased profitability
  - Increased productivity

*Notes:*
**Team Development**

- **Team development** is the process (a process of change) of:
  - Transforming a group of individuals who may have different interests, backgrounds, and expertise into an integrated and effective working unit
  - Awareness building
    - It’s helping people to understand that they are greater collectively than individually
    - It is an understanding that all of our decisions will be better when some degree of collaboration is applied

- **Develop Project Team** is a process which improves the competencies and interaction of team members to enhance project performance

*Figure 19-6. Team Development*
Objectives of Team Development In Project Management

- Improve skills of team members in order to increase their ability to complete project activities
- Encourage open communications
- Improve feelings of trust and cohesiveness among team members
- Establish realistic, achievable, objectives for the team
- Gain commitment of team member support to make the team successful
- Encourage team members to test their abilities and ideas
- Understand the boundaries placed on the team which may dictate what the team can and cannot do
- Allow for more effective conflict resolution

Notes:
## Tuckman Model of Group Development

<table>
<thead>
<tr>
<th>Group Stages</th>
<th>Group Behavioral Patterns</th>
<th>Group Task Issues</th>
<th>Leadership Issues</th>
<th>Leader’s Key Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forming</td>
<td>Hesitant climate, testing boundaries, superficial, polite ambiguity, confusion</td>
<td>Focus on commonalities, orientation, introductions, clarify membership</td>
<td>Dependence on others to assume leadership role</td>
<td>Set clear objectives, conduct team kickoff, set team charter</td>
</tr>
<tr>
<td>Storming</td>
<td>Establish operating rules, attempt to create order, conflict, seeking status, power</td>
<td>Decision-making process clarified, power and influence issues emerge</td>
<td>Counter dependence, alliances, subgroup formation</td>
<td>Resolve conflicts, use objectives to pull team together, clarify team member roles and responsibilities</td>
</tr>
<tr>
<td>Norming</td>
<td>Cohesion, negotiation, open communication, increased harmony, understanding of team and operating norms</td>
<td>Development of functional working relationships</td>
<td>Interdependence between team members</td>
<td>Provide feedback on performance, tune the project’s operating processes</td>
</tr>
<tr>
<td>Performing</td>
<td>Growth, insight, collaboration, shared responsibility, personal accountability, less formal</td>
<td>Production, creativity, shared ownership</td>
<td>Interdependence between team members</td>
<td>Give positive feedback, channel the team’s energy</td>
</tr>
<tr>
<td>Adjourning</td>
<td>Concern with uncertain future, feel loss, deny feelings by joking, miss meetings; positive feelings about team accomplishments</td>
<td>General decrease</td>
<td>Increase directive and supportive behavior as appropriate</td>
<td>Keep team focused on completion, give recognition, formally close project, release team</td>
</tr>
</tbody>
</table>

*Figure 19-8. Tuckman Model of Group Development*

**Notes:**
Barriers to Team Building and Performance

- Credibility of the project leader
- Unclear project objectives
- Changing project goals and priorities
- Lack of team definition and structure
- Confusion about the team member’s roles and responsibilities
- Lack of effective communication
- Lack of commitment of team members
- Uninvolved, unsupportive upper management support
- Performance appraisals that fail to recognize teamwork
- Lack of appropriate team rewards and recognition
- Diversity of team members
- Excessive team size
- Insufficient resources

Adapted from Managing the Project Team, Vijay Verma, 1997

Notes:
Behavior Roles of Team Members

- **Task-oriented behaviors** - Focus on what a team needs to do to get the job done, facilitates and coordinates decision-making tasks.

- **Relations-oriented (Maintenance-oriented) behavior** - Focus on the social needs of the team, deals with team tasks, sentiments and viewpoints.

- **Self-oriented behavior** - Focuses only on the needs of individual team members, sometimes at the cost of the team.

Figure 19-10. Behavior Roles of Team Members

**Notes:**
Task-Oriented Behavior Role

Directed toward facilitating and coordinating decision-making tasks

- **Initiators** - Offer new ideas and suggest methods or strategies for proceeding
- **Information givers** - Offer facts or generalizations that relate experiences pertinent to team problems
- **Information seekers** - Clarify suggestions and obtain authoritative information
- **Evaluators** - Assess how the team is functioning and questions the practicality, logic, or suggestions of other team members
- **Coordinators** - Coordinate team members' ideas, suggestions and activities
- **Summarizors** - Combining ideas of team ideas into a cohesive statement and drawing conclusions

Figure 19-11. Task-Oriented Behavior Role
Relations-Oriented Behavior Role

Directed toward maintaining good interpersonal relationships within the team

- **Encouragers** - Welcome others’ ideas and opinions, being accepting of and responsive to others’ perspectives, giving others an opportunity to contribute
- **Harmonizers** - Reduce tension and resolve intragroup conflict by emphasizing points of agreement and reconciling differences of opinion
- **Group Observers** - Sense mood of team and reflect it back for discussion, shares own feelings about group processes
- **Compromisers (Followers)** - Give in or give up their position for the sake of harmony, admit mistakes or errors, exercise personal discipline in response to conflict
- **Gatekeepers** - Encourage communication and participation by all team members
- **Standard Setters** - Establish mutually acceptable ways of interacting within the team setting

**Notes:**
Self-Oriented Behavior Role

Directed toward satisfying an individual's psychological needs in relation to identity, personal needs, intimacy, power, and control and influence

- **Blockers** - Negative and reject the views of others, attempt to get own way regardless of others
- **Topic Jumpers** - Do not stay focused on the topic, continually change the subject
- **Recognition Seekers** - Try to get attention and monopolize discussion
- **Dominator** - Assert personal dominance; interrupt the contributions of others
- **Devil's Advocates** - Bring up alternative viewpoints, resist authority
- **Avoiders** - Maintain a distance from others and resist new ideas and teamwork

Notes:
Diversity in Teams

DIVERSITY IS AN ASSET TO TEAMS, but it only becomes an asset when team members develop skills to work with other people:

- Problem solving skills
- Conflict resolution skills
- Planning and goal setting skills
- Communication and working in group skills

DIVERSITY ENCOURAGES INCREASED CREATIVITY, leading to:

- Better problem definition
- Enhanced concentration
- More alternatives
- Better solutions
- Better decisions

Diversity is about celebrating the differences and similarities that all of us bring to the workplace

Notes:
Common Problems Teams Must Overcome

When teams fail, it's usually because of one of five reasons:

- Members don't understand the team's mission
- Members don't understand their own roles or responsibilities
- Members don't understand how to do their tasks or how to work as part of a team
- Members don't buy into the team's function, purpose, or goals
- Members reject their roles or responsibilities

Notes:
Conflict in Project Teams

- **Conflict is inevitable in a project environment**
  - It is important to be able to work through conflict in a constructive way, in order to maintain motivation within the team
  - It is virtually impossible for people with diverse backgrounds, skills, and norms to work together as a team to meet project objectives without conflict

- **Conflict is healthy, any team contains people with different perspectives and priorities**
  - Conflict identifies these differences and causes them to be resolved
  - Conflict is natural and actually improves creativity; without creative contention innovative solutions to new problems will not be found

- **Conflict is often destructive**
  - Unacknowledged or unresolved conflict causes problems because it
    - Wastes energy, diverts attention from more important issues, increases tension, decreases cooperation, morale and productivity
  - We must learn to manage conflict in order to foster creativity and minimize destructive conflict

Notes:
Conflict Intensity By Life Cycle Phase

Notes:
Managing Team Conflicts Effectively

To handle conflict in team environments the project manager should remember:

- Conflict is natural
- Openness resolves conflict
- Conflict resolution must focus on issues, not personalities
- Conflict forces a search for alternatives
- Conflict resolution is present-oriented
- Conflict is a team issue

Managing team conflicts promptly and effectively is one of the prime responsibilities of the project manager

Adapted from Managing the Project Team, Vijay Verma, 1997

Notes:
Key Messages for Unit 19

- Team Development is a process that must be planned, budgeted, and scheduled just like any other phase in the project life cycle.
- A team is made up of people who are committed to a common purpose.
- Understanding the stages of growth for teams helps avoid overreacting to normal problems and setting unrealistic expectations for a project team.
- Team members should engage in the appropriate behaviors to encourage team development.
- Individuals are usually not aware of their behaviors in situations when conflict arises.
- Because project teams are increasingly multicultural, finding ways to communicate across cultural boundaries is critical.

Notes:
Unit 20. Wrap-Up of Principles of Project Management

What This Unit is About
This section summarizes the project management framework and the skills a project manager needs, and it closes the course. The course concludes with an exam to let the students test what they have learned in the class.

What You Should Be Able to Do
Now that you have completed this course, you should be able to:
- Build a performing organization and project team
- Identify and validate project requirements
- Create project plans
- Establish project estimates and project schedules
- Develop Work Breakdown Structures (WBS)
- Manage overall change control
- Control project execution processes
- Terminate a project with a closure strategy
- Perform your role as a project manager
- Describe the nine PMI knowledge areas

References
Wrap-Up of Principles of Project Management

Unit 20

**Notes:**
Principles of Project Management
Final Objectives

Now that you have completed this course, you should be able to:

- Build a performing organization and project team
- Identify and validate project requirements
- Create project plans
- Establish project estimates and project schedules
- Develop Work Breakdown Structures (WBS)
- Manage overall change control
- Control project execution processes
- Terminate a project with a closure strategy
- Perform your role as a project manager
- Describe the nine PMI knowledge areas

Notes:
Skills a Project Manager Needs (1 of 2)

A project manager needs:

- A sound understanding of the industry
- Experience managing projects through all phases of the project life cycle
- Excellent communication and teaming skills
- Skills managing and motivating people to deliver according to rigorous timetables
- A solid appreciation of business planning and strategy techniques

Notes:
Skills a Project Manager Needs (2 of 2)

A project manager needs:

- Ability to understand and implement change management programs
- IT literacy and knowledge of the advantages that IT might bring to an application
- Ability to execute the concepts of risk management
- Ability to manage client expectations while retaining alignment with evolving business needs
Additional Project Management Courses

More courses designed to enhance your project management skills:

- Project Leadership and Team Building (N2651)
- Financial Management for Project Managers (N2652)
- Contracting for Project Managers (N2653)
- Project Risk Management (N2654)
- Project Cost & Schedule Management (N2658)
- Applying Project Management Principles (N2670)
- Leading Complex Projects Workshop (N2677)
- PMP Examination Preparation (N2672)

Notes:
See You...

Thanks and Good Luck

Notes:
End of Class Exam

25 questions in 30 minutes

Have Fun!

Notes:
Appendix A. Case Study

Improvement Project Summary of Intent

RestEasy Hotels

The Statement of Need

RestEasy Hotels chain has 20 hotels spread throughout the country. This number is due to increase throughout the coming year with a planning estimate of 24 hotels at the end of next year.

The hotel chain follows a set of standard manual procedures across all the hotels that interface back to the home office functions. Apart from some word processing, no computing is done by the hotels themselves. However, at the Home Office some computing facilities exist for typical business functions, such as General Ledger and Payroll.

The Executive Director of the hotel group has expressed a number of concerns about the group’s ability to survive in the increasingly competitive environment. The points that have been made by the executive director are:

- "I believe that our efficiency in the hotels themselves could be raised so that we can cut costs and show a greater profitability."
- "I think that our image and customer satisfaction index is falling, relative to other hotels as they become more efficient."
- "We don't appear to have any efficient links between hotels that can exploit the repeat business in other hotels in the chain."
- "I think individual hotels could make use of personal data captured to secure repeat business or create additional business."
- "I'm sure we could raise our occupancy with more up-to-date information than the current processes provide."
The Benefit

By addressing the above issues, the hotel chain believes that the customer satisfaction index could be improved and more repeat business would be secured. Also, if the chain could become more profitable, then funds could be allocated to the acquisition of more hotels and thus increase market share.

Through a combination of staff reductions and significant increases in both the hotel occupancy and utilization of facilities, the costs are expected to be recouped after approximately 18 months using the new system. The main areas where the benefits are expected are in:

- Guest administration
- Function administration
- Staff and services management
- Marketing information
The Solution Chosen by RestEasy

A number of options were considered, but the Executive Director decided to install a computer system in each hotel. Personal computers would be spread throughout the hotel business functions and tied into an IBM midsize system in the Home Office. The IBM midsize system is running an end-to-end hotel management system provided by the Sleep Away Software Group which provides flexibility for tailoring its functionality to the needs of a hotel chain.

A supplied network connects each of the 20 hotels together with the two computers installed at the Home Office to enable the timely flow of information within the organization. The cost for implementing this solution has yet to be determined but the Executive Director is convinced that the chain needs to undertake this project to remain competitive and grow the business.

Considerations

1. Structural changes required within the hotels and head office to accommodate the computer system.
2. New procedures need to be established for both the hotel and head office staff.
3. The system needs to be installed without causing disruption of hotel functions and without provoking complaints from the guests.
4. The staff of each hotel needs to be trained on the new system and procedures prior to the system going live in their hotel.
5. The system needs to provide a mechanism for the RestEasy Hotel staff to get questions answered related to the new systems and procedures.
6. Establish metrics to measure the productivity increase of the hotel staff in accomplishing administrative tasks.
7. Establish process for measuring the customer’s satisfaction with the new systems and procedures.

Summary

Based on the Executive Director’s decision, a computer-based system is installed in each hotel and linked to the head office. This decision was made exclusively by the Executive Director based on information he gathered while attending a conference on hotel management. The exact functional requirements of the computer and software systems to satisfy the needs of the hotels and head office are not clearly defined and documented. It is clearly the intent of the chain to have a standard system installed which has demonstrable and measurable benefits for the chain, its staff, and most importantly, its customers. Since the chain plans to add four hotels by the end of next year, the Executive Director has indicated his desire to have the computer system installed and functional in the existing hotels within 12 months.
Appendix B. Project Charter

To: Project Manager of RestEasy Hotels Improvement Project

From: Executive Director, RestEasy Hotels Group

Date: January 12, 2005

Assignment

As part of the RestEasy Hotels Improvement Project, you have been assigned as the Project Manager responsible for the initial training of the hotel staff on the new hotel management system that is being installed in all 20 hotels around the country. You are responsible for ensuring that all users in each hotel are trained within one week of the system’s installation at their hotel. You work closely with other members of the RestEasy Hotels Improvement Project Team to ensure that all project objectives are met.

Responsibilities

Specifically, you are to do the following:

• Act as the central point of contact for all formal project-related communication among the project stakeholders.
• Ensure that all project team members are aware of their responsibilities and commitments and that they perform them as promised.
• Ensure that all contractual commitments are fulfilled on time, within budget, and to the complete satisfaction of the sponsor.
• Ensure that a system is in place to document and control contractual performance.
• Prepare a realistic, detailed project plan and obtain agreement to the plan from all stakeholders.
• Maintain a Project Control Book that contains all relevant project information.
• Control cost, schedule, and technical variance from the plan.
• Report project status to management on a regular basis.
Authority

The scope of your authority as Project Manager includes the following:

- Authority to lead your project team
- Authority to issue specific directives as necessary
- Direct access to the sponsor or executive project manager on all matters related to this project
- Control and distribution of your project budget
- Authority to require periodic project team status reporting
- Authority to monitor the time, cost, and performance activities of your project team and to ensure that all problems are promptly identified, reported, and solved
- Authority to cross functional organization lines and to interface with all levels of RestEasy Hotels management to achieve project success
- Authority to negotiate with RestEasy Hotel’s functional managers for changes in resource assignments
- Authority to delegate responsibilities and authority to project team associates.

Constraints

- Some of the project team members have constraints on when they can travel, and for how long they can be away from their primary work location.
- Team members' functional managers can assign them full or part time to other project teams, but I assure you that this project is currently at the top of our portfolio.
- Overtime hours need to have prior approval.
- Cost containment must be a priority of all team members but must not impact the overall success of the project.

Scope Statement

The overall project sets up, configures, and installs IBM processors and third-party hotel-management software in all RestEasy hotels within 12 months, in accordance with the specifications approved by the sponsor. The system is rolled out as follows:

- A prototype of the new system and its training is developed, installed, and tested in a sponsor-designated hotel no later than six weeks before the targeted installation date for the first hotel.
- All reviews of the prototype, training, and agreed-to changes must be completed within two weeks of the targeted first installation.

Please refer to the RestEasy Hotels Improvement Project Summary of Intent which contains additional information related to this project.
Appendix C. Customer Contract

Draft Contract
Between
RestEasy Hotels
and
IBM Corporation

Statement of Work

IBM Corporation (hereinafter, the Supplier) provides the two midrange computers and all applicable operating systems software to be installed at the RestEasy (hereinafter, the Customer) Hotels Home Office. The Supplier sources the personal computers to be installed at each of the hotels and the Home Office from American Systems per the specifications listed below. The Supplier sources that hotel package software from Royal Software, and the Supplier is responsible for tailoring the software to meet the needs of the Customer. The actual locations, dates, and quantities for delivery is determined at a later date. The Customer provides this delivery information in separate correspondence 30 days prior to scheduled deployment. All locations are domestic and spread across the country.

Exact technical requirements and specifications are incorporated herein by inclusion in the specifications list below. The Supplier preloads necessary software provided by the Supplier, as well as any software provided by the Customer, before delivery to the Customer’s sites as agreed to in this contract. A two year warranty is provided under this base contract, while follow-on services, if any, are described and agreed to under separate agreements. The personal computers are to be delivered 90 days from contract date.
Specifications List

Standard Features:

- 2.49 GHz Intel Pentium 4 Processor
- 128 MB DDR SDRAM memory
- 80 GB hard drive
- CD-RW
- Integrated Ethernet and modem
- 15-inch (13.8-inch VIS) Color Monitor

Preloaded software:

- Microsoft Windows 2000 Professional Edition, including standard utilities
- Lotus SmartSuite Millennium
- Norton Antivirus (OEM Version)
- Internet Explorer
- Royal Client Hotel software, provided by Royal Software, customized by the Supplier

Terms of Payment

The Customer pays the Supplier on two milestones for the work performed and equipment/software supplied under this contract. Those milestones are:

- One-half of all monies due under this contract payable upon receipt and acceptance of one-half of the required equipment/software.
- The other half of the total due under this contract is payable at the conclusion of the work under this contract.
Exercise 4-1. Establish Goals and Objectives

Read the Project Charter and document the business needs goals and objectives of the project from the perspective of the Executive Sponsor and then from the project team. to which you have been assigned.

Goals

The goals of this project are:

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Objectives

The objectives of this project are:

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
Exercise 6-1. Team Charter

Instructions

You have just joined the RestEasy Hotels Improvement Project team. Your group is meeting to kick off the project. As a group, you have been requested to prepare a team charter and develop the team administrative requirements and responsibilities, as well as to define the procedural guidelines that governs the behavior of the team.
Exercise 8-1. Build a WBS

Background Information

The following major items have been identified as being required to make the necessary changes required to achieve the RestEasy Hotels objectives.

Major Items

1. Define requirements of hotel system
2. Define functionality of Sleep Away Software Group
3. Install prototype
4. Accept prototype
5. Install host hardware and software
6. Define networking tests
7. Test networking
8. Accept Royal hotel system application
9. Develop host operations procedures
10. Develop hotel operational procedures
11. Develop rollout procedures and checklists
12. Accept hotel operational procedures
13. Develop and implement help desk
14. Define hotel modifications
15. Develop staff/hotel readiness checklists
16. Test rollout procedures and checklists
17. Develop training course
18. Train staff
19. Roll out to hotels

Based on the above major items, the following deliverables can be created:

<table>
<thead>
<tr>
<th>Team Assignments</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team 1</td>
<td>1. Requirement, functionality, and acceptance of hotel system</td>
</tr>
<tr>
<td></td>
<td>2. Hardware and software installation</td>
</tr>
<tr>
<td></td>
<td>3. Hotel modification</td>
</tr>
<tr>
<td>Team 2</td>
<td>4. Prototype installation</td>
</tr>
<tr>
<td></td>
<td>5. Operations and operational procedures</td>
</tr>
<tr>
<td></td>
<td>6. Help Desk</td>
</tr>
<tr>
<td>Team 3</td>
<td>7. Site preparation</td>
</tr>
<tr>
<td></td>
<td>8. Rollout plan</td>
</tr>
<tr>
<td></td>
<td>9. Network/home office systems</td>
</tr>
<tr>
<td>Team 4</td>
<td>• As assigned by the Instructor</td>
</tr>
<tr>
<td>Team 5</td>
<td>• As assigned by the Instructor</td>
</tr>
</tbody>
</table>
Instructions

Below is a representative set of activities and related tasks for one of the deliverables, *Developing a training course*, for the RestEasy Hotels Improvement Project. In this exercise, you build a Work Breakdown Structure (WBS) for each of the deliverables, including the one diagrammed below. You need to define the activities for each of the other deliverables and build the corresponding Work Breakdown Structure (WBS). For each of the other deliverables create no more than two (2) major activities and for each activity three (3) to five (5) tasks.

**Sample:** Assume that the WBS for the two-day training course involves three major activities. The design document must be developed, the content for the class workbook must be produced, and the course must be piloted. There are subtasks underneath each major task. The following table lists the possible tasks and some subtasks for developing the training course for the RestEasy Hotels Improvement Project.

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Activities</th>
<th>Tasks</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing a Training Course</td>
<td>Design the course</td>
<td>1.1 Establish goals</td>
<td>Project Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2 Analyze tasks</td>
<td>Designer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3 Identify objectives</td>
<td>SME</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.4 Write high-level design</td>
<td>Designer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 Complete technical design</td>
<td>Designer</td>
</tr>
<tr>
<td></td>
<td>Develop the course</td>
<td>2.1 Write the content</td>
<td>Writer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2 Create media</td>
<td>Editor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.3 Review/Edit content</td>
<td>SME and Editor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4 Produce course</td>
<td>Writer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 Print books</td>
<td>Kitter</td>
</tr>
<tr>
<td></td>
<td>Pilot the course</td>
<td>3.1 Conduct pilot</td>
<td>Instructor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2 Evaluate the course</td>
<td>Students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3 Finalize the course</td>
<td>Writer</td>
</tr>
</tbody>
</table>
Exercise 9-1. Risk Management

Everything has gone well to date. Most of the hotels have been installed with the midrange computer network system as planned and a successful project completion is expected. The sponsor has asked for a review of some of the major risks that were identified during the project life cycle so he can sell the concept of risk management to the other executives. The major risks that were identified were:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical solution does not work</td>
<td>Project is canceled</td>
</tr>
<tr>
<td>Application design cannot provide all required functions</td>
<td>All benefits are not achieved</td>
</tr>
<tr>
<td>Head office cannot implement technical solution</td>
<td>Project is canceled</td>
</tr>
<tr>
<td>Software company is late with handover of application</td>
<td>Project slips</td>
</tr>
</tbody>
</table>

Questions:

1. Which risks could have been identified during project definition?
2. Assign a value (L = Low, M = Moderate, H= High) to each risk for impact and probability and order the risks in priority sequence of severity.
3. How can the consequences of the highest severity risk be reduced?
Use the following template:

<table>
<thead>
<tr>
<th>Risk Event</th>
<th>Probability</th>
<th>Impact</th>
<th>Severity</th>
<th>Rank</th>
<th>Risk Response (Mitigation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exercise 10-1. Estimating

The WBS you created in Exercise 8-1 defines the activities for each of the deliverables. The dates for these deliverables to start is a delta date (for example, two weeks from today). You now need to estimate the work effort in hours and compute the duration and labor cost associated with each of the tasks.

Provided here for the Developing a training course deliverables is a table with the subtask:

- Each deliverable has been divided into activities and their respective tasks.
- The effort for each subtask has been estimated in hours.
- The task work has been allocated to the training development team. The writers and media specialists have the required skills and experience. All resources work a maximum of 35 hours per week. Refer to the attached table for the task list.
- Cost per hour for the resources listed in the table are:

<table>
<thead>
<tr>
<th>Resource</th>
<th>Cost Per Hour</th>
<th>Resource</th>
<th>Cost Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writer</td>
<td>$125</td>
<td>Editor</td>
<td>$150</td>
</tr>
<tr>
<td>Subject Matter</td>
<td>$160</td>
<td>Designer</td>
<td>$140</td>
</tr>
<tr>
<td>Expert</td>
<td></td>
<td>Kitter</td>
<td>$50</td>
</tr>
<tr>
<td>Instructor</td>
<td>$160</td>
<td>Students</td>
<td>$130</td>
</tr>
<tr>
<td>Project Manager</td>
<td>$200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. For the Developing a training course deliverable reference the table below to compute the Duration and the Labor Cost using the Availability and Productivity percentages shown.

<table>
<thead>
<tr>
<th>Compute the Duration at:</th>
<th>Compute the Labor Cost at:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Productivity</td>
</tr>
<tr>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>75%</td>
<td>80%</td>
</tr>
</tbody>
</table>

2. For the two major activities in Developing a Training Course without estimates, you are to:
   a. Develop an estimate of the work effort in hours for each of the subtask associated with the activities.
   b. Determine the resources required and define a cost per hour for each resource.
   c. Compute the Duration and the Labor Cost using the Availability and Productivity percentages shown in the table above.
Use the information given to answer these questions:

1. What things did you take into consideration in developing your estimates?

2. What are some of the challenges, if any, you had in coming up with the estimates?
<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Activities</th>
<th>Task</th>
<th>Task Estimate (hours)</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing a Training course</td>
<td>Design the course</td>
<td>1.1 Establish goals</td>
<td>20</td>
<td>Project Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2 Analyze tasks</td>
<td>25</td>
<td>Designer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3 Identify objectives</td>
<td>22</td>
<td>SME</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.4 Write high-level design</td>
<td>20</td>
<td>Designer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 Complete technical design</td>
<td>19</td>
<td>Designer</td>
</tr>
<tr>
<td></td>
<td>Develop the course</td>
<td>2.1 Write the content</td>
<td>120</td>
<td>Writer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2 Create media</td>
<td>40</td>
<td>Editor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.3 Review/Edit content</td>
<td>80</td>
<td>SME and Editor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4 Produce course</td>
<td>100</td>
<td>Writer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 Print books</td>
<td>20</td>
<td>Kitter</td>
</tr>
<tr>
<td></td>
<td>Pilot the course</td>
<td>3.1 Conduct pilot</td>
<td>16</td>
<td>Instructor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2 Evaluate the course</td>
<td>2</td>
<td>Students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3 Finalize the course</td>
<td>40</td>
<td>Writer</td>
</tr>
</tbody>
</table>
Exercise 11-1. Precedence Diagramming Method

1. Calculate the forward and backward pass with Task A and Task B starting on Day 0.
2. Calculate the float for each path.
3. Identify the critical path.

Precedence Diagramming Method

![Diagram of precedence diagram with tasks and durations]
Exercise 11-2. Scheduling

Use the WBS your team created in Exercise 8-1 to do the following exercises:

• For the three deliverables you computed estimates for in Exercise 8-1, calculate the duration per task in days. Use a six-, seven-, or eight-hour workday. The team can choose the workday length.

• Create a precedence diagram (Activity On Node) for all subtasks for your three from Exercise 3 using the WBS your team created from Exercise 8-1.

• Calculate the forward pass, backward pass, and float.

• Find the critical path.

Based on the delta date assigned by the instructor answer these two questions:

1. What date would you commit to for completion?
2. What assumptions are you making in this commitment?
Exercise 13-1. Integrated Change Control

The RestEasy Hotels chain has acquired two extra hotels, one in Paris and one in Hawaii on the island of Maui. These hotels must be included with the other 20 hotels in the same computer system rollout. The RestEasy Hotels Executive Director has asked you to add these two new hotels to the project. In turn, the project executive asks you what impact this change could have on the project. Your assignment is to create a list of impacts.

Questions:

1. What might change as a result of this modification?
2. Which deliverables are impacted?
3. What impact does this have on:
   • The overall project
   • The benefits
   • The budget
4. How should a decision be reached and who should make it?
Exercise 15-1. Earned Value Analysis

For the Developing a training course deliverables, the training group plans to complete the training course for a budget of $120,000.

<table>
<thead>
<tr>
<th>Work Unit</th>
<th>PV $K Budget</th>
<th>Planned % Complete</th>
<th>Actual % Complete</th>
<th>AC $K Actuals</th>
<th>EV $K Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design the course</td>
<td>30</td>
<td>100</td>
<td>100</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Develop the course</td>
<td>70</td>
<td>100</td>
<td>70</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Pilot the course</td>
<td>20</td>
<td>100</td>
<td>20</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Questions:

1. For each of the training tasks as well as for the total training development subproject, find the project's to-date EV and add the values to the EV column. Also, calculate the total EV and AC.

2. Based on cost variances, which of the training development tasks have cost more than was planned?

3. For each task dollar spent, what was the value of the course design task's work performed? (Hint: CPI)

4. What is the EAC for the total training subproject?

5. How much does it cost to complete the total training subproject? (Hint: ETC)
Exercise 16-1. Establishing Relationships Using Contracts

Objectives:
- Examine and discuss the relationship between the project team and the customer.
- Make recommendations to support project planning.

Background Information:
You are the Project Manager for the RestEasy Hotels Improvement Project

Exercise Materials:
Use the following handouts:
- Improvement Project Summary of Intent
- Project charter developed by the Executive Director
- Output from Exercise 4-1
- Draft contract between RestEasy Hotels and IBM

Team Assignment:
Answer the following questions:
1. What are the major disconnects contained in the materials?
2. What specific risks should be identified on this project?
3. What specific recommendations (contractual or otherwise) do you have for the project manager?
Exercise 17-1. Conducting an Independent Project Peer Review

You have been asked by an associate to make an informal review of her project. She indicates that although the project has slipped somewhat, she believes that the schedule, cost, and requirements baseline commitments can still be met. In your discussion she observes that "the success of good project managers seems to be based on their ability to effectively deal with surprises."

As a Team consider and discuss the following issues:

• What should be the major issues discussed in a project review?

• If there is bad news, how should the PM present this? (answer - honestly and if possible with an action plan for fixing the problem)

• What would be some land mines to avoid stepping on?

   **Remember:**
   - Don't forget to discuss the good news as well!
   - Look at the review process as a tool for better projects and not as an adversarial situation

You may find the ideas and guidelines on pages 12-14 and 12-15, Guidelines for Collecting and Evaluating Project Performance, helpful.
## Appendix D. Prevention Measures To Avoid Troubled Projects

### Risk Containment and Prevention Measures

<table>
<thead>
<tr>
<th>A-1. Failure to properly set and manage customer/user expectations.</th>
<th>Prevention measures.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marketing</strong></td>
<td></td>
</tr>
<tr>
<td>• Include experienced performance resources early in the discussions with the customer/user regarding the potential solution. Because of inexperience and/or a desire to win business, there is a tendency to underestimate the complexity, costs, and time required for solutions. Avoid the tendency to <strong>over promise and under deliver</strong>.</td>
<td></td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td></td>
</tr>
<tr>
<td>• Inform the customer/user of <strong>bad news</strong> as early as possible. The reluctance to tell the customer/user news they might not want to hear has almost invariably led to a worse situation. Many times what we might think of as bad news is not considered that bad by the customer/user if presented tactfully and candidly.</td>
<td></td>
</tr>
<tr>
<td>• Communicate with all appropriate levels within the customer/user organization. Expectations are often different between the customer executives, MIS staff, and user groups. Ensure that there is understanding and <strong>buy-in</strong> at all appropriate levels. Continue to communicate progress and status to all levels.</td>
<td></td>
</tr>
<tr>
<td>• At the beginning of a project, document with the customer/user their expectations and priorities. This can be done in a simple <strong>Customer/user Satisfaction Plan</strong>. Once the expectations and priorities are established, the project team should list actions which are taken to meet those expectations. Documenting the customer’s expectations and priorities accomplishes the following:</td>
<td></td>
</tr>
<tr>
<td>1. It reduces the chance of misunderstanding between your project team and the customer/user;</td>
<td></td>
</tr>
<tr>
<td>2. It forces the various people within the customer/user organization to reach a consensus on their sometimes conflicting expectations and priorities;</td>
<td></td>
</tr>
<tr>
<td>3. It reduces the chances of the customer/user selective memory or amnesia with regard to their initial expectations and priorities; and</td>
<td></td>
</tr>
<tr>
<td>4. It allows the team to keep a focus on those identified expectations and priorities when decisions are made during the project.</td>
<td></td>
</tr>
<tr>
<td>Project Initiation</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td></td>
</tr>
<tr>
<td>• Before beginning a project, be sure to identify all major risks and what the contingency plans are with respect to the risks. When appropriate, get the customer/user to acknowledge the risks and, if possible, agree to the contingency plan. If they have a problem with your approach, the issue should be resolved earlier rather than later.</td>
<td></td>
</tr>
<tr>
<td>• Strongly encourage the customer/user to budget for changes up front so the customer/user has the flexibility to address their changing requirements without seeking additional internal funding. Change is a reality on nearly every project and the customer's expectations regarding change should be set early on. Discuss the fact that changes probably occur. Give examples of how previous projects involved change.</td>
<td></td>
</tr>
<tr>
<td>• The customer/user should understand the importance of their involvement and responsibilities in a service engagement. The customer/user should fully understand and agree with your proposed approach. The customer's full involvement and commitment are essential to the success of a project. The customer/user should think of themselves as part of a team rather than spectators. The combined project team (your team and the customer's team) either succeeds together or fails together.</td>
<td></td>
</tr>
</tbody>
</table>
### A-2. Fixed-price contracts.

A fixed-price contract might be a profitable way to structure a deal if there is a previous successful base of experience with a particular solution implementation. However, in cases where you do not have experience implementing a particular type of solution, the projects can often be underestimated in terms of both cost and schedule. Thus many fixed-price projects result in unprofitable engagements and customer dissatisfaction.

Unless the scope of an engagement is defined in detail with very accurate estimates (by an experienced project team), the chances of a fixed-price complex contract completing on time and within budget are slim. Factors that make fixed-price contracts undesirable include:

- Lack of project team relevant experience.
- Untested components in new environment.
- Lack of detailed specifications to guide development.
- Unanticipated technical glitches.
- Multiphase projects which include requirements, design, and implementation.
- Built-in conflict of interests (that is, desire for provider to limit efforts and customer to expand scope under a fixed-price).
- Not fully understanding the customer's requirements.

### Prevention measures.

- Limit fixed-price engagements to:
  1. Short, relatively simple projects or phases.
  2. Projects that have been done successfully before by the project team.
- Efforts should be made to avoid bidding fixed-priced projects unless there is a high degree of confidence that the project can be accomplished profitably within a fixed price. Marketing efforts should be focused on level-of-effort contracts. (The customer pays for the work they receive.)
- Large projects should be broken into logical phases with each phase bid separately. Bids for entire life-cycle projects should be done as budget and planning estimates for the entire project with firm prices given only for the next phase (that is, design) to be performed. Budget and planning estimates for the full project can be revalidated after completion of each phase.
- For large projects with no detailed design specifications, you should bid only on the requirements validation and solution design phases (preferably time and materials). At the end of the design phase, you can then offer a fixed price or level-of-effort implementation phase.
A-3. Customer/user unprepared to take on their project responsibilities.

In some cases, the customer/user might not have the resources, skills, infrastructure, or time to support the implementation of your proposed solution. As a result, the project falls behind schedule, you might be required to assume customer/user responsibilities and/or the project might not proceed as planned.

Do not assume that just because the SOW clearly states the customer/user responsibilities that the customer/user has the skills or resource availability to meet those responsibilities.

Prevention measures.

- A readiness assessment should be conducted on the customer/user prior to bidding a significant project. Elements to be assessed include:
  - Executive commitment to the solution
  - User and management commitment to the solution
  - Adequate funding to cover all internal as well as external costs
  - Internal resource skill level and availability
  - Adequate infrastructure to support the new solution
  - Business process change requirements and adequate time to implement necessary changes
  - Conflicts with busy seasons which may affect internal resource availability
- Share the results with the customer and attempt to develop an action plan to address any identified concerns.
- At the beginning of every project, ensure that you review the SOW with the customer project manager and obtain full concurrence regarding the tasks, your and the customer’s responsibilities, deliverables, completion criteria, schedule, project organization, and roles.
A-4. Failure to reach a common understanding of the requirements.

Experience has shown that in many cases your interpretation of the requirements might not be the same as the customer’s. In some cases, requirements are interpreted differently by different people in the customer’s organization. Because of the potential for varying interpretations of requirements and the impact to costs and customer satisfaction as a result of misinterpretations, it is very important that you have a clear and common understanding of the customer’s requirements. If the contract has already been signed, resolving the misunderstanding often becomes extremely contentious when additional costs or schedule delays are involved.

Disagreements as to requirements often result in customer dissatisfaction and a solution being delivered that you did not intend to deliver.

Prevention measures.

- Ensure that appropriately skilled and experienced personnel are involved in the marketing phase and proposal development.
- The best way to avoid misunderstandings between you and the customer regarding your proposed solution is to have a walkthrough of the requirements. Alternatively, the first phase of the contract could be designed as a requirements validation and solution review phase. It is extremely valuable both to the customer and you to avoid costly and frustrating misunderstandings on both sides by jointly reviewing the requirements. The customer should understand that it is to their advantage to go through this process so they can ensure that you understand their requirements.
- Simply exchanging requirements documents and responses between you and the customer for review is no substitute for up-front, joint walkthroughs. Misunderstandings are usually identified and resolved when the detailed solution is discussed.

A-5. Failure to reach a common understanding of the proposed solution.

There have been situations where a provider clearly understood the customer’s technical requirements, but their solution was not how the customer wanted its requirements met. There are often many different approaches and technical solutions (often with significantly different costs) that meet particular requirements. Some solutions are acceptable to a customer and some are unacceptable to the customer even though they technically meet the requirements. To avoid costly disputes, the customer should have a clear understanding of your proposed solution and how it meets their requirements. If the contract has already been signed, resolving a misunderstanding often becomes extremely contentious if additional costs or schedule delays are involved.

Prevention measures.

- The best way to avoid misunderstandings between you and the customer regarding your proposed solution is to have a walkthrough of your proposed solution before the contract is executed. Alternatively, the first phase of the contract could be designed as a requirements validation and solution review. It is extremely valuable both to the customer and you to avoid costly and frustrating misunderstandings on both sides by jointly reviewing the requirements and your proposed solution. The customer should understand that it is to their advantage to go through this process so they can ensure that they understand what you are proposing to implement.
- Misunderstandings are usually identified and resolved when the detailed solution is discussed. Simply exchanging requirements documents and proposal materials between you and the customer for review is no substitute for up-front, joint walkthroughs.
- In some cases, such as rapid application development, it is not always practical to describe up-front, the ultimate solution in detail.
A-6. Failure to establish an appropriate contractual baseline.

For SI and AD projects, requirements documents generally serve as a poor contractual baseline. A customer's documented requirements can be addressed with a variety of solutions that involve a variety of costs to deliver. Managing change and scope can be extremely difficult when the customer's requirements serve as the baseline. If the requirements serve as the technical baseline and you discover that you must develop a different solution than originally priced, you have no basis to go back for a change order if the requirements have not changed. If your proposed solution serves as the technical baseline and it is decided that a different solution should be implemented, you can then issue a change order to cover any additional costs incurred as a result of the new approach.

Prevention measures:

- Unless the contract is a time and materials contract to develop a solution based on a customer requirements document, you should, to the extent practical, be very careful in using a requirements document as a contractual baseline for a solution.

- One alternative to using the requirements as a baseline is for your proposal to include a detailed solution description (not just task descriptions) that could serve as the baseline until the external design is developed. The solution description should also cross-reference the requirements so the customer can understand how your proposed solution addresses each requirement. Your solution description can be included in the proposal, SOW, or referenced as an appendix to the SOW. After the external design is developed, it (along with any approved change orders) should supersede the solution description as the baseline.

- For RAD development, the scope should be bounded in additional ways such as maximum number of iterations or up to X amount of hours per function.

- What if you cannot describe the solution in detail at the inception of the contract? In such circumstances, a time and materials design phase should be proposed. When the design phase is complete, you can then bid on the implementation phase with a clear understanding of the effort required.

- Include all relevant assumptions in the SOW.

A-7. Poorly constructed or unauthorized subcontracts.

You can be left with little leverage with a subcontractor who has been selected and committed to the customer before you established an appropriate SOW and contract with the subcontractor. Experienced subcontractors might, in many cases, out negotiate your marketing and perform personnel who attempt to structure deals without the assistance of experienced contract personnel. Often times, your company might end up absorbing more costs than were originally intended.

Prevention measures:

- Ensure your procurement and contract staff are involved prior to contacting subcontractors for discussions. Utilize the experience and guidance of your procurement and contracts staff.

- Ensure that no internal resources are available to provide the services sought from a subcontractor.

- Determine if the subcontractor is qualified and if they have done any work for your company in the past.

- Make sure the subcontractor thinks you are considering other subcontractors so the contractor will give you a competitive bid.

- Make sure the subcontractor SOW is mapped to the customer SOW obligations and assumptions.
A-8. Failure of key subcontractor to deliver.

Many of your proposed solutions might be dependent on the performance of key subcontractors. When you sign a contract with a customer, you are on the line to deliver regardless of whether the subcontractor can ultimately deliver.

<table>
<thead>
<tr>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Thoroughly check references of the subcontractor for delivering the type of solution required.</td>
</tr>
<tr>
<td>• Review the subcontractor's detailed project and staffing plans.</td>
</tr>
<tr>
<td>• Require the subcontractor to provide detailed status reports and issue logs.</td>
</tr>
<tr>
<td>• Monitor performance of the subcontractor closely.</td>
</tr>
<tr>
<td>• Allow for resources, money, and the time in the schedule to review and correct the subcontractor's work-product before delivery to client.</td>
</tr>
<tr>
<td>• Add a schedule buffer to the customer contract to cover for delays and corrections in the subcontractor's work.</td>
</tr>
<tr>
<td>• Develop a contingency plan for alternative resources and methods to backfill the subcontractor in case of default.</td>
</tr>
<tr>
<td>• Require a performance bond.</td>
</tr>
<tr>
<td>• If the customer requires you to use a particular subcontractor, then you should try to include a clause that allows you to terminate the contract if the subcontractor is unable or unwilling to complete its responsibilities.</td>
</tr>
<tr>
<td>• In some cases, it is prudent to review certain contingency plans with the customer/user to get the agreement on the backup strategy and approach</td>
</tr>
<tr>
<td>• Ensure the subcontractor's SOW is:</td>
</tr>
<tr>
<td>1. Consistent with the SOW you have with the customer/user</td>
</tr>
<tr>
<td>2. Detailed enough for you to assess the probability of success</td>
</tr>
<tr>
<td>3. Reviewed by your technical resources to assess viability</td>
</tr>
</tbody>
</table>
A-9. Poor quality proposals and SOWs.

One of the main reasons for poor quality proposals is the lack of time allocated to develop proposals. Proper proposal preparation is essential to providing a high quality proposal that addresses the customer’s needs and protects your company’s interests. Poor quality proposals and SOWs also result from failure to utilize assurance reviews and peer reviews to check the quality and content of the bids. The consequences of a poorly defined or constructed SOW are that you have no solid basis to create a project plan and disputes over scope are difficult to reconcile.

Prevention Measures.

- If your company has any proposal development guidelines refer to them for sample proposal wording and format.
- Decline to bid on a project if there is inadequate time to prepare a quality proposal. Both you and the customer/user are not served by developing a deficient proposal in a few days. It is better to decline to bid than to submit an embarrassing or unprofitable proposal. Preparing a quality proposal takes time. Make sure the customer/user understands that it is to their benefit to allow adequate time to prepare a proposal.
- Understand the customer’s business needs and develop a proposal that clearly addresses those needs with our solution.
- Involve specialists in developing the solution.
- Obtain agreement on scope and approach first. Then price the effort.
- Use peer reviews to obtain independent opinion of clarity and completeness.
- Request independent technical reviews to validate the feasibility and ensure that nothing is overlooked or misrepresented.
- If your company has a quality assurance staff obtain formal quality assurance approval per your company’s procedures. Make sure assurance has the time to review the final proposal documents that will go to the customer/user.
- Review proposed SOWs internally with management, assurance, finance, and legal as appropriate, before they are presented to the customer/user.
- After all customer/user requests are considered or incorporated, schedule adequate time for a final internal review. The review should be scheduled with enough time to make changes before it goes back to the customer/user for review and sign-off.
- Ensure the SOW clearly states what is in scope and what is out of scope.
### A-10. Inaccurate project estimates.

Many projects are financially doomed from the beginning as a result of underestimating the effort required to complete a project. Although Assurance helps provide a certain level of validation, utilizing independent technical resources to validate the estimates is key to reducing the risk of underestimating the project effort.

**Prevention measures.**

- Involve the actual performance personnel in either the development or validation of the estimates during the proposal or at the contract start.
- In addition to Assurance reviews, technical reviews should be conducted to validate estimates and schedules. Experienced staff should review estimates during technical reviews.
- Use the most appropriate estimating tools available.
- Utilize experienced perform staff to validate the estimates either at proposal or contract start.
- Make adjustments for:
  - The learning curve of new development tools and methodologies
  - Systems management efforts
  - Untested hardware and software components
  - Subcontractor underestimates
  - Adequate testing and correction periods
  - Unknown risks

### A-11. Failure to plan for project risks.

All projects involve some risks. The risks should be understood and planned for prior to beginning a project. Both technical and business risks should be addressed. Many risks can be avoided or reduced after they have been identified.

**Prevention measures.**

- Utilize technical, peer, and Assurance reviews to identify risks and develop containment strategies.
- Create a risk management plan during the proposal preparation stage. Develop an action plan to eliminate, reduce, or contain the risks. Review the plan with Assurance and management to ensure that it covers the major risks and has appropriate plans to contain them.
- Incorporate the risk management plan with the overall project plan to manage the risks throughout the project.
### A-12. Problems with new software and hardware.

In some cases a bid may be based on the assumption that an unannounced or new product would work in a new environment. However, sometimes the products do not work as anticipated. Quick and adequate response from the third-party manufacturers is not always possible or forthcoming.

A product need not be unannounced or new to cause unexpected problems in an integration project. There might be situations where products have been generally available; however, they may not integrate into a new environment as expected.

#### Prevention measures.
- Set appropriate customer/user expectations. If new or untested components are to be integrated as a part of the solution, the customer/user should understand that there might be delay risks in the integration effort. If a customer/user wants 100% assurance of a fit, then a fully tested solution of standard available products should be proposed.
- If the customer/user wants leading-edge components, then the customer/user should be made aware that a certain level of risk is inherent in implementing a solution in an untested environment. Conservative schedules and estimates should also be used to cover the unanticipated delays that invariably arise.
- Conduct due diligence by modeling and testing the components to validate that they work in the target environment.
- Be prepared to propose an alternate solution if the components do not integrate as expected. (This conversation is much easier with the customer/user up front, rather than in the middle of the project when things are all over the floor.)
- Obtain a written commitment from the product owner outlining the level of support, cost, and liability coverage you can expect to receive should problems arise with the product during the project. If you cannot obtain a written commitment or adequate assurances, seriously consider not bidding the new or untested component.

### A-13. Customer/user unprepared to support the new system.

Customers are sometimes resistant to accepting a system if their staff is unable to effectively support it. As a result, they might want to keep you on site to support the new system by delaying acceptance.

#### Prevention measures.
- Include in the SOW, the appropriate level of training tasks to enable the customer/user to support the system.
- Include a post-implementation support task to keep the system running while the customer’s personnel become trained to support the system.
### A-14. Inability to actually acquire skilled resources as planned for the project.

You might spend a considerable amount of unplanned time to locate and acquire the resources needed to perform the project. In some cases these resources cannot be quickly found or end up costing more than the cost case estimated.

<table>
<thead>
<tr>
<th>Prevention measures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Review formal staffing plan with a resource manager and line management to ensure that appropriate staffing can be secured.</td>
</tr>
<tr>
<td>• Ensure that documents of understanding are in place, as applicable, to formally commit resources prior to committing a bid to the customer/user.</td>
</tr>
<tr>
<td>• Particularly for key-planned resources, ensure that appropriate management is aware of and committed to the provider responsibilities.</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
</tbody>
</table>
| Failure of you and the customer/user project manager to review the SOW as the appropriate definition of the scope. The customer/user should also be aware of the project plan and how the customer/user personnel are used as a part of the overall project. See also “Ineffective or unclear project organization and roles.” | • At the beginning of every project, ensure that you review the SOW with the customer/user project manager and obtain full concurrence regarding the tasks, your and their responsibilities, deliverables, completion criteria, change control procedures, schedule, project organization and roles, and so on.  
• Ensure that any resulting changes to the SOW are formally incorporated via the change control procedure before the project proceeds. |

<table>
<thead>
<tr>
<th>A-16. Ineffective or unclear project organization and roles.</th>
<th>Prevention measures.</th>
</tr>
</thead>
</table>
| Projects often begin with confusion as to who does what because the roles and responsibilities are not well defined. | • Define the project organization along with the roles and responsibilities of each team member. The customer’s staff should also clearly understand their responsibilities.  
• Define an escalation process for you and the customer/user as well as ensure there is a communication plan.  
• Establish a joint steering committee with the customer/user to facilitate project oversight and decisions. |

<table>
<thead>
<tr>
<th>A-17. Inadequate project management.</th>
<th>Prevention measures.</th>
</tr>
</thead>
</table>
| In a number of cases, poor project planning and execution are the cause of unsuccessful projects. Inexperienced project managers and project teams are sometimes assigned a project that they are not prepared to manage without assistance. Sometimes, the problem is failure to follow consistent project management procedures. Often the project manager is unaware of the existence of these procedures. As a result, projects end up being managed inconsistently and, if a change in project managers occurs, the transition between them becomes more difficult. | • If your company has a formal project management methodology and procedures for project management, adhere to them. If there is no formal methodology or procedures, then establish a set of procedures to be followed by the project team.  
• Properly train all project managers and provide close supervision of projects from the beginning.  
• In projects where project managers have limited experience or training, an experienced project manager should be assigned to closely review the project plans and ongoing project status.  
• When the project is initiated, the project manager should request a contract readiness review to ensure the project is on the right track.  
• Implement effective tracking mechanisms and tools to track actuals against estimates with revalidation of the estimates to complete activities. |
### A-18. Lack of project management reviews and effective followup.

In many cases, project management reviews are not scheduled until the project is in serious trouble. By that time, it is often too late to avoid significant problems.

**Prevention measures.**
- Schedule a contract initiation review by experienced Assurance staff to help ensure that the project begins on solid footing.
- Ensure timely project management reviews by Assurance staff are held. The project manager is responsible for ensuring timely project reviews take place. A project management review schedule should be developed with Assurance at contract execution and adhered to throughout the life of the contract.
- Ensure **follow-through on action plans** that result from project management reviews. The business managers should keep an updated action plan and issues list on all of the projects in their business area. Project managers should brief the business managers on their project status monthly. Other resources such as Quality Assurance and senior staff can be invited as needed to help solve issues.


Line management in some cases does not have a good mechanism to track its respective portfolio of projects and, therefore, projects often become troubled before they come to the attention of management. Management assistance is sometimes provided too late.

**Prevention measures.**
- Line management should ensure that a mechanism is in place to closely track the status of all significant projects.
- A project management review schedule should be developed and tracked in all business entities to identify which projects are not being reviewed as required.
- Close monitoring of troubled projects by line management should be instituted.
- Project executives and project managers should keep their line executives briefed on a frequent basis with regard to the status of all projects. The briefings should include project actuals versus plan, risk management issues, and actions as well as requests for management assistance.
### A-20. Failure to implement change control process.

Many well-intentioned project teams make changes during a project without the formality of change authorizations. However, when disputes arise over scope or overruns, you may be in a difficult position to defend your actions, intent, or baseline because you failed to follow your own process. **Defeat scope creep.**

<table>
<thead>
<tr>
<th>Prevention measures.</th>
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</thead>
<tbody>
<tr>
<td>• Encourage the customer/user to fund hours dedicated for approved changes (and investigative charges). This might be anywhere from 5% to 25% of the contract value, depending on the length of the contract and the number of expected changes.</td>
</tr>
<tr>
<td>• Stress the importance of adhering to a formal, documented change control process. Following such a process is as much in the customer’s interest as it is in yours.</td>
</tr>
<tr>
<td>• During the project kickoff, walk through the change control process with the customer/user team.</td>
</tr>
</tbody>
</table>
### Prevention Measures to Avoid Troubled Projects

#### A-21. Starting a phase prior to completing a preceding phase (that is, beginning implementation before the design is complete).

Starting a phase before a related preceding phase is complete is a risky decision. Much rework might be required as a result of work beginning prematurely. The client might refuse to pay for the rework required.

**Prevention measures.**
- Ensure that you plan and execute the project in a manner that disallows a phase (or task) to start before a dependent predecessor phase has been completed.
- Ensure that there is regular assessment of the status of the project so that there is awareness of any decisions to start a phase before a prior phase has been completed.

#### A-22. Unplanned turnover of key project team members.

As a result of unplanned staff turnover, cost and schedule overruns occur because of delays caused by the time required to locate replacements, actually make them available to work, and familiarize them with the specifics of the project.

**Prevention measures.**
- Ensure that you have a *succession plan* in place for key project team members in the event that they leave the project for personal or business reasons. This plan should include the identification of potential replacements with comparable experience/expertise along with the manner in which a transition of responsibilities from the original person to the replacement might take place.
- Ensure that you practice cross-training so if a key project team member leaves the project, an existing peer on the project could at least temporarily handle the responsibilities until a permanent replacement is brought in. This can help keep disruption to a minimum.
# Appendix E. Acronyms

## A

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>ABC</td>
<td>Activity-Based Costing</td>
</tr>
<tr>
<td>AC</td>
<td>Actual Cost</td>
</tr>
<tr>
<td>ACWP</td>
<td>Actual Cost of Work Performed</td>
</tr>
<tr>
<td>AD</td>
<td>Activity Description</td>
</tr>
<tr>
<td>AECI</td>
<td>Agreement for Exchange of Confidential Information</td>
</tr>
<tr>
<td>ALAP</td>
<td>As Late As Possible</td>
</tr>
<tr>
<td>AOA</td>
<td>Activity-on-Arrow</td>
</tr>
<tr>
<td>ASAP</td>
<td>As Soon As Possible</td>
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</tbody>
</table>

## B

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>B&amp;F</td>
<td>Best and Final</td>
</tr>
<tr>
<td>BAC</td>
<td>Budget at Completion</td>
</tr>
<tr>
<td>BCR</td>
<td>Benefit-Cost Ratio</td>
</tr>
<tr>
<td>BCWP</td>
<td>Budgeted Cost of Work Performed</td>
</tr>
<tr>
<td>BCWS</td>
<td>Budgeted Cost of Work Scheduled</td>
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</table>

## C

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>CCB</td>
<td>Change Control Board</td>
</tr>
<tr>
<td>COE</td>
<td>Center of Excellence</td>
</tr>
<tr>
<td>CPFF</td>
<td>Cost-Plus-Fixed Fee</td>
</tr>
<tr>
<td>CPI</td>
<td>Cost Performance Index</td>
</tr>
<tr>
<td>CPIF</td>
<td>Cost-Plus-Incentive Fee</td>
</tr>
<tr>
<td>CPM</td>
<td>Critical Path Method</td>
</tr>
<tr>
<td>CRR</td>
<td>Comparative Risk Ranking</td>
</tr>
<tr>
<td>CV</td>
<td>Cost Variance</td>
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## D

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>DCP</td>
<td>Decision Checkpoint</td>
</tr>
<tr>
<td>DOU</td>
<td>Document of Understanding</td>
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## E

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAC</td>
<td>Estimate of Completion</td>
</tr>
<tr>
<td>EF</td>
<td>Early Finish Date</td>
</tr>
<tr>
<td>EMV</td>
<td>Expected Mandatory Value</td>
</tr>
<tr>
<td>ES</td>
<td>Early Start Date</td>
</tr>
<tr>
<td>ETC</td>
<td>Estimate to Complete</td>
</tr>
</tbody>
</table>
EU  Estimating Unit
EV  Earned Value
EVM  Earned Value Management
EVT  Earned Value Technique

F
FF  Finish-to-Finish
FFP  Firm-Fixed-Price
FNET  Finish No Earlier Than
FNLT  Finish No Later Than
FPIF  Fixed-Price Incentive Fee
FS  Finish-to-Start
FTE  Full-Time Equivalent

G
G&A  General and Administrative
GA  General Availability
GERT  Graphical Evaluation Review Technique

H
HW  Hardware

I
ICA  Inter-Company Agreement
ICM  Intellectual Capital Management
IFB  Invitation for Bid
ITT  Invitation to Tender

J
JAD  Joint Application Design

L
LAN  Local Area Network
LCC  Life-Cycle Cost
LF  Late Finish Date
LOA  Letter of Authorization
LOE  Level-of-Effort
LS  Late Start Date
### Acronyms

<table>
<thead>
<tr>
<th>M</th>
<th>Must Finish On (MFO)</th>
<th>Must Start On (MSO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Net Earnings Before Taxes (NEBT)</td>
<td>Net Present Value (NPV)</td>
</tr>
<tr>
<td>O</td>
<td>Organizational Breakdown Structure (OBS)</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Percent Complete (PC)</td>
<td>Project Control Book (PCB)</td>
</tr>
<tr>
<td></td>
<td>Precedence Diagramming Method (PDM)</td>
<td>Program Evaluation and Review Technique (PERT)</td>
</tr>
<tr>
<td></td>
<td>Planned Finish Date (PF)</td>
<td>Project Manager or Project Management (PM)</td>
</tr>
<tr>
<td></td>
<td>Project Change Request (PCR)</td>
<td>Project Change Request (PCR)</td>
</tr>
<tr>
<td></td>
<td>Project Control Book (PCB)</td>
<td>Project Management Body of Knowledge (PMBOK®)</td>
</tr>
<tr>
<td></td>
<td>Project Management Information System (PMIS)</td>
<td>Project Management Office or Program Management Office (PMO)</td>
</tr>
<tr>
<td></td>
<td>Project Management Professional (PMP®)</td>
<td>Planned Start Date (PS)</td>
</tr>
<tr>
<td></td>
<td>Planned Value (PV)</td>
<td>Quality Assurance (QA)</td>
</tr>
<tr>
<td></td>
<td>Quality, Control (QC)</td>
<td>Risk Assessment Checklist (RACL)</td>
</tr>
<tr>
<td></td>
<td>Responsibility Assignment Matrix (RAM)</td>
<td>Resource Breakdown Structure or Risk Breakdown Structure (RBS)</td>
</tr>
<tr>
<td></td>
<td>Remaining Duration (RD)</td>
<td>Request for Information (RFI)</td>
</tr>
<tr>
<td></td>
<td>Request for Proposal (RFP)</td>
<td>Request for Quotation (RFQ)</td>
</tr>
</tbody>
</table>
|       | Risk Identification Number (RIN) | }
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIW</td>
<td>Risk Identification Workshop</td>
</tr>
<tr>
<td>ROI</td>
<td>Return on Investments</td>
</tr>
<tr>
<td>SF</td>
<td>Scheduled Finish Date or Start-to-Finish</td>
</tr>
<tr>
<td>SGA</td>
<td>Selling, General, and Administrative Expenses</td>
</tr>
<tr>
<td>SLA</td>
<td>Service Level Agreement</td>
</tr>
<tr>
<td>SNET</td>
<td>Start No Earlier Than</td>
</tr>
<tr>
<td>SNLT</td>
<td>Start No Later Than</td>
</tr>
<tr>
<td>SOW</td>
<td>Statement of Work</td>
</tr>
<tr>
<td>SPI</td>
<td>Schedule Performance Index</td>
</tr>
<tr>
<td>SS</td>
<td>Scheduled Start Date or Start-to-Start</td>
</tr>
<tr>
<td>SV</td>
<td>Schedule Variance</td>
</tr>
<tr>
<td>TC</td>
<td>Target Completion Date</td>
</tr>
<tr>
<td>TCPI</td>
<td>To-Complete Performance Index</td>
</tr>
<tr>
<td>TF</td>
<td>Target Finish Date or Total Float</td>
</tr>
<tr>
<td>T&amp;M</td>
<td>Time-and-Materials</td>
</tr>
<tr>
<td>TQM</td>
<td>Total Quality Management</td>
</tr>
<tr>
<td>Ts and Cs</td>
<td>Terms and Conditions</td>
</tr>
<tr>
<td>TS</td>
<td>Target Start Date</td>
</tr>
<tr>
<td>VAC</td>
<td>Variance at Completion</td>
</tr>
<tr>
<td>WBS</td>
<td>Work Breakdown Structure</td>
</tr>
</tbody>
</table>
Appendix F. Glossary

A

Abilene Paradox. Recognition of the fact that it is just as difficult for people to manage agreement as it is to manage conflict.

Acceptance. Agreement to the terms offered in a proposal or contract; the taking or receiving of a contract deliverable.

Acceptance Criteria. Those criteria which must be met before project deliverables are accepted. (PMBOK® pg 350).

Accounting Equation. Assets = Liabilities + Owners’ Equity

Activity. A component of work performed during the course of a project. (PMBOK® pg 350).

Actual Cost (AC). Total costs actually incurred and recorded in accomplishing work performed during a given time period for a schedule activity or work breakdown structure component. Actual cost can sometimes be direct labor hours alone, direct costs alone, or all costs including indirect costs. Also referred to as the actual cost of work performed (ACWP). (PMBOK® pg 351).

Actual Cost of Work Performed (ACWP). This term has been replaced with the term Actual Cost.

Actual Damages. The real, measurable, out-of-pocket costs recoverable as compensation for actual loss.

Agency Law. Law that allows one party, called the principal, to delegate authority to another party, called an agent, to act in all matters relating to the business of the principal.

Agreement. Synonymous with contract.

Altruistic-Nurturing. Characteristic of an individual concerned with the protection, growth, and welfare of others.

Amendment. A change to a contract by authority. Note: Either party to a contract can amend or change the contract. Usually all changes must be signed by both parties.

Analogous Estimating [Technique]. An estimating technique that uses the values of parameters, such as scope, cost, budget, and duration or measures of scale such as size, weight, and complexity from a previous, similar activity as the basis for estimating the same parameter or measure for a future activity. (PMBOK® pg 351).

Analytical Skills. The power to simplify what is either complex or complicated.

Analytic-Autonomizing. Characteristics of an individual concerned with planning and is fair and principled.

Arbitration. The process of settlement of a dispute between two parties by an impartial third party.

Arrow Diagramming Method (ADM) [Technique]. A schedule network diagramming technique in which schedule activities are represented by arrows. The tail of the arrow represents the start, and the head represents the finish of the schedule activity. (PMBOK® pg 352).

Aspiration. A strong desire or ambition, as for advancement or honor.

Assertive-Directing. Characteristics of an individual concerned with task accomplishment.

Assets. All items of value owned by a company.

Assignment. The transfer of a right, a contractual obligation, or property from one party to another.

Assumptions [Output/Input]. Assumptions are factors that, for planning purposes, are considered to be true, real, or certain without proof or demonstration. Assumptions affect all aspects of project planning, and are part of the progressive elaboration of the project. (PMBOK® pg 352).

Attitudes. One’s disposition or opinion; position or stand; point of view.

Authorized Representatives. The only people who can make, accept, reject, defer, or negotiate change.

Award. The act of granting or assigning a contract from a buyer to a seller. Phase 2 of the contract management process.

B

Backward Pass. The calculation of late finish dates and late start dates for the uncompleted portions of all schedule activities. Determined by working backwards through the schedule network logic from the project’s end date. The end date may be calculated in a forward pass or set by the customer or sponsor. (PMBOK® pg 352).

Bankruptcy. The state of being insolvent; failure or inability to pay just debts or obligations.

Bar Chart [Tool]. A graphic display of schedule-related information. In the typical bar chart, schedule activities or work breakdown structure components are listed down the left side of the chart, dates are shown across the top, and activity durations are shown as date-placed horizontal bars. Also called a Gantt chart. (PMBOK® pg 352).

Baseline. The approved time phased plan (for a project, a work breakdown structure component, a work package, or a schedule activity), plus or minus approved project scope, cost, schedule, and technical changes. Generally refers to the current baseline, but may refer to the original or some other baseline. Usually used with a modifier (for example, cost baseline, schedule baseline, performance measurement baseline, technical baseline). (PMBOK® pg 353).

Baseline Plan. A version of a plan, with its associated estimate, that has been accepted as part of the contract, and is now subject to change.
Beliefs. Anything accepted as true; a creed, doctrine, or tenant; an opinion, expectation, or judgment.

Benefit-Cost Analysis. Usually used with a modifier (for example, cost baseline, schedule baseline, performance measurement baseline).

Best Efforts. A statement in a proposal or contract that implies that the buyer or seller will put forth its best skills and dedication with the intent of meeting an obligation.

Best Estimate. The estimated cost of a project based on the currently known facts regarding scope, schedule, and expectations. See time-and-materials.

Bid Bond. A monetary guarantee that the bidder, if awarded a contract, will in fact execute (sign) it. 
Note: A bid bond expires automatically at the time the contract is signed by the parties or if the contract is not awarded.

Bond. A monetary guarantee to cover losses suffered for specified reasons, an obligation, or constraint. See also bond; performance bond.

Bottom-Up Estimating [Technique]. A method of estimating a component of work. The work is decomposed into more detail. An estimate is prepared of what is needed to meet the requirements of each of the lower, more detailed pieces of work, and these estimates are then aggregated into a total quantity for the component of work. (PMBOK® pg 353).

Breach. Failure to perform a contractual obligation without legal excuse.

Budget. The approved estimate for the project or any work breakdown structure component or any schedule activity. See also estimate. (PMBOK® pg 353).

Budget at Completion (BAC). The sum of all the budget values established for the work to be performed on a project or a work breakdown structure component or a schedule activity. The total planned value for the project. (PMBOK® pg 353).

Budgeted Cost of Work Performed (BCWP). This term has been replaced with the term earned value. See Earned Value.

Budgeted Cost of Work Scheduled (BCWS). This term has been replaced with the term planned value. See Planned Value.

Budget Estimate. See estimate.

Business Partner. A business entity with a special relationship to a principal, making it easier to jointly address a business opportunity.

Cartel. A combination of producers of any product joined together to control its production, sale, and price so as to obtain a monopoly and restrict competition in any particular industry or commodity.

Change Control. Identifying, documenting, approving or rejecting, and controlling changes to the project baselines*. (PMBOK® pg 353).

Change Control Board. A formally constituted group of stakeholders responsible for reviewing, evaluating, approving, delaying, or rejecting changes to the project, with all decisions and recommendations being recorded. (PMBOK® pg 353).

Change Control System [Tool]. A collection of formal documented procedures that define how project deliverables and documentation will be controlled, changed, and approved. In most application areas, the change control system is a subset of the configuration management system. (PMBOK® pg 353).

Change Management. Procedures used to manage and control the baseline.

Change Order. A formal, written request by a buyer directing the seller to make changes according to the provisions of the contract documents.

Change Request. Requests to expand or reduce the project scope, modify policies, plans, or procedures, modify costs or budgets, or revise schedules. Requests for a change can be direct or indirect, externally or internally initiated, and legally or contractually mandated or optional. (PMBOK® pg 353).

Chart of Accounts [Tool]. Any numbering system used to monitor project costs by category (for example, labor, supplies, materials, and equipment). The project chart of accounts is usually based upon the corporate chart of accounts of the primary performing organization. Contrast with code of accounts. (PMBOK® pg 353).

Checklist [Output/Input]. Items listed together for convenience of comparison, or to ensure the actions associated with them are managed appropriately and not forgotten. (PMBOK® pg 353).

Civil Law. The body of law created by acts of legislatures and concerned with civil or private rights and remedies.

Clarifying. Making or becoming easier to understand.

Cohesion. The act or condition of sticking together; blending or merging.

Common Law. The body of those principles and rules of action that derive their authority from tradition, usage, custom, and previous judicial decisions.

Common Sense. Sound and prudent judgment.

Communication. A process through which information is exchanged among persons using a common system of symbols, signs, or behaviors. (PMBOK® pg 354).

Communication Management Plan [Output/Input]. The document that describes: the communications needs and expectations for the project; how and in what format information will be communicated; when and where each communication will be made; and who is responsible for providing each type of...
communication. A communication management plan can be formal or informal, highly detailed or broadly framed, based on the requirements of the project stakeholders. The communication management plan is contained in, or is a subsidiary plan of, the project management plan. (PMBOK® pg 354).

Communication Planning [Process]. The process of determining the information and communications needs of the project stakeholders: who they are, what is their level of interest and influence on the project, who needs what information, when will they need it, and how it will be given to them. (PMBOK® pg 354).

Competent Parties. Persons or legal entities possessing legal capacity and authority to enter into a contract.

Component. A constituent part, element, or piece of a complex whole. (PMBOK® pg 354).

Composer. A person who creates or develops.

Condition. Component of a statement of risk; a single phrase or sentence that briefly describes the key circumstances or situations causing the doubt, concern, anxiety, or uncertainty.

Confidentiality. State or quality of being confidential; treated as private not for publications. A special term and condition in many companies contracts that covers the exchange of confidential information between parties to a contract.

Configuration Management System [Tool]. A subsystem of the overall project management system. It is a collection of formal documented procedures used to apply technical and administrative direction and surveillance to: identify and document the functional and physical characteristics of a product, result, service, or component; control any changes to such characteristics; record and report each change and its implementation status; and support the audit of the products, results, or components to verify conformance to requirements. (PMBOK® pg 354).

Conflict. Is a difference in opinion between two or more persons or groups that causes each to attempt to influence a situation affecting all parties concerned.

Consequence. Component of a statement of risk; a single phrase or sentence that briefly describes the key possible outcomes of the current conditions.

Consequential Damages. Damages that do not flow directly and immediately from the act of a party, but only from some of the consequences or results of the act. Example: The client’s point-of-sale system is down for four hours due to a software problem. As a result, the client claims to have lost hundreds of thousands of dollars due to lost sales.

Consideration. Something of value.

Constraint [Input]. The state, quality, or sense of being restricted to a given course of action or inaction. An applicable restriction or limitation, either internal or external to the project, that will affect the performance of the project or a process. (PMBOK® pg 355).

Containment. Risk mitigation strategy in which tasks are added to the WBS; the tasks are estimated, scheduled, costed, and priced.

Contingency. Risk mitigation strategy in which funds are held in a separate account for future use; based on a percentage of the overall cost of the project.

Contingency Planning. The development of a management plan that identifies alternative strategies to be used to ensure project success if specified risk events occur.

Contingency Reserve [Output/Input]. The amount of funds, budget, or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable to the organization. (PMBOK® pg 355).

Contract [Output/Input]. A contract is a mutually binding agreement that obligates the seller to provide the specified product or service or result and obligates the buyer to pay for it. (PMBOK® pg 355).

Contract Administration [Process]. The process of managing the contract and the relationship between the buyer and seller, reviewing and documenting how a seller is performing or has performed to establish required corrective actions and provide a basis for future relationships with the seller, managing contract related changes and, when appropriate, managing the contractual relationship with the outside buyer of the project. (PMBOK® pg 355).

Contract Authority. The power that the principal confers on the agent to act on his or her behalf to enter into a contract.

Contract Closure [Process]. The process of completing and settling the contract, including resolution of any open items and closing each contract. (PMBOK® pg 355).

Contract Law (Uniform Commercial Code [UCC]). A model law developed in the United States to standardize commercial contracting among the states.

Contract Management. The process of planning, forming, and administering an agreement to buy and sell goods and services from one party to another.

Contract Management Plan [Output/Input]. The document that describes how a specific contract will be administered and can include items such as required documentation delivery and performance requirements. A contract management plan can be formal or informal, highly detailed or broadly framed, based on the requirements in the contract. Each contract management plan is a subsidiary plan of the project management plan. (PMBOK® pg 355).

Contract Statement of Work (SOW) [Output/Input]. A narrative description of products, services, or results to be supplied under contract. (PMBOK® pg 355).

Contract Work Breakdown Structure (CWBS) [Output/Input]. A portion of the work breakdown structure for the project developed and maintained by a seller contracting to provide a subproject or project component. (PMBOK® pg 355).
Control Account (CA) [Tool]. A management control point where the integration of scope, budget, actual cost, and schedule takes place, and where the measurement of performance will occur. Control accounts are placed at selected management points (specific components at selected levels) of the work breakdown structure. (PMBOK® pg 355).

Control Account Plan (CAP) [Tool]. A plan for all the work and effort to be performed in a control account. Each CAP has a definitive statement of work, schedule, and time-phased budget. Previously called a Cost Account Plan. (PMBOK® pg 356).

Convergence. Is discovery, where you narrow down or weed out thoughts, data, and so forth, produced during the diverging stage as you head towards reaching a single conclusion. Judgmental and critical thinking are necessary during this stage.

Copyright. The right to literary property, giving authors, composers, and other creators the sole right to reproduce and distribute their work for a limited period of time.

Corrective Action. Documented direction for executing the project work to bring expected future performance of the project work in line with the project management plan. (PMBOK® pg 356).

Cost. The monetary value or price of a project activity* or component that includes the monetary worth of the resources required to perform and complete the activity or component, or to produce the component. (PMBOK® pg 356).

Cost Baseline. See Baseline.

Cost Budgeting [Process]. The process of aggregating the estimated costs of individual activities or work packages to establish a cost baseline. (PMBOK® pg 356).

Cost Control [Process]. The process of influencing the factors that create variances, and controlling changes to the project budget. (PMBOK® pg 356).

Cost Estimating [Process]. The process of developing an approximation of the cost of the resources needed to complete project activities*. (PMBOK® pg 356).

Cost Management Plan [Output/Input]. The document that sets out the format and establishes the activities and criteria for planning, structuring, and controlling the project costs. A cost management plan can be formal or informal, highly detailed or broadly framed, based on the requirements of the project stakeholders. The cost management plan is contained in, or is a subsidiary plan, of the project management plan. (PMBOK® pg 356).

Cost of Quality (COQ) [Technique]. Determining the costs incurred to ensure quality. Prevention and appraisal costs (cost of conformance) include costs for quality planning, quality control (QC), and quality assurance to ensure compliance to requirements (that is, training, QC systems, etc.). Failure costs (cost of non-conformance) include costs to rework products, components, or processes that are non-compliant, costs of warranty work and waste, and loss of reputation. (PMBOK® pg 356).

Cost Performance Index (CPI). A measure of cost efficiency on a project. It is the ratio of earned value (EV) to actual costs (AC). CPI = EV divided by AC. A value equal to or greater than one indicates a favorable condition and a value less than one indicates an unfavorable condition (PMBOK® pg 356).

Cost-Plus-a-Percentage-of-Cost (CPPC). A type of contract in which the seller gets reimbursed for the cost of producing the item and also gets a fee calculated as a percentage of cost. Not permitted in contracts with the federal government.

Cost-Plus-Award Fee (CPAF). A type of contract in which the seller gets reimbursed for costs of producing the item and gets paid a fee for winning the contract.

Cost-Plus-Fee (CPF). A type of cost reimbursable contract where the buyer reimburses the seller for the seller’s allowable costs for performing the contract work and seller also receives a fee calculated as an agreed upon percentage of the costs. The fee varies with the actual cost. (PMBOK® pg 356).

Cost-Plus-Fixed-Fee (CPFF) Contract. A type of cost-reimbursable contract where the buyer reimburses the seller for the seller’s allowable costs (allowable costs are defined by the contract) plus a fixed amount of profit (fee). (PMBOK® pg 356).

Cost-Plus-Incentive-Fee (CPIF) Contract. A type of cost-reimbursable contract where the buyer reimburses the seller for the seller’s allowable costs (allowable costs are defined by the contract), and the seller earns its profit if it meets defined performance criteria. (PMBOK® pg 357).

Cost-Plus-Percentage of Cost (CPPC). See cost-plus-fee.

Cost-Reimbursable Contract. A type of contract involving payment (reimbursement) by the buyer to the seller for the seller’s actual costs, plus a fee typically representing seller’s profit. (PMBOK® pg 357).

Cost Variance (CV). A measure of cost performance on a project. It is the algebraic difference between earned value (EV) and actual cost (AC). CV = EV minus AC. A positive value indicates a favorable condition and a negative value indicates an unfavorable condition. (PMBOK® pg 357).

Crashing [Technique]. A specific type of project schedule compression technique performed by taking action to decrease the total project schedule duration* after analyzing a number of alternatives to determine how to get the maximum schedule duration compression for the least additional cost. (PMBOK® pg 357).

Critical Chain Method [Technique]. A schedule network analysis technique* that modifies the project schedule to account for limited resources. The critical chain method mixes deterministic and probabilistic approaches to schedule network analysis. (PMBOK® pg 357).

Critical Path [Output/Input]. Generally, but not always, the sequence of schedule activities that
determines the duration of the project. Generally, it is the longest path through the project. However, a critical path can end, as an example, on a schedule milestone that is in the middle of the project schedule and that has a finish-no-later-than imposed date schedule constraint. See also critical path method. (PMBOK® pg 357).

Critical Path Analysis. Any approach using network parameters to determine the critical path.

Critical Path Method (CPM) [Technique]. A schedule network analysis technique used to determine the amount of scheduling flexibility (the amount of float) on various logical network paths in the project schedule network, and to determine the minimum total project duration. Early start and finish dates* are calculated by means of a forward pass, using a specified start date. Late start and finish dates* are calculated by means of a backward pass, starting from a specified completion date, which sometimes is the project early finish date determined during the forward pass calculation. (PMBOK® pg 357).

Customer. Individual or organization who will use the product of the project.

D

Damages. Compensation recoverable for a wrong or an injury. See also actual damages; consequential damages; liquidated damages.

Decision. The passing of judgment on an issue under consideration. The act of reaching a conclusion or making up one’s mind.

Decision Tree Analysis [Technique]. The decision tree is a diagram that describes a decision under consideration and the implications of choosing one or another of the available alternatives. It is used when some future scenarios or outcomes of actions are uncertain. (PMBOK® pg 358).

Decomposition [Technique]. A planning technique that subdivides the project scope and project deliverables into smaller, more manageable components, until the project work associated with accomplishing the project scope and providing the deliverables is defined in sufficient detail to support executing, monitoring, and controlling the work. (PMBOK® pg 358).

Default. The omission or failure to a legal or contractual duty: esp. The failure to pay a debt when due.

Defect. A deficiency in something essential to the proper use of a product.

Deferred Payment. The buyer’s making payment to the seller some period of time after the deliverable has been accepted for the convenience of one or both of the parties.

Delayed Invoicing. The seller’s invoicing the buyer some period of time after the deliverable has been completed for the convenience of one or both of the parties.

Deliverable [Output/Input]. Any unique and verifiable product, result, or capability to perform a service that must be produced to complete a process, phase, or project. Often used more narrowly in reference to an external deliverable, which is a deliverable that is subject to approval by the project sponsor or customer. (PMBOK® pg 358).

Delphi Technique [Technique]. An information gathering technique used as a way to reach a consensus of experts on a subject. Experts on the subject participate in this technique anonymously. (PMBOK® pg 358).

Dependency. Something necessarily consequent on something else.

Depreciation. A method that spreads the cost of a long-lived asset over its entire service life.

Divergence. Divergence is exploratory, used to generate a lot of ideas. Creative thinking is necessary during the diverging stage.

Document of Understanding. A formal, written agreement between business functions to establish responsibilities, obligations, and actions in performing a project.

Duration. The number of work periods (not including holidays or other nonworking periods) required to complete an activity or other project element; usually expressed as workdays or workweeks; sometimes incorrectly equated with elapsed time.

E

Early Finish Date (EF). In the critical path method, the earliest possible point in time on which the uncompleted portions of a schedule activity (or the project) can finish, based on the schedule network logic, the data date, and any schedule constraints. Early finish dates can change as the project progresses and as changes are made to the project management plan. (PMBOK® pg 359).

Early Start Date (ES). In the critical path method, the earliest possible point in time on which the uncompleted portions of a schedule activity (or the project) can start, based on the schedule network logic, the data date, and any schedule constraints. Early start dates can change as the project progresses and as changes are made to the project management plan. (PMBOK® pg 359).

Earned Value (EV). The value of completed work expressed in terms of the approved budget assigned to that work for a schedule activity or work breakdown structure component. Also referred to as the budgeted cost of work performed (BCWP). (PMBOK® pg 359).

Earned Value Management (EVM). A management methodology for integrating scope, schedule, and resources, and for objectively measuring project performance and progress. Performance is measured by determining the budgeted cost of work performed (that is, earned value) and comparing it to the actual cost of work performed (that is, actual cost). Progress is measured by comparing the
earned value to the planned value. (PMBOK® pg 359).

**Earned Value Technique (EVT)** [Technique]. A specific technique for measuring the performance of work for a work breakdown structure component, control account, or project. Also referred to as the earned rules and crediting method. (PMBOK® pg 360).

**Effort.** The number of labor units required to complete a schedule activity or work breakdown structure component. Usually expressed as staff hours, staff days, or staff weeks. (PMBOK® pg 360).

**Elapsed Time.** Number of calendar days over which the task occurs.

**Emotional Issues: Causes of Self-Oriented Emotional Behavior.** Behaviors displayed by individual team members sometimes at the expense of the rest of the team and its objectives.

**Entrepreneurial.** Organizing and managing a business undertaking.

**Escrow.** The deposit of something into the care of a mutually agreed-upon custodian for delivery to the grantee on some defined set of conditions.

**Estimate** [Output/Input]. A quantitative assessment of the likely amount or outcome. Usually applied to project costs, resources, effort, and durations and is usually preceded by a modifier (that is, preliminary, conceptual, feasibility, order-of-magnitude, definitive). It should always include some indication of accuracy (for example, ±x percent). (PMBOK® pg 360).

**Estimate at Completion (EAC)** [Output/Input]. The expected total cost of a schedule activity, a work breakdown structure component, or the project when the defined scope of work will be completed. EAC is equal to the actual cost (AC) plus the estimate to complete (ETC) for all of the remaining work. EAC = AC plus ETC. The EAC may be calculated based on performance to date or estimated by the project team based on other factors, in which case it is often referred to as the latest revised estimate. See also earned value technique and estimate to complete. (PMBOK® pg 360).

**Estimate to Complete (ETC)** [Output/Input]. The expected cost needed to complete all the remaining work for a schedule activity, work breakdown structure component, or the project. See also earned value technique and estimate at completion. (PMBOK® pg 360).

**Exclusions.** Statements of "not included" for a future system.

**Expected Monetary Value (EMV) Analysis.** A statistical technique that calculates the average outcome when the future includes scenarios that may or may not happen. A common use of this technique is within decision tree analysis. Modeling and simulation are recommended for cost and schedule risk analysis because it is more powerful and less subject to misapplication than expected monetary value analysis. (PMBOK® pg 360).

**Expense (also known as indirect costs).** The funds a company spends in order to sell services and products. Examples include rent, utilities, depreciation, and so forth.

**Expert Judgment** [Technique]. Judgment provided based upon expertise in an application area, knowledge area, discipline, industry, etc. as appropriate for the activity being performed. Such expertise may be provided by any group or person with specialized education, knowledge, skill, experience, or training, and is available from many sources, including: other units within the performing organization; consultants; stakeholders, including customers; professional and technical associations; and industry groups. (PMBOK® pg 360).

**External Risks.** Risks beyond the control or influence of the project team.

**Extraversion.** Focusing attention and energy outside oneself.

**F**

**Facilitating Communication.** Making it easier to exchange information.

**Facilitating Understanding.** Making it easier to explain difficult ideas.

**Fast Tracking** [Technique]. A specific project schedule compression technique that changes network logic to overlap phases that would normally be done in sequence, such as the design phase and construction phase, or to perform schedule activities in parallel. See schedule compression and see also crashing. (PMBOK® pg 361).

**Feedback.** Is communication to a person about his or her behavior.

**Finality of Acceptance.** The character or condition of being finished, complete, and conclusive.

**Finish-to-Finish (FF).** The logical relationship where completion of work of the successor activity cannot finish until the completion of work of the predecessor activity. See also logical relationship. (PMBOK® pg 361).

**Finish-to-Start (FS).** The logical relationship where initiation of work of the successor activity depends upon the completion of work of the predecessor activity. See also logical relationship. (PMBOK® pg 361).

**Firm-Fixed-Price (FFP) Contract.** A type of fixed price contract where the buyer pays the seller a set amount (as defined by the contract), regardless of the seller's costs. (PMBOK® pg 361).

**Fixed-Price Contract.** See firm-fixed-price contract.

**Fixed-Price-Incentive-Fee (FPIF) Contract.** A type of contract where the buyer pays the seller a set amount (as defined by the contract), and the seller can earn an additional amount if the seller meets defined performance criteria. (PMBOK® pg 361).

**Fixed-Price or Lump-Sum Contract.** A type of contract involving a fixed total price for a well-defined product. Fixed-price contracts may also
include incentives for meeting or exceeding selected project objectives, such as schedule targets. The simplest form of a fixed price contract is a purchase order. (PMBOK® pg 361).

**Flexible-Cohering.** Characteristic of an individual able to meet conflict and opposition flexibly.

**Float.** Also called slack. See total float and see also free float.

**Flowcharting [Technique].** The depiction in a diagram format of the inputs, process actions, and outputs of one or more processes within a system. (PMBOK® pg 361).

**Forbearance.** Influenced or dependent on previously existing terms or agreements; an intentional failure of a party to enforce, or willingly delay enforcement of, a contract requirement, usually done for an act of immediate or future consideration from the other party.

**Force Majeure.** An act of God or irresistible force or inevitable accident that could not be avoided by the exercise of due care. Examples: earthquake, fire, flood, hurricane, and third-party labor dispute/strike.

**Forecasts.** Estimates or predictions of conditions and events in the project’s future based on information and knowledge available at the time of the forecast. (PMBOK® pg 361).

**Forward Pass.** The calculation of the early start and early finish dates for the uncompleted portions of all network activities. (PMBOK® pg 361).

**Fraud.** An intentional perversion of the truth; a false representation.

**Free Float (FF).** The amount of time that a schedule activity can be delayed without delaying the early start of any immediately following schedule activities. See also total float. (PMBOK® pg 362).

**Functional Organization Structure.** A hierarchical organization where each employee has one clear superior, staff are grouped by areas of specialization, and managed by a person with expertise in that area. (PMBOK® pg 362).

**G**

**General and Administrative.** A non-overhead-related expense not directly attributable to a single project. This account is generally used by administrative and senior management.

**Governing Law.** The country or state law applicable to the contract.

**Gross Mistake.** A grave error, caused by negligence or incompetence, with significant negative consequences.

**Gross Profit.** The amount remaining after all revenues are accounted for and all direct costs are deducted, but before all indirect expenses are deducted.

**Groupthink.** Groupthink is defined as a mode of thinking in which group members’ premature striving for agreement somehow overrides their ability (motivation) to realistically appraise alternative courses of action.

**H**

**Holdback.** Nondelivery of a product or nonpayment of an obligation due as a means of applying pressure to the receiving party.

**I**

**Income (also called profit, net income, and net profit).** The amount remaining after all revenues are accounted for and all costs and expenses are deducted.

**Indemnity.** Compensation for loss or damage.

**Inspection [Technique].** Examining or measuring to verify whether an activity, component, product, result or service conforms to specified requirements. (PMBOK® pg 362).

**Integrated Change Control [Process].** The process of reviewing all change requests, approving changes and controlling changes to deliverables and organizational process assets. (PMBOK® pg 363).

**Internal Risks.** Risks the project team can control or influence.

**Introversion.** Focusing attention and energy inside oneself.

**Intuitive Types.** Persons who gather by looking for possibilities, meanings, and relationships between and among things.

**Invitation for Bid (IFB).** Generally, this term is equivalent to request for proposal. However, in some application areas, it may have a narrower or more specific meaning. (PMBOK® pg 363).

**Issue.** A point or matter in question or in dispute, or a point or matter that is not settled and is under discussion or over which there are opposing views or disagreements. (PMBOK® pg 363).

**L**

**Lag [Technique].** A modification of a logical relationship that directs a delay in the successor activity. For example, in a finish-to-start dependency with a ten-day lag, the successor activity cannot start until ten days after the predecessor activity has finished. See also lead. (PMBOK® pg 363).

**Late Finish Date (LF).** In the critical path method, the latest possible point in time that a schedule activity may be completed based upon the schedule network logic, the project completion date, and any constraints assigned to the schedule activities without violating a schedule constraint or delaying the project completion date. The late finish dates are determined during the backward pass calculation of the project schedule network. (PMBOK® pg 363).
Late Start Date (LS). In the critical path method, the latest possible point in time that a schedule activity may begin based upon the schedule network logic, the project completion date, and any constraints assigned to the schedule activities without violating a schedule constraint or delaying the project completion date. The late start dates are determined during the backward pass calculation of the project schedule network. (PMBOK® pg 363).

Latent Defect. A defect that existed at the time of acceptance but that could not be discovered by reasonable inspection or test.

Latest Revised Estimate. See estimate at completion. (PMBOK® pg 363).

Lead [Technique]. A modification of a logical relationship that allows an acceleration of the successor activity. For example, in a finish-to-start dependency with a ten-day lead, the successor activity can start ten days before the predecessor activity has finished. See also lag. A negative lead is equivalent to a positive lag. (PMBOK® pg 363).

Leading. Establishing direction, aligning people, and motivating and inspiring.

Legal Purpose. The underlying purpose of the contract must be allowed by law.

Lessons Learned [Output/Input]. The learning gained from the process of performing the project. Lessons learned may be identified at any point. Also considered a project record, to be included in the lessons learned knowledge base. (PMBOK® pg 363).

Lessons Learned Knowledge Base. A store of historical information and lessons learned about both the outcomes of previous project selection decisions and previous project performance. (PMBOK® pg 363).

Letter of Authorization. A letter format agreement that authorizes contract performance to start for a limited scope and time while final negotiations are taking place. Note: Previously known as “letter of intent.”

Level of Effort (LOE). Support-type activity (for example, seller or customer liaison, project cost accounting, project management, etc.) that does not readily lend itself to measurement of discrete accomplishment. It is generally characterized by a uniform rate of work performance over a period of time determined by the activities supported. (PMBOK® pg 363).

Liabilities. All debts and moneys owed to others by a company.

Liability. The condition of being responsible for a possible or actual loss.

Life-Cycle Costing. Concerned with the cost of the resources needed to complete project activities and the effects of project decisions on the cost of using the project product.

Liquidated Damages. A sum stipulated and agreed upon by the parties at the time they entered the contract as an estimate of the actual damages the harmed party will suffer as a result of not meeting an obligation. Note: If a party fails to meet the specified obligation but pays the liquidated damages, he or she cannot be considered in default of the contract for not meeting that obligation.

Litigation. The act of carrying on a suit in a court of law.

Logical Relationship. A dependency between two project schedule activities, or between a project schedule activity and a schedule milestone. See also precedence relationship. The four possible types of logical relationships are: Finish-to-Start; Finish-to-Finish; Start-to-Start; and Start-to-Finish. (PMBOK® pg 364).

M

Magnitude. Greatness in size or measurable quantity.

Maintenance. The act of applying updates, changes, and fixes to a product.

Make-or-Buy Analysis. Determining whether a particular product can be produced cost-effectively by the performing organization.

Management Reserve. A separately planned quantity used to allow for future situations which may be planned for only in part (sometimes called “known unknowns”). Management reserves may involve cost or schedule. Management reserves are intended to reduce the risk of missing cost or schedule objectives. Use of management reserves requires a change to the project’s cost baselines.

Margin. The actual percentage earned on a project.

Markup. The factor applied to get from cost to final price.

Matrix Organization. Any organizational structure in which the project manager shares responsibility with the functional managers for assigning priorities and for directing the work of persons assigned to the project. (PMBOK® pg 364).

Matrix Organizational Structure. Project manager shares responsibility with functional managers to assign priorities and direct the work of the people assigned to the project; a blend of functional and projectized structure (PMBOK® 2.3.3).

Memorandum of Understanding. The documentation of mutually agreed-to statement of facts, intentions, procedures, and parameters for future actions and matters of coordination. Also, the documentation of mutual understanding of an issue by two or more parties.

Mentor. A person who serves as teacher or coach; an advisor.

Methodology. A system of practices, techniques, procedures, and rules used by those who work in a discipline. (PMBOK® pg 364).

Milestone. A significant point or event in the project. See also schedule milestone. (PMBOK® pg 364).

Milestone Schedule [Tool]. A summary-level schedule that identifies the major schedule...
milestones. See also master schedule. (PMBOK® pg 364).

Model Agreement. A generic agreement containing the base definitions and terms and conditions, which can be used as a base for generation of the final agreement.

Modification. A change to a document or understanding.

Monopoly. A form of market structure in which one or only a few firms dominate the total sales of a product or service.

Monte Carlo Analysis. A technique that computes, or iterates, the project cost or project schedule many times using input values selected at random from probability distributions of possible costs or durations, to calculate a distribution of possible total project cost or completion dates. (PMBOK® pg 364).

N

Near-Critical Activity. A schedule activity that has low total float. The concept of near-critical is equally applicable to a schedule activity or schedule network path. The limit below which total float is considered near critical is subject to expert judgment and varies from project to project. (PMBOK® pg 364).

Negotiating. Conferring with others in order to come to terms or reach an agreement (PMBOK® 2.4.3).

Negotiation. Can be described as the process through which two parties move from diverse positions to a point of mutual agreement by means of discussions.

Net Earnings before Taxes (NEBT). A method of calculating earnings that does not consider the effect of taxes on the earnings.

Network. See project schedule network diagram.

Nonperformance. Failure of a party to meet an expectation or a contractual commitment.

Normalized Risk Score. Unsophisticated technique that uses the severity scores of the top 10 risk events plus the sum of the scores; the normalized risk score then equals risk score (sum of severity ratings) times 10, divided by the number of risk events.

O

Offer. An unequivocal and intentionally communicated statement of proposed terms made to another party. A proposal is normally a written offer by a seller describing its offering terms.

Operator. A person who manages to achieve his or her goals.

Opportunity. A condition or situation favorable to the project, a positive set of circumstances, a positive set of events, a risk that will have a positive impact on project objectives, or a possibility for positive changes. Contrast with threat. (PMBOK® pg 365).

Order of Precedence. A statement in a contract that specifies which provision should control if the contract or related contracts or agreements contain conflicting or inconsistent provisions.

Organization. A group of persons organized for some purpose or to perform some type of work within an enterprise. (PMBOK® pg 365).

Organization Chart [Tool]. A method for depicting interrelationships among a group of persons working together toward a common objective. (PMBOK® pg 365).

Organizational Breakdown Structure (OBS) [Tool]. A hierarchically organized depiction of the project organization arranged so as to relate the work packages to the performing organizational units. (PMBOK® pg 365).

Owners' Equity. The interest or stake the owners have in a company; the sum of the owners' original investment plus the accumulation of all profits that have been retained (not distributed to stockholders) in the company since inception.

Ownership. The right to reuse (that is, remarket, modify, enhance, and prepare derivative works based on) all material prepared under a buyer's direction and control.

P

Parametric Estimating [Technique]. An estimating technique that uses a statistical relationship between historical data and other variables (for example, square footage in construction, lines of code in software development) to calculate an estimate for activity parameters, such as scope, cost, budget, and duration. (PMBOK® pg 365).

Pareto Chart [Tool]. A histogram, ordered by frequency of occurrence, that shows how many results were generated by each identified cause. (PMBOK® pg 366).

Patent. A government grant giving an inventor the exclusive right to make or sell his or her invention for a limited period of time.

Penalties. Compensation to be paid in case of nonperformance of the conditions of a contract.

Percent Complete (PC or PCT). An estimate, expressed as a percent, of the amount of work that has been completed on an activity or a work breakdown structure component. (PMBOK® pg 366).

Perceptions. Awareness, comprehension; insight or intuition; discernment. To take notice of; observe to achieve understanding.

Performance Bond. A monetary guarantee that the contractor will perform according to contract terms.

Performance Measurement Baseline. An approved plan for the project work against which project execution is compared and deviations are measured for management control. The
performance measurement baseline typically integrates scope, schedule, and cost parameters of a project, but may also include technical and quality parameters. (PMBOK® pg 366).

Performance Reporting [Process]. The process of collecting and distributing performance information. This includes status reporting, progress measurement, and forecasting. (PMBOK® pg 366).

Performance Reports [Output/Input]. Documents and presentations that provide organized and summarized work performance information, earned value management parameters and calculations, and analyses of project work progress and status. (PMBOK® pg 366).

Performance Reviews. Meetings held to assess project status or progress. Planned Finish Date (PF). See scheduled finish date.

Planned Start Date (PS). See scheduled start date.

Planned Value (PV). The authorized budget assigned to the scheduled work to be accomplished for a schedule activity or work breakdown structure component. Also referred to as the budgeted cost of work scheduled (BCWS). (PMBOK® pg 366).

Planning Package. A WBS component below the control account with known work content but without detailed schedule activities. See also control account. (PMBOK® pg 366).

Portfolio. A collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives. The projects or programs of the portfolio may not necessarily be interdependent or directly related. (PMBOK® pg 367).

Portfolio Management [Technique]. The centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic business objectives. (PMBOK® pg 367).

Postaward. The time frame after a contract has been awarded. The activities of the buyer and the seller after a contract has been awarded. Phase 3 of the contract management process.

Preaward. The time frame before a contract is awarded. The activities of the buyer and the seller before a contract is awarded. Phase 1 of the contract management process.

Precedence Diagramming Method (PDM) [Technique]. A schedule network diagramming technique in which schedule activities are represented by boxes (or nodes). Schedule activities are graphically linked by one or more logical relationships to show the sequence in which the activities are to be performed. (PMBOK® pg 367).

Precedence Relationship. The term used in the precedence diagramming method for a logical relationship. In current usage, however, precedence relationship, logical relationship, and dependency are widely used interchangeably, regardless of the diagramming method used. (PMBOK® pg 367).

Predicting Potential Problem Areas. Forecasting where difficulties might arise.

Preventive Action. Documented direction to perform an activity that can reduce the probability of negative consequences associated with project risks*. (PMBOK® pg 367).

Prime Contractor. The principal seller performing under the contract.

Privity. Knowledge shared between two parties regarding a private matter, usually implying consent or concurrence. Note: When two parties sign an agreement, there is privity between them.

Procurement Management Plan [Output/Input]. The document that describes how procurement processes from developing procurement documentation through contract closure will be managed. (PMBOK® pg 367).

Product. An artifact that is produced, is quantifiable, and can be either an end item in itself or a component item. Additional words for products are material and goods. Contrast with result and service. See also deliverable. (PMBOK® pg 367).

Program. A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs may include elements of related work outside of the scope of the discrete projects in the program. (PMBOK® pg 368).

Program Management. The centralized coordinated management of a program to achieve the program’s strategic objectives and benefits. (PMBOK® pg 368).

Program Management Office (PMO). The centralized management of a particular program or programs such that corporate benefit is realized by the sharing of resources, methodologies, tools, and techniques, and related high-level project management focus. See also project management office. (PMBOK® pg 368).

Progressive Elaboration [Technique]. Continuously improving and detailing a plan as more detailed and specific information and more accurate estimates become available as the project progresses, and thereby producing more accurate and complete plans that result from the successive iterations of the planning process. (PMBOK® pg 368).

Project. A temporary endeavor undertaken to create a unique product, service, or result. (PMBOK® pg 368).

Project Charter [Output/Input]. A document issued by the project initiator or sponsor that formally authorizes the existence of a project, and provides the project manager with the authority to apply organizational resources to project activities. (PMBOK® pg 368).

Project Closeout. Process that provides for acceptance of the project by the client/project sponsor and includes completion of project records,
Project Control. Process used to monitor, evaluate, and compare the project’s planned results with its actual results to determine the status of cost, schedule, and technical performance objectives.

Project Control Book. A repository for the project management system of a project. This repository includes all the agreements, plans and procedures to be followed by the project, and all of the project management products produced by these plans and procedures. Abbreviated “PCB.”

Project Cost Management. A subset of project management that includes the processes required to ensure that the project is completed within the approved budget. It consists of resource planning, cost estimating, cost budgeting, and cost control.

Project Life Cycle. A collection of generally sequential project phases whose name and number are determined by the control needs of the organization or organizations involved in the project. A life cycle can be documented with a methodology. (PMBOK® pg 368)

Project Management (PM). The application of knowledge, skills, tools, and techniques to project activities* to meet the project requirements. (PMBOK® pg 368)

Project Management Information System (PMIS) [Tool]. An information system consisting of the tools and techniques used to gather, integrate, and disseminate the outputs of project management processes. It is used to support all aspects of the project from initiating through closing, and can include both manual and automated systems. (PMBOK® pg 368)

Project Management Knowledge Area. An identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques. (PMBOK® pg 369)

Project Management Office (PMO). An organizational body or entity assigned various responsibilities related to the centralized and coordinated management of those projects under its domain. The responsibilities of a PMO can range from providing project management support functions to actually being responsible for the direct management of a project. See also program management office. (PMBOK® pg 369)

Project Management Plan [Output/Input]. A formal, approved document that defines how the project is executed, monitored and controlled. It may be summary or detailed and may be composed of one or more subsidiary management plans and other planning documents. (PMBOK® pg 369)

Project Management System [Tool]. The aggregation of the processes, tools, techniques, methodologies, resources, and procedures to manage a project. The system is documented in the project management plan and its content will vary depending upon the application area, organizational influence, complexity of the project, and the availability of existing systems. (PMBOK® pg 369)

Project Management Team. The members of the project team who are directly involved in project management activities. On some smaller projects, the project management team may include virtually all of the project team members. (PMBOK® pg 369)

Project Manager (PM). The person assigned by the performing organization to achieve the project objectives*. (PMBOK® pg 369)

Project Network Diagram. Schematic display of the project’s activities and the logical relationships (dependencies) among them.

Project Organization Chart [Output/Input]. A document that graphically depicts the project team members and their interrelationships for a specific project. (PMBOK® pg 369)

Project Phase. A collection of logically related project activities*, usually culminating in the completion of a major deliverable. Project phases (also called phases) are mainly completed sequentially, but can overlap in some project situations. Phases can be subdivided into subphases and then components; this hierarchy, if the project or portions of the project are divided into phases, is contained in the work breakdown structure. A project phase is a component of a project life cycle. (PMBOK® pg 369)

Project Schedule [Output/Input]. The planned dates for performing schedule activities and the planned dates for meeting schedule milestones. (PMBOK® pg 370)

Project Schedule Network Diagram [Output/ Input]. Any schematic display of the logical relationships among the project schedule activities. Always drawn from left to right to reflect project work chronology. (PMBOK® pg 370)

Project Scope. The work that must be performed to deliver a product, service, or result with the specified features and functions. (PMBOK® pg 370)

Project Sponsor. See sponsor.

Project Stakeholder. See stakeholder.

Project Summary Work Breakdown Structure (PSWBS) [Tool]. A work breakdown structure for the project that is only developed down to the subproject level of detail within some legs of the WBS, and where the detail of those subprojects are provided by use of contract work breakdown structures. (PMBOK® pg 370)

Project Team. All the project team members, including the project management team, the project manager and, for some projects, the project sponsor. (PMBOK® pg 370)

Projectized Organization. Any organizational structure in which the project manager has full authority to assign priorities, apply resources, and direct the work of persons assigned to the project. (PMBOK® pg 371)

Promoter. A person who helps bring about or further the growth or establishment of a project or an organization.
Proposition. A definition of the business opportunity that is to be accomplished in a project; includes a statement of the business need, a set of requirements, and a schedule.

Proprietary. Owned by a particular person; relating to a certain owner.

Public Domain. Material on which the copyright or patent right has expired and that is available for unrestricted use. Property owned by a state or national government.

Q

Qualitative Risk Analysis [Process]. The process of prioritizing risks for subsequent further analysis or action by assessing and combining their probability of occurrence and impact. (PMBOK® pg 371)

Quality. The degree to which a set of inherent characteristics fulfills requirements. (PMBOK® pg 371)

Quality Assurance. Evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

Quality Management Plan [Output/Input]. The quality management plan describes how the project management team will implement the performing organization’s quality policy. The quality management plan is a component or a subsidiary plan of the project management plan. The quality management plan may be formal or informal, highly detailed, or broadly framed, based on the requirements of the project. (PMBOK® pg 371)

Quality Planning [Process]. The process of identifying which quality standards are relevant to the project and determining how to satisfy them. (PMBOK® pg 371)

Quantitative Risk Analysis [Process]. The process of numerically analyzing the effect on overall project objectives of identified risks. (PMBOK® pg 371)

Request for Quotation (RFQ). A type of procurement document used to request price quotations from prospective sellers of common or standard products or services. Sometimes used in place of request for proposal and in some application areas, it may have a narrower or more specific meaning. (PMBOK® pg 371)

Requirement. A condition or capability that must be met or possessed by a system, product, service, result, or component to satisfy a contract, standard, specification, or other formally imposed documents. Requirements include the quantified and documented needs, wants, and expectations of the sponsor, customer, and other stakeholders. (PMBOK® pg 371)

Reserve. A provision in the project management plan to mitigate cost and/or schedule risk. Often used with a modifier (for example, management reserve, contingency reserve) to provide further detail on what types of risk are meant to be mitigated. The specific meaning of the modified term varies by application area. (PMBOK® pg 372)

Residual Risk. A risk that remains after risk responses have been implemented. (PMBOK® pg 372)

Resource. Skilled human resources (specific disciplines either individually or in crews or teams), equipment, services, supplies, commodities, material, budgets, or funds. (PMBOK® pg 372)

Resource Breakdown Structure (RBS). A hierarchical structure of resources by resource category and resource type used in resource leveling schedules and to develop resource-limited schedules, and which may be used to identify and analyze project human resource assignments. (PMBOK® pg 372)

Resource Histogram. A bar chart showing the amount of time that a resource is scheduled to work over a series of time periods. Resource availability may be depicted as a line for comparison purposes. Contrasting bars may show actual amounts of resource used as the project progresses. (PMBOK® pg 372)

Resource Leveling [Technique]. Any form of schedule network analysis in which scheduling decisions (start and finish dates) are driven by resource constraints (for example, limited resource availability or difficult-to-manage changes in resource availability levels). (PMBOK® pg 372)

Responsibility Assignment Matrix (RAM) [Tool]. A structure that relates the project organizational breakdown structure to the work breakdown structure to help ensure that each component of the project’s scope of work is assigned to a responsible person. (PMBOK® pg 372)

Revenue. The total funds received from the sales of products or services.

Reward and Recognition Systems. Formal management actions that promote or reinforce desired behavior (PMBOK® 9.3.2.3).
Rework. Action taken to bring a defective or nonconforming component into compliance with requirements or specifications. (PMBOK® pg 372)

Rights. Claims, power, or privileges to which a party is justly entitled; can be legally enforceable.

Rights in Data. Synonymous with ownership as it applies to materials that are considered intellectual property, including code, program listings, reports, documentation, programming tools, drawings, and similar works; it does not include licensed programs.

Risk. An uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives. See also risk category and risk breakdown structure. (PMBOK® pg 372)

Risk Acceptance [Technique]. A risk response planning technique* that indicates that the project team has decided not to change the project management plan to deal with a risk, or is unable to identify any other suitable response strategy. (PMBOK® pg 372)

Risk Action Log (RAL). Used to keep track of the action plan for each risk event; there is one RAL for each risk event.

Risk Avoidance [Technique]. A risk response planning technique* for a threat that creates changes to the project management plan that are meant to either eliminate the risk or to protect the project objectives from its impact. Generally, risk avoidance involves relaxing the time, cost, scope, or quality objectives. (PMBOK® pg 372)

Risk Assessment Checklist (RACL). Risk evaluation technique that makes use of a checklist of risk sources against which selected conditions in a proposal or concept are compared. In some business units, tools are available to facilitate the comparison, provide a score, and in some cases suggest mitigation approaches.

Risk Breakdown Structure (RBS) [Tool]. A hierarchically organized depiction of the identified project risks* arranged by risk category and subcategory that identifies the various areas and causes of potential risks. The risk breakdown structure is often tailored to specific project types. (PMBOK® pg 373)

Risk Category. A group of potential causes of risk. Risk causes may be grouped into categories such as technical, external, organizational, environmental, or project management. A category may include subcategories, such as technical maturity, weather, or aggressive estimating. See also risk breakdown structure. (PMBOK® pg 373)

Risk Checklist. A checklist of potential focus areas and risk drivers; most checklists have an evaluation capability, and some offer mitigation suggestions.

Risk Control Form (RCF). Used to provide a description of a risk identified in the risk identification report.

Risk Database. A repository that provides for collection, maintenance, and analysis of data gathered and used in the risk management processes. (PMBOK® pg 373)

Risk Event. A discrete occurrence that may affect the project for better or worse. (PMBOK® pg 207)

Risk Event Impact. The effect imposed on a project if a risk event occurs.

Risk Event Probability. The likelihood (expressed as a percentage) that a possible risk event will occur.

Risk Event Severity Matrix. A consistent way to relate probability and impact with respect to a given risk event.

Risk Identification [Process]. The process of determining which risks might affect the project and documenting their characteristics. (PMBOK® pg 373)

Risk Identification Report (RIR). The product of a risk identification workshop; it lists risks by focus area, risk drivers, risk owners, actions required to facilitate evaluation of risks, and a preliminary prioritization of the risks identified.

Risk Identification Workshop (RIW). A formal facilitated workshop intended to identify risks to the project.

Risk Log. Used to summarize risk events and their status.

Risk Management. A strategic process for identifying and managing possible future events which may influence project performance and results. The process is applied throughout the project life cycle and is most valuable when started early.

Risk Management Communication. Activities that focus on the iteration of the Four-Step Risk Model and all other activities involving project stakeholders intended to inform, focus, motivate, surface, assign ownership, report status, encourage risk outlooks, identify, and resolve risks, and generally improve the management of risk on a project.

Risk Management Plan [Output/Input]. The document describing how project risk management will be structured and performed on the project. It is contained in or is a subsidiary plan of the project management plan. The risk management plan can be informal and broadly framed, or formal and highly detailed, based on the needs of the project.

Risk Management Planning [Process]. The process of deciding how to approach, plan, and execute risk management activities for a project. (PMBOK® pg 373)

Risk Mitigation [Technique]. A risk response planning technique* associated with threats that seek to reduce the probability of occurrence or impact of a risk to below an acceptable threshold. (PMBOK® pg 373)
Risk Mitigation Report (RMR). The product of a risk management workshop; contents include alternative propositions considered, recommended mitigation plans, problems, recommended contingency actions and costs, recommended action plans, and risk evaluation.

Risk Mitigation Workshop. A facilitated workshop intended to identify and develop risk mitigation options and actions.

Risk Model. The four-step interactive process that is focused on risk identification, evaluation, mitigation, and monitoring and applied throughout the project life cycle.

Risk Monitoring and Control [Process]. The process of tracking identified risks, monitoring residual risks, identifying new risks, executing risk response plans, and evaluating their effectiveness throughout the project life cycle. (PMBOK® pg 373)

Risk Owner. Person assigned primary responsibility to mitigate a particular risk event and keep the project team informed of the status of efforts; the owner should be the person who controls the source of the risk.

Risk Register [Output/Input]. The document containing the results of the qualitative risk analysis, quantitative risk analysis, and risk response planning. The risk register details all identified risks, including description, category, cause, probability of occurring, impact(s) on objectives, proposed responses, owners, and current status. The risk register is a component of the project management plan. (PMBOK® pg 373)

Risk Response Plan. A document detailing all identified risks, including description, cause, probability of occurring, impact(s) on objectives, proposed responses, owners, and current status. Also known as the risk register. (PMBOK® pg 207)

Risk Response Planning [Process]. The process of developing options and actions to enhance opportunities and to reduce threats to project objectives. (PMBOK® pg 373)

Risk Transference [Technique]. A risk response planning technique that shifts the impact of a threat to a third party, together with ownership of the response. (PMBOK® pg 373)

Role and Responsibility Assignments. Assigning roles (who does what) and responsibilities (who decides what) to appropriate project stakeholders; uses a responsibility assignment matrix (RAM) (PMBOK® pg 9.1.3.1).

Royalties. A share of proceeds paid to a proprietor, author, or inventor by those doing business under some right belonging to that proprietor, author, or inventor.

Schedule. See project schedule and see also schedule model.

Schedule Baseline. See baseline.
**Sole Source.** The only source in a marketplace that offers a desired product or service. There are no other choices.

**Specification.** A document that specifies, in a complete, precise, verifiable manner, the requirements, design, behavior, or other characteristics of a system, component, product, result, or service and, often, the procedures for determining whether these provisions have been satisfied. (PMBOK® pg 376)

**Sponsor.** The person or group that provides the financial resources, in cash or in kind, for the project. (PMBOK® pg 376)

**Staffing Management Plan [Process].** The document that describes when and how human resource requirements will be met. It is contained in, or is a subsidiary plan of, the project management plan. The staffing management plan can be informal and broadly framed, or formal and highly detailed, based on the needs of the project. Information in the staffing management plan varies by application area and project size. (PMBOK® pg 376)

**Stakeholder.** Persons and organizations, such as customers, sponsors, performing organization and the public, that are actively involved in the project, or whose interests may be positively or negatively affected by execution or completion of the project. They may also exert influence over the project and its deliverables. (PMBOK® pg 376)

**Standard.** A document established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context. (PMBOK® pg 376)

**Start Date.** A point in time associated with a schedule activity's start, usually qualified by one of the following: actual, planned, estimated, scheduled, early, late, target, baseline, or current. (PMBOK® pg 376)

**Start-to-Finish (SF).** The logical relationship where completion of the successor schedule activity is dependent upon the initiation of the predecessor schedule activity. See also logical relationship. (PMBOK® pg 376)

**Start-to-Start (SS).** The logical relationship where initiation of the work of the successor schedule activity depends upon the initiation of the work of the predecessor schedule activity. See also logical relationship. (PMBOK® pg 376)

**Statement of Risk.** A clear and concise documentation of a risk event; consists of a condition and a consequence for each identified risk event.

**Statement of Work (SOW).** A narrative description of products, services, or results to be supplied. (PMBOK® pg 376)

**Status Reporting.** Describing where the project stands at any moment in time.

**Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis.** This information gathering technique examines the project from the perspective of each project's strengths, weaknesses, opportunities, and threats to increase the breadth of the risks considered by risk management. (PMBOK® pg 376)

**Subcontract.** A contract between a buyer and a seller in which the products or services being acquired are for use in a prime contract.

**Subcontractor.** A business entity that does work for you under a contract.

**Subproject.** A smaller portion of the overall project created when a project is subdivided into more manageable components or pieces. Subprojects are usually represented in the work breakdown structure. A subproject can be referred to as a project, managed as a project, and acquired from a seller. (PMBOK® pg 377)

**Supplier.** A business entity that can provide a product or service as a third party, part of a client/project sponsor organization, or part of your own organization.

**Supplier Management.** Process used by the project manager to manage and control suppliers' responsibilities and performance on the project.

**T**

**Target Completion Date (TC).** An imposed date that constrains or otherwise modifies the schedule network analysis. (PMBOK® pg 377)

**Target Finish Date (TF).** The date that work is planned (targeted) to finish on a schedule activity. (PMBOK® pg 377)

**Target Schedule.** A schedule adopted for comparison purposes during schedule network analysis, which can be different from the baseline schedule. See also baseline. (PMBOK® pg 377)

**Target Start Date (TS).** The date that work is planned (targeted) to start on a schedule activity. (PMBOK® pg 377)

**Task.** A term for work whose meaning and placement within a structured plan for project work varies by the application area, industry, and brand of project management software. (PMBOK® pg 377)

**Team.** A small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable.

**Team Charter.** Sets broad performance objectives, the roles and responsibilities for the project team, and ground rules for the team’s operation.

**Team Development.** Enhancing the ability of stakeholders to contribute as individuals as well as enhancing the ability of the team to function as a team.

**Team Predictions.** What the team believes will happen.

**Temperament Defined.** Relates to observable behaviors and core values that help shape one's leadership and management styles.
Termination. Clause in a contract that defines the circumstances under which one or both of the parties can end the agreement. Termination might be for cause when one party does not do something called for in the contract, causing the other party to terminate (for example, the client fails to pay the bill). Usually termination requires written notice within a certain period of time (for example, 60 days).

Terms and Conditions. Terms — The essential statements on which the validity of the contract depends. Conditions — Defined events that must occur before contingent terms in a contract become fixed.

Third Party. Another business entity, not part of your own or the client/project sponsor's business.

Threat. A condition or situation unfavorable to the project, a negative set of circumstances, a negative set of events, a risk that will have a negative impact on a project objective if it occurs, or a possibility for negative changes. (PMBOK® pg 377)

Threshold. A cost, time, quality, technical, or resource value used as a parameter, and which may be included in product specifications. Crossing the threshold should trigger some action, such as generating an exception report. (PMBOK® pg 378)

Time-and-Materials. A type of contract in which the buyer reimburses the seller for labor expended and the cost of materials provided.

Time and Material (T&M) Contract. A type of contract that is a hybrid contractual arrangement containing aspects of both cost-reimbursable and fixed-price contracts. Time and material contracts resemble cost-reimbursable type arrangements in that they have no definitive end, because the full value of the arrangement is not defined at the time of the award. (PMBOK® pg 378)

Time Is of the Essence. A statement in a proposal or contract that implies a seller must deliver a product or service in the shortest possible time.

To Be Objective. Without bias or preference. Being logical, detached, and analytical.

To-Complete Performance Index (TCPI). A measure that provides ratio of the work remaining to the budget remaining. (BAC–EV)/(BAC–AC).

Top 10 Scoring. Use of a consistent method to weigh and apply the probability and impact of risk parameter by using prior progress reporting periods' data and projecting how much that parameter's variance from baseline might be at some future point in the project if no changes are made in executing the project. (PMBOK® pg 378)

Triggers. Indications that a risk has occurred or is about to occur. Triggers may be discovered in the risk identification process and watched in the risk monitoring and control process. Triggers are sometimes called risk symptoms or warning signs. (PMBOK® pg 378)

Triple Constraint. A framework for evaluating competing demands. The triple constraint is often depicted as a triangle where one of the sides or one of the corners represent one of the parameters being managed by the project team. (PMBOK® pg 378)

U

Unit Price. A type of contract in which the buyer pays a fixed price for each unit of product purchased.

Unwarranted. Not authorized or justified.

User. The person or organization that will use the project's product or service. See also customer. (PMBOK® pg 378)

Utilization Factor. Amount of time a full-time equivalent (FTE) can be used for the length of the project.

V

Value Engineering (VE). A creative approach used to optimize project life cycle costs, save time, increase profits, improve quality, expand market share, solve problems, and/or use resources more effectively. (PMBOK® pg 379)

Variance. A quantifiable deviation, departure, or divergence away from a known baseline or expected value. (PMBOK® pg 379)

Variance Analysis [Technique]. A method for resolving the total variance in the set of scope, cost, and schedule variables into specific component variances that are associated with defined factors affecting the scope, cost, and schedule variables. (PMBOK® pg 379)

Variation at Completion (VAC). The difference between the budget at completion and the estimate at completion. BAC–EAC.

Vendor. A business entity that provides a commercial, off-the-shelf product.

Verification [Technique]. The technique of evaluating a component or product at the end of a phase or project to assure or confirm it satisfies the conditions imposed. Contrast with validation. (PMBOK® pg 379)
Virtual Team. A group of persons with a shared objective who fulfill their roles with little or no time spent meeting face to face. Various forms of technology are often used to facilitate communication among team members. Virtual teams can be comprised of persons separated by great distances. (PMBOK® pg 379)

W

Waiver. The voluntary relinquishment of a right, privilege, or advantage.

Warranty. An assurance by the seller of property that the property is, or shall be, as it is represented or promised; an agreement that the seller will fix a defect. Warranty will be limited in time.

Work Authorization [Technique]. A permission and direction, typically written, to begin work on a specific schedule activity or work package or control account. It is a method for sanctioning project work to ensure that the work is done by the identified organization, at the right time, and in the proper sequence. (PMBOK® pg 379)

Work Authorization System [Tool]. A subsystem of the overall project management system. It is a collection of formal documented procedures that defines how project work will be authorized (committed) to ensure that the work is done by the identified organization, at the right time, and in the proper sequence. (PMBOK® pg 379)

Work Breakdown Structure (WBS) [Output/Input]. A deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables. It organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of the project work. The WBS is decomposed into work packages. The deliverable orientation of the hierarchy includes both internal and external deliverables. See also work package, control account, contract work breakdown structure, and project summary work breakdown structure. (PMBOK® pg 379)

Work Breakdown Structure Dictionary [Output/Input]. A document that describes each component in the work breakdown structure (WBS). For each WBS component, the WBS dictionary includes a brief definition of the scope or statement of work, defined deliverable(s), a list of associated activities, and a list of milestones. (PMBOK® pg 379)

Work Element. Delivers a distinct, identifiable product or result with definite completion criteria.

Work Item. Term no longer in common usage. See activity and schedule activity. (PMBOK® pg 380)

Work Package. A deliverable or project work component at the lowest level of each branch of the work breakdown structure. The work package includes the schedule activities and schedule milestones required to complete the work package deliverable or project work component. See also control account. (PMBOK® pg 380)

Work Products. Any measurable, tangible, verifiable outcome, result, or item that must be produced by a project or sub-project. A work product that is specified in an agreement is called a deliverable.

Workaround [Technique]. A response to a negative risk that has occurred. Distinguished from contingency plan in that a workaround is not planned in advance of the occurrence of the risk event. (PMBOK® pg 380)

Works for Hire. An agreement between two parties that one hired the other and whatever the skilled labor produces is at the direction of the hiring party; therefore, ownership of all work products goes to the paying party.
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**Contracting**


**Applied Project Management**


Appendix H. Web Sites

IBM

IBM Global Services http://www.ibm.com/services/
IBM IT Education Services http://www-3.ibm.com/services/learning/
IBM IT Education Services can meet all your training needs - public classes, private
classes, custom classes, technical conferences, technical books, computer-based and
technology-based training, and education-related services.

Project Management Institute (PMI®)

PMI® Home Page http://www.pmi.org
PMI® is a worldwide nonprofit professional organization for project management
professionalism.

The Project Management Institute (PMI®) stands as a global leader in the field of
project management. It is well known that PMI certification involves a rigorous,
exam-based process that represents the highest caliber in professional
standards.

Earned Value Management

Earned Value Management http://www.acq.osd.mil/pm/
Sponsored by the Office of the Under Secretary of Defense (Acquisition, Technology &
Logistics) Acquisition Resources & Analysis/Acquisition Management.

Contract Management

National Contract Management Association (NCMA) http://www.ncmahq.org/

Quality Management

American Society for Quality (ASQ) http://www.isixsigma.com/or/asq/
ISOOnline.frontpage