ARBA MINCH UNIVERSITY

INSTITUTE OF TECHNOLOGY FACULTY OF COMPUTING & SOFTWARE ENGINEERING

INTORMATION TECHNOLOGY PROJECT MANGEMENT

Module

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Module Description

This Module will introduce the area of Software project management, presenting basic techniques and approaches and aiming to develop a critical awareness of the challenges and shortcomings of the area. Software Project Management is an important area of study since most non-trivial IS development efforts will be making use of some type of project management approach in an aim to manage the development process in such a way that the IS meets its requirements and is on-time and within budget.

Module Objective

At the end of the module students will be able to:

- ✓ Understand the issues involved in Software project management and the factors that affect Software quality;
- ✓ Familiar with a range of standards, techniques and tools developed to support Software project management and the production of high quality Software;
- ✓ Develop Software project plans, supporting Software quality plans and risk management plans.
- ✓ Capable of actively participating or successfully managing a Software development project by applying project management concepts
- ✓ Demonstrate knowledge of project management terms and techniques

1. Introduction to Software Project Management

Learning Objective:

At the end of this chapter students will able to:

- ✓ Understand the growing need for PM, especially for IT
- ✓ Explain what a project is, provide examples of IT projects, list various attributes of project and describe the triple constraint
- ✓ Describe PM and key elements of PM framework
- ✓ Understand the role of PM by describing what PM do, what skills they need, what the career field like for IT PMs

1.0 introduction

Many people and organizations today have a new—or renewed—interest in project management. Until the 1980s, project management primarily focused on providing schedule and resource data to top management in the military, computer, and construction industries. Today's project management involves much more, and people in every industry and every country manage projects. Project management is a distinct profession with degree programs, certifications, and excellent career opportunities. New technologies have become a significant factor in many businesses. Computer hardware, software, networks, and the use of interdisciplinary and global work teams have radically changed the work environment. The following statistics demonstrate the significance of project management in today's society, especially for projects involving information technology (IT):

- ✓ Worldwide IT spending was $3.5 trillion in 2017, a 2.4 percent increase from 2016 spending. Communications services accounted for 40 percent of the spending.
- ✓ The Project Management Institute reported that the number of project related jobs reached almost 66 million in 2017, and demand continues to increase. "By 2027, employers will need 87.7 million individuals working in project management–oriented roles.
- ✓ The unemployment rate for IT professionals is generally half the rate of the overall labor market in the United States. The U.S. Bureau of Labor Statistics estimates the rate to be only 2 percent, and project management is one of the ten hottest tech skills.
- ✓ In 2017, the average annual salary (without bonuses) for someone in the project management profession was $112,00 per year in the United States and $130,866 in

Switzerland, the highest-paid country. Salaries of survey respondents across 37 counties were 23 percent higher for those with the Project Management Professional credential than those without it.

- ✓ The top skills employers look for in new college graduates are all related to project management: team work, decision making, problem-solving, and verbal communications.
- ✓ Organizations waste $97 million for every $1 billion spent on projects, according to PMI's Pulse of the Profession report. Excelling at project management definitely affects the bottom line. The complexity and importance of IT projects, which involve using hardware, software, and networks to create a product, service, or result, have evolved dramatically. Today's companies, governments, and nonprofit organizations are recognizing that to be successful, they need to use modern project management techniques, especially for IT projects. Individuals are realizing that to remain competitive in the workplace, they must develop skills to become good project team members and project managers. They also realize that many of the concepts of project management will help them in their everyday lives as they work with people and technology on a day-to-day basis.

1.1 Importance of IS project Management

Software Projects have failure record because of following reasons:

- ✓ Most of IT and software projects failed or delayed costing billions of $
- ✓ Many bugs/1000 lines of codes
- ✓ Delivering the system over budget
- ✓ Scope creeping (failure to fulfill all the tasks)
- ✓ Less quality system
- ✓ Higher cost of project than the planned one

Reasons for the failure:

- ✓ Lack of structured and organized methodologies
- ✓ Lack of good Project Management

As the result the need for IS projects keeps increasing

Using Formal Project Management has the following importance

- ✓ Better control of financial, physical, and human resources

- ✓ Improved customer relations
- ✓ Shorter development times
- ✓ Lower costs and improved productivity
- ✓ Higher quality and increased reliability
- ✓ Higher profit margins
- ✓ Better internal coordination
- ✓ Higher worker morale (the amount of confidence and enthusiasm)

1.1.1 What is a project?

A project is a temporary endeavor undertaken to create a unique product, service, or result.

A project can create:

- ✓ A product that can either a component of another item or an end item in itself
- ✓ A capability to perform a service (a business function that supports the production or distribution)
- ✓ A result such as an outcome or document

Attributes of Project

Temporary

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 it becomes clear that the project objectives will not or cannot be met, or the need for the project no longer exists and the project is terminated. Temporary does not necessarily mean short in duration; many projects last for several years. In every case, however, the duration of a project is finite. Projects are not ongoing efforts.

In addition, temporary does not generally apply to the product, service or result created by the project. Most projects are undertaken to create a lasting outcome. For example, a project to erect a national monument will create a result expected to last centuries. Projects also may often have intended and unintended social, economic and environmental impacts that far outlast the projects themselves.

The temporary nature of projects may apply to other aspects of the endeavor as well:

- ✓ The opportunity or market window is usually temporary—some projects have a limited time frame in which to produce their product or service.

- ✓ The project team, as a working unit, seldom outlives the project—a team created for the sole purpose of performing the project will perform that project, and then the team is disbanded and the team members reassigned when the project ends.

Unique Products, Services, or Results

A project creates unique deliverables, which are products, services, or results. Projects can create:

- ✓ A product or artifact that is produced, is quantifiable, and can be either an end item in itself or a component item
- ✓ A capability to perform a service, such as business functions supporting production or distribution
- ✓ A result, such as outcomes or documents. For example, a research project develops knowledge that can be used to determine whether or not a trend is present or a new process will benefit society.

Uniqueness is an important characteristic of project deliverables. For example, many thousands of office buildings have been developed, but each individual facility is unique—different owner, different design, different location, different contractors, and so on. The presence of repetitive elements does not change the fundamental uniqueness of the project work.

Progressive Elaboration

Progressive elaboration is a characteristic of projects that accompanies the concepts of temporary and unique. Progressive elaboration means developing in steps, and continuing by increments. For example, the project scope will be broadly described early in the project and made more explicit and detailed as the project team develops a better and more complete understanding of the objectives and deliverables. Progressive elaboration should not be confused with scope creep.

Progressive elaboration of a project's specifications needs to be carefully coordinated with proper project scope definition, particularly if the project is performed under contract. When properly defined, the scope of the project—the work to be done—should be controlled as the project and product specifications are progressively elaborated. The relationship between product scope and project scope is discussed further in the Chapter 5 introductory material.

For example:

- ✓ Development of a chemical processing plant begins with process engineering to define the characteristics of the process. These characteristics are used to design the major processing units. This information becomes the basis for engineering design, which defines both the detailed plant layout and the mechanical characteristics of the process units and ancillary facilities. All of this results in design drawings that are elaborated to produce fabrication and construction drawings. During construction, interpretations and adaptations are made as needed and are subject to proper approval. This further elaboration of the deliverables is captured in as-built drawings, and final operating adjustments are made during testing and turnover.

A project requires resources, often from various areas: Resources include people, hardware, software, and other assets. For the IT collaboration project, people from IT, marketing, sales, distribution, and other areas of the company would need to work together to develop ideas

A Project should have a primary sponsor or customer: The project sponsor usually provides the direction and funding for the project. The project sponsor usually provides the direction and funding for the project. Once further IT projects are selected, however, the sponsors for those projects would be senior managers in charge of the main parts of the company affected by the projects.

A Project involve uncertainty: Because every project is unique, it is sometimes difficult to define its objectives clearly, estimate how long it will take to complete, or determine how much it will cost. External factors also cause uncertainty, such as a supplier going out of business or a project team member needing unplanned time off.

Projects vs. Operational Work

Organizations perform work to achieve a set of objectives. Generally, work can be categorized as either projects or operations, although the two sometimes overlap. They share many of the following characteristics:

- ✓ Performed by people
- ✓ Constrained by limited resources
- ✓ Planned, executed, and controlled.

- ✓ Projects and operations differ primarily in that operations are ongoing and repetitive, while projects are temporary and unique.

The objectives of projects and operations are fundamentally different. The purpose of a project is to attain its objective and then terminate. Conversely, the objective of an ongoing operation is to sustain the business. Projects are different because the project concludes when its specific objectives have been attained, while operations adopt a new set of objectives and the work continues.

Examples of projects include, but are not limited to:

- ✓ Developing a new product or service
- ✓ Effecting a change in structure, staffing, or style of an organization
- ✓ Designing a new transportation vehicle
- ✓ Developing or acquiring a new or modified information system
- ✓ Constructing a building or facility
- ✓ Building a water system for a community
- ✓ Running a campaign for political office
- ✓ Implementing a new business procedure or process
- ✓ Responding to a contract solicitation.
- ✓ A college campus upgrades its technology infrastructure to provide wireless Internet access across the whole campus
- ✓ A cross-functional taskforce in a company decides what Voice-over-Internet-Protocol (VoIP) system to purchase and how it will be implemented
- ✓ An ERP system in Multinational company
- ✓ A company develops a new system to increase sales force productivity and customer relationship management

1.1.2 Problems with Software Projects

Every project is constrained in different ways, often by its scope, time, and cost goals. These limitations are sometimes referred to in project management as the ***triple constraint***. To create a successful project, a project manager must consider scope, time, and cost and balance these three often-competing goals:

Scope:

- ✓ What is the project trying to accomplish?
- ✓ What work will be done as part of the project?
- ✓ What unique product, service, or result does the customer or sponsor expect from the project? How will the scope be verified?

Time:

- ✓ How long should it take to complete the project? What is the project's schedule? How will the team track actual schedule performance? Who can approve changes to the schedule?

Cost:

- ✓ What should it cost to complete the project? What is the project's budget? How will costs be tracked? Who can authorize changes to the budget?

It is the project manager's duty to balance these three often competing triple constraints goals

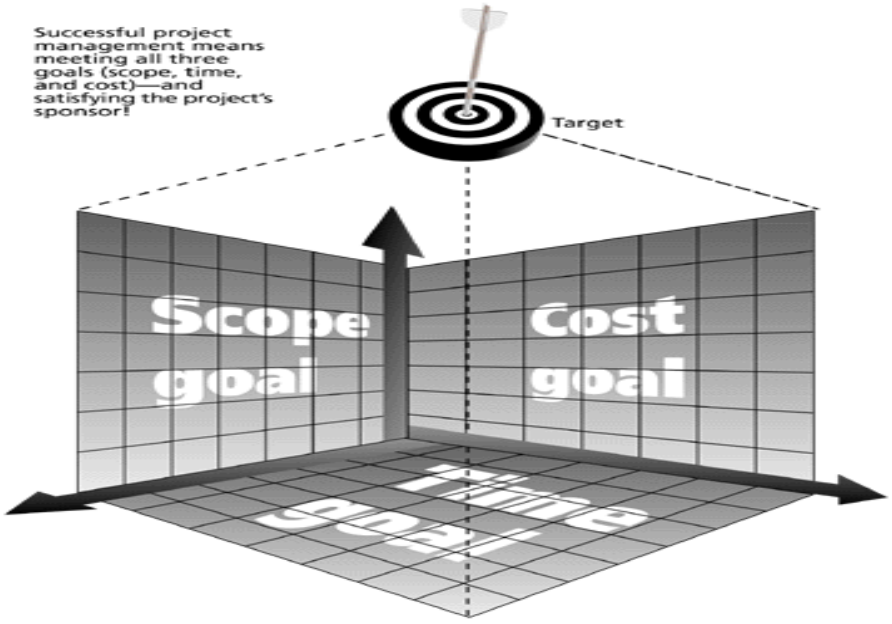


Figure 1.1 Triple constraint of project

Projects and Strategic Planning

- ✓ Projects are a means of organizing activities that cannot be addressed within the organization's normal operational limits. Projects are, therefore, often utilized as a means of achieving an organization's strategic plan, whether the project team is employed by the organization or is a contracted service provider.
- ✓ Projects are typically authorized as a result of one or more of the following strategic considerations:
- ✓ A market demand (e.g., an oil company authorizes a project to build a new refinery in response to chronic gasoline shortages)
- ✓ An organizational need (e.g., a training company authorizes a project to create a new course in order to increase its revenues)
- ✓ A customer request (e.g., an electric utility authorizes a project to build a new substation to serve a new industrial park)

- ✓ A technological advance (e.g., a software firm authorizes a new project to develop a new generation of video games after the introduction of new gameplaying equipment by electronics firms)
- ✓ A legal requirement (e.g., a paint manufacturer authorizes a project to establish guidelines for the handling of a new toxic material).

1.1.3 What is Project Management?

Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. Project management is accomplished through the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling, and closing. The project manager is the person responsible for accomplishing the project objectives. Managing a project includes:

- ✓ Identifying requirements
- ✓ Establishing clear and achievable objectives
- ✓ Balancing the competing demands for quality, scope, time and cost
- ✓ Adapting the specifications, plans, and approach to the different concerns and expectations of the various stakeholders.

Project managers often talk of a "triple constraint"—project scope, time and cost—in managing competing project requirements. Project quality is affected by balancing these three factors. High quality projects deliver the required product, service or result within scope, on time, and within budget. The relationship among these factors is such that if any one of the three factors changes, at least one other factor is likely to be affected. Project managers also manage projects in response to uncertainty. Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective.

The project management team has a professional responsibility to its stakeholders including customers, the performing organization, and the public.

It is important to note that many of the processes within project management are iterative because of the existence of, and necessity for, progressive elaboration in a project throughout the project's life cycle. That is, as a project management team learns more about a project, the team can then manage to a greater level of detail.

The term “project management” is sometimes used to describe an organizational or managerial approach to the management of projects and some ongoing operations, which can be redefined as projects, that is also referred to as “management by projects.” An organization that adopts this approach defines its activities as projects.

1.2. Stages of Project

Most experienced project management practitioners recognize there is more than one way to manage a project. The specifics for a project are defined as objectives that must be accomplished based on complexity, risk, size, time frame, project team’s experience, access to resources, amount of historical information, the organization’s project management maturity, and industry and application area. The required Process Groups and their constituent processes are guides to apply appropriate project management knowledge and skills during the project. In addition, the application of the project management processes to a project is iterative and many processes are repeated and revised during the project.

Project phases are divisions within a project where extra control is needed to effectively manage the competition of a major deliverable. The phase structure allows the project to be segmented into logical subsets for ease of management, planning and control. The number of phases , the need for phases, and the degree of control applied depends on the size, complexity and potential impact of the project.

The project management process groups include

- ✓ **I**nitiating processes
- ✓ **P**lanning processes
- ✓ **E**xecuting processes
- ✓ **C**ontrolling processes

- ✓ **C**losing processes

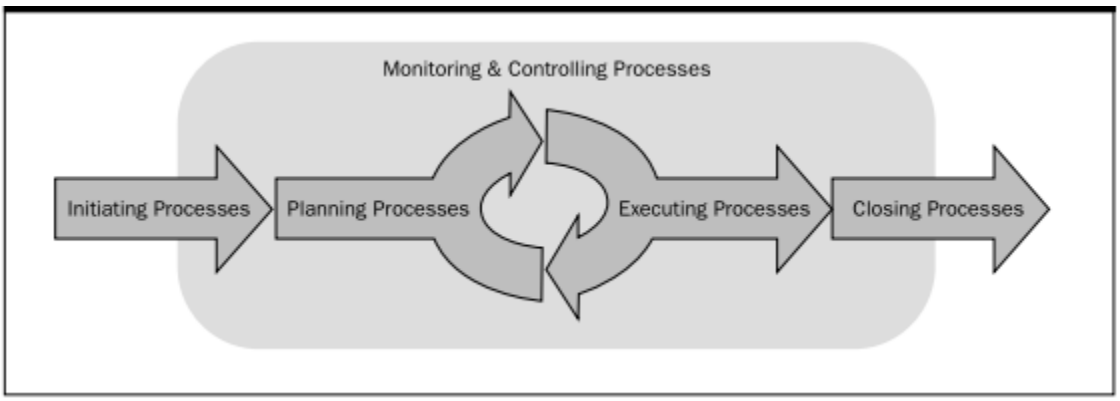


Figure 1.2 phases of project

1.2.1. The Feasibility Study

The Cost-benefit Analysis

1.2.2. Planning

The planning tasks include the definition of project scope, deliverables and constraints (what will be done), the selection of management and technical methods that will be used (how it will be done), the definition and organization of the project team (who will do it), the estimation of effort and resources required (how much it will cost), and the determination of project milestones and schedules (when it will be done).

This project planning foundation has to be laid to ensure the success of the project execution. The planning information will be documented in the key deliverable of this phase i.e. the Project Charter. The Project Charter is reviewed and approved by the designated participants before the project team is formed and the project is initiated. After approval of the Project Charter, the project team is formed and the project is initiated.

1.2.3. Project Execution

This phase is primarily focused on carrying out the project plans documented in the Project Charter. All of the work required to define, design, construct, test and deploy the product is done during this project management lifecycle (PMLC) phase. Successful project execution will require the use of the management and control methods identified in this phase.

1.2.4 Project and Product Life Cycles

The scope of project management is not the technical work which prepares the information technology-based products. Rather, the domain of project management is the management of all the factors which surround and enable the technical development work to be accomplished. These factors include

- ✓ project resources,
- ✓ time,
- ✓ cost,
- ✓ schedule and quality.

Project success is often defined as meeting the project cost, schedule and quality constraints.

The scope of the Product Development Life Cycle (PDLC) is all of the project technical functions that have to be performed to produce, maintain and support the expected product deliverables.

These functions include

- ✓ business analysis,
- ✓ functional and technical requirements definition,
- ✓ system design,
- ✓ construction,
- ✓ rollout/release and maintenance.

During the formation and execution of a project, the activities in the PMLC and product development life cycle (PDLC) are integrated, i.e., all technical activities are planned (using the PDLC as a source of technical activities to be performed) and executed using the planning, execution and control methods defined in the PMLC.

1.3. The Stakeholder of a Project

Stakeholders are the people involved in or affected by project activities, and include the project sponsor, project team, support staff, customers, users, suppliers, and even opponents of the project.

These stakeholders often have very different needs and expectations. Stakeholders' needs and expectations are important in the beginning and throughout the life of a project.

Successful project managers develop good relationships with project stakeholders to understand and meet their needs and expectations.

1.3.1 The Role of Project Manager

The project manager is the person assigned by the performing organization to achieve the project objectives. The role of the project manager is distinct from functional manager or operation manager. Typically, the functional manager is focused on provide\ng management oversight for administrative areas and operation manager is responsible for a facet of the core business.

Depending the organizational structure, a project manager may report to the functional manager. In other cases, a project manager may be one of several project managers who report to a portfolio or program manager that is ultimately responsible for enterprise wide projects.

Many of the tools and techniques for managing projects are specific to project management. However, understanding and applying the knowledge, tools and techniques that are recognized as good practice is not sufficient for effective project management.in addition to any specific skills and general management proficiencies required for the project, effective project management requires that the project manager possess the following characteristics:

Knowledge: this refers to what the project manager knows about the project.

Performance: this refers to what the project manager is able to do or accomplish while applying their project management knowledge.

Personal: this refers to how the project manager behaves when performing the project or related activities. Personal effectiveness encompasses attitudes, core personality characteristics and leadership that is the ability to guide the project team while achieving project objectives and balancing the project constraints.

Job descriptions of project managers vary as per the organization, but most include responsibilities like **planning, scheduling, coordinating, and working with people** to achieve project goals. Remember that 97% of successful projects were led by experienced project managers, who can often help influence success factors.

- ✓ Project managers should also possess general management knowledge and skills.
- ✓ Much of the knowledge needed to manage projects is unique to PM

- ✓ However, project managers must also have knowledge and experience in
    - general management
    - the application area of the project

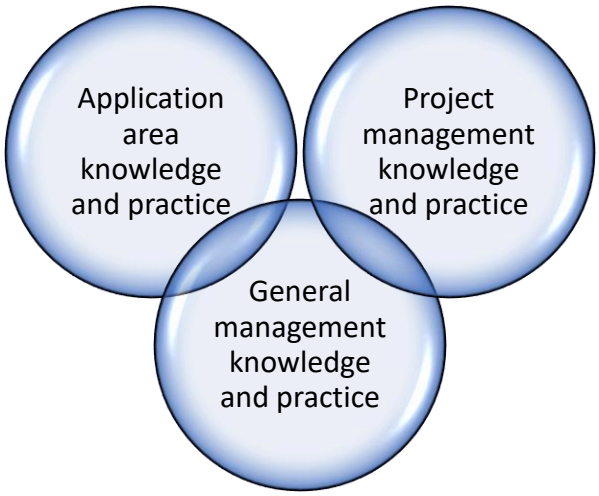


Figure 1.3 PM and other disciplines

1.4. Project Management Framework

The Project Management Framework, provides a basic structure for understanding project management.

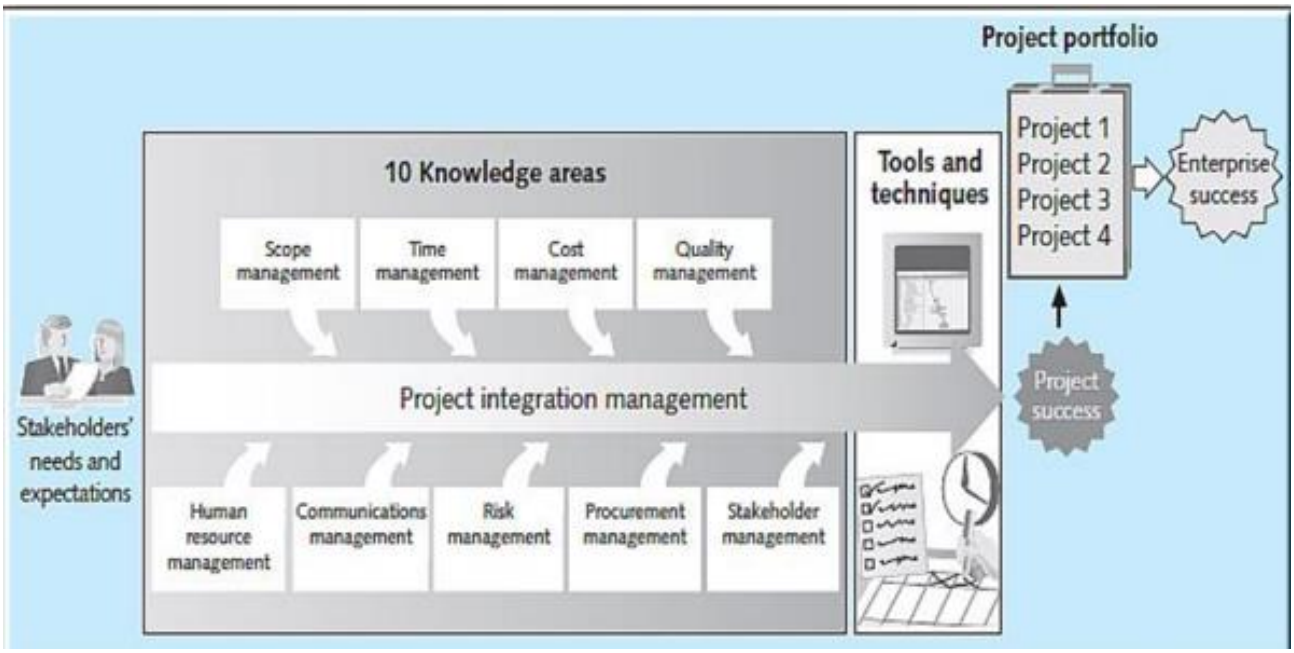


Figure 1.4 Project management Framework

1. ***Project scope management*** involves defining and managing all the work required to complete the project successfully. It describes the processes involved in ascertaining that the project includes all the work required, and only the work required, to complete the project successfully. It consists of the Scope Planning, Scope Definition, Create WBS, Scope Verification, and Scope Control project management processes
2. *Project* ***time management*** includes estimating how long it will take to complete the work, developing an acceptable project schedule, and ensuring timely completion of the project. It describes the processes concerning the timely completion of the project. It consists of the Activity Definition, Activity Sequencing, Activity Resource Estimating, Activity Duration Estimating, Schedule Development, and Schedule Control project management processes.
3. *Project* ***cost management*** consists of preparing and managing the budget for the project. It describes the processes involved in planning, estimating, budgeting, and controlling costs

so that the project is completed within the approved budget. It consists of the Cost Estimating, Cost Budgeting, and Cost Control project management processes.

4. *Project **quality management*** ensures that the project will satisfy the stated or implied needs for which it was undertaken. It describes the processes involved in assuring that the project will satisfy the objectives for which it was undertaken. It consists of the Quality Planning, Perform Quality Assurance, and Perform Quality Control project management processes.

5. *Project **human resource management*** is concerned with making effective use of the people involved with the project. It describes the processes that organize and manage the project team. It consists of the Human Resource Planning, Acquire Project Team, Develop Project Team, and Manage Project Team project management processes.

6. *Project **communications management*** involves generating, collecting, disseminating, and storing project information. It describes the processes concerning the timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information. It consists of the Communications Planning, Information Distribution, Performance Reporting, and Manage Stakeholders project management processes.

7. *Project risk management* includes identifying, analyzing, and responding to risks related to the project. It describes the processes concerned with conducting risk management on a project. It consists of the Risk Management Planning, Risk Identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk Response Planning, and Risk Monitoring and Control project management processes.

8. *Project **procurement management*** involves acquiring or procuring goods and services for a project from outside the performing organization. It describes the processes that purchase or acquire products, services or results, as well as contract management processes. It consists of the Plan Purchases and Acquisitions, Plan Contracting, Request Seller Responses, Select Sellers, Contract Administration, and Contract Closure project management processes.

9. *Project **stakeholder management*** includes identifying and analyzing stakeholder needs while managing and controlling their engagement throughout the life of the project.

10. *Project* ***integration management*** is an overarching function that affects and is affected by all of the other knowledge areas. It describes the processes and activities that integrate the various elements of project management, which are identified, defined, combined, unified and coordinated within the Project Management Process Groups. It consists of the Develop Project Charter, Develop Preliminary Project Scope Statement, Develop Project Management Plan, Direct and Manage Project Execution, Monitor and Control Project Work, Integrated Change Control, and Close Project management processes.

Project managers must have knowledge and skills in all ten of these areas.

1.5. IS Tools for Project Management

As the world continues to become more complex, it is even more important for people to develop and use tools, especially for managing important projects. Project management tools and techniques assist project managers and their teams in various aspects of project management. Some specific ones include

- ✓ Project Charter and WBS (scope)
- ✓ Gantt charts, network diagrams, critical path analysis, critical chain scheduling (time)
- ✓ Cost estimates and earned value management (cost)

Chapter review questions

discussion Questions

1. Why is there a new or renewed interest in the field of project management?
2. What is a project, and what are its main attributes? How is a project different from what most people do in their day-to-day jobs? What is the triple constraint? What other factors affect a project?
3. What is project management? Briefly describe the project management framework, providing examples of stakeholders, knowledge areas, tools and techniques, and project success factors?
4. What is the role of the project manager? What are suggested skills for all project managers and for IT project managers? Why is leadership so important for project managers? How is the job market for IT project managers?
5. Discuss ethical decisions that project managers often face. Do you think a professional code of ethics makes it easier to work in an ethical manner?
6. Discuss about the project management information system tools?
7. Discuss the differences b/n project Lifecyle and product lifecycle?

2.Project Planning

learning objective:

At the end of the chapter students will able to:

- ✓ know how project integration management affect and is affected by other knowledge areas.
- ✓ understand how project integration management coordinates all aspects of the project.
- ✓ Understand the essence of PI management for successful execution of the project.
- ✓ Describe the project plan development and performing stakeholder analysis to help manage r/ships.
- ✓ Explain project plan execution, its r/ship to project planning, the factors related to successful results, and tools and techniques to assist in project plan execution.

2.1. Integration Management

Many new project managers have trouble looking at the "big picture" and want to focus on too many details. Project integration management is not the same thing as software integration.

In project management context, integration includes characteristics of unification, consolidation, articulation, and integrative action that are crucial to project completion, successfully managing stakeholder expectations and meeting requirements. Project integration management entails making choices about resource allocation, making trade-offs among competing objectives and alternatives and managing the resource interdependencies among the project management knowledge areas.

2.1.1 What is Integration Management

Project integration management involves coordinating all of the other project management knowledge areas throughout a project's life cycle. This integration ensures that all the elements of a project come together at the right times to complete a project successfully.

Project management integration includes process and activities to identify, define, combine, unify and coordinate the various processes and project management activities within the project management process groups.

Project Integration Management Processes

- ✓ **Develop the project charter**: :/project brief/ project initiation document: Project definition document that describes the project essential information like project name, location, project objective, project vision and project stakeholders etc.

working with stakeholders to create the document that formally authorizes a project—the charter. A project can't begin without a project charter. It is an official document that authorize the project formally. By developing project charter, you will be able to establish a direct link b/n the organization objective and the undertaken project.

The inputs for project charter development are business documents, agreements, enterprise environmental factors and organizational process assets.

Develop the project management plan: coordinating all planning efforts to create a consistent, coherent document—the project management plan. It creates a guideline for project management system.

The input for PMP are project charter, output from other process, enterprise environmental factors & organization process assets.

- ✓ **Direct and manage project execution**: carrying out the project management plan by performing the activities included in it. It is managing of the execution of the project work.

Managing the project work involves managing deliverables, directing the project team, managing procurement activities.

The outputs of this process are deliverables, work performance information, change requests, project management plan updates, and project documents updates.

- ✓ **Manage project knowledge**: involves using the knowledge of the team and creating additional knowledge to complete the project successfully. Transferring the gained knowledge to the organization is very important for future projects.

Output is lessons learned, PMP updates, organization process asset updates.

- ✓ **Monitor and control the project work**: overseeing project work to meet the performance objectives of the project. Involves work performance reporting and comparing the actual and

planned values to ensure that the project is on track. It all about controlling the scope, quality, schedule and stakeholder engagement to the project.

The outputs of this process are change requests, project management plan updates, and project documents updates.

- ✓ **Perform integrated change control**: coordinating changes that affect the project's deliverables and organizational process assets. It insure that any change requests evaluate and either accepted or rejected according to projects agreed up on goals and the organizations objective.

The outputs of this process include change request status updates, project management plan updates, and project documents updates.

- ✓ **Close the project or phase**: finalizing all project activities to formally close the project or phase. Conduct a post project review to document the successes and failures of the project and talk about how you can make integration better next time.

Outputs of this process include final product, service, or result transition and organizational process assets updates.

Figure 2.1 project integration management processes

Good project integration management is critical for providing stakeholder satisfaction. Project integration management includes interface management, which involves identifying and managing the points of interaction between various elements of a project. The number of interfaces can increase exponentially as the number of people involved in a project increase. Thus, one of the most important jobs of a project manager is to establish and maintain good communication and relationships across organizational interfaces.

2.1.2. Project Plan Development

Developing the project management plan involves coordinating all planning efforts to create a consistent, coherent document the project management plan.

To coordinate and integrate information across project management knowledge areas and across the organization, there must be a good project management plan. A project management plan is a document used to coordinate all project planning documents and help guide a project's execution and control. Plans created in the other knowledge areas are considered subsidiary parts of the overall project management plan.

Project management plans also document project planning assumptions and decisions regarding choices, facilitate communication among stakeholders, define the content, extent, and timing of key management reviews, and provide a baseline for progress measurement and project control. Project management plans should be dynamic, flexible, and subject to change when the environment or project changes. These plans should greatly assist the project manager in leading the project team and assessing project status.

To create and assemble a good project management plan, the project manager must practice the art of project integration management, because information is required from all of the project management knowledge areas. Working with the project team and other stakeholders to create a project management plan will help the project manager guide the project's execution and understand the overall project.

The main inputs for developing a project management plan include the project charter, outputs from planning processes, enterprise environment factors, and organizational process assets.

The main tool and technique is expert judgment, and the output is a project management plan.

Attributes of Project Plans

Just as projects are unique, so are project plans

- ✓ Plans should be dynamic
- ✓ Plans should be flexible
- ✓ Plans should be updated as changes occur
- ✓ Plans should first and foremost guide project execution

Common Elements of Project Management Plan

- ✓ Introduction or overview of the project
    - o History of the Business
    - o Description of the Business's current facilities
    - o The descriptions of the problems that triggered the project
- ✓ Description of how the project is organized
- ✓ Management and technical processes used on the project
- ✓ Work to be done, Schedule, and Budget Information

2.1.3. Plan Execution

The project manager would also need to focus on leading the project team and managing stakeholder relationships to execute the project management plan successfully.

Project plan execution involves managing and performing the work described in the project plan

The majority of time and money is usually spent on execution. The application area or the project directly affects project execution because the products of the project are produced during execution.

In project integration management, project planning and execution are intertwined and inseparable activities. The main function of creating a project management plan is to guide project execution.

A good plan should help produce good products or work results, and should document what constitutes good work results. Updates to plans should reflect knowledge gained from completing work earlier in the project. Anyone who has tried to write a computer program from poor specifications appreciates the importance of a good plan. Anyone who has had to document a poorly programmed system appreciates the importance of good execution.

A common-sense approach to improving the coordination between project plan development and execution is to follow this simple rule: Those who will do the work should plan the work. All project personnel need to develop both planning and executing skills, and they need experience in these areas. In IT projects, programmers who have to write detailed specifications and then create the code from them become better at writing specifications. Likewise, most systems analysts begin their careers as programmers, so they understand what type of analysis and documentation they need to write good code.

Important Skills for Project Execution

- ✓ General management skills like leadership, communication, and political skills
- ✓ Product skills and knowledge
- ✓ Use of specialized tools and techniques

Tools and Techniques for Project Execution

- ✓ Work Authorization System: a method for ensuring that qualified people do work at the right time and in the proper sequence
- ✓ Status Review Meetings: regularly scheduled meetings used to exchange project information
- ✓ Project Management Software: special software to assist in managing projects

2.2 Scope Management

One of the most important and most difficult aspects of project management is defining the scope of a project.

Scope refers to all the work involved in creating the products of the project and the processes used to create them. Project scope management includes the processes of required to ensure that the project includes all the work required and only the work required to complete the project successfully. Managing the project scope is primarily concerned with defining and controlling what is and what is not included in the project.

2.2.1 What is Scope Management?

Scope management is the process in which we identify, define, and control output, outcome and benefit of the project. Project scope management includes the processes involved in defining and controlling what is or is not included in a project.

It is a process that helps in determining and documenting the list of all project goals, tasks, deliverables, deadlines, and budgets as a part of the planning process. It is the process in which we can identify, define and control output and benefits of project.

Project scope management includes the processes required to ensure that the project includes all the work required and only the work required to complete the project successfully.

In the project context, the term scope can refer to;

Product scope: the features and functions that characterize a product, service or result.

Project scope: the work performed to deliver the product, service or result with the specified feature and functions.

Scope management facilitates productive communication with stakeholders and the team and serves as a tool to manage client's expectations, workload balancing and team role.

It used to manage scope properly that avoid scope creep and poor scope verification. Effective project scope management gives a clear idea about time, labor, and cost involved in the project.

Project Scope Management Processes

A) Plan scope management: a process of creating scope management plan that documents how the project and the product scope will be defined, validated and controlled.

The first step in project scope management is planning how the scope will be managed throughout the life of the project. It provides a guidance and direction on how scope will be managed throughout the project. This process is performed once a predefined point in the project.

The inputs including project charter, PMP, other plans like quality management plan, organizational process assets, environmental factors.

Tools and techniques used are expert judgement, meetings and data analysis. Output of this process is scope management plan and requirement management plan

B) Collecting requirements: defining and documenting the features and functions of the products produced during the project as well as the processes used for creating them.

A requirement is "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 formal document" (PMBOK® Guide, 2008). For some IT projects, it is helpful to divide requirements development into categories called elicitation, analysis, specification, and validation. It is important to use an iterative approach to defining requirements since they are often unclear early in a project.

Collect requirement is the process of determining, documenting and managing stakeholder needs and requirements to meet the objectives. It provides the basis of defining the project and product scope. Inputs for collecting requirement includes project charter, PMP, project document, business document, agreement, enterprise environmental factors and organizational process assets.

Tools and techniques including expert judgement, data gathering, data analysis, decision making, interpersonal and team skills, data representations, context diagrams and prototypes.

Output of this phase is requirements document and requirements traceability matrix.

Methods for Collecting Requirements

- ✓ Interviewing
- ✓ Focus groups and facilitated workshops
- ✓ Using group creativity and decision-making techniques
- ✓ Questionnaires and surveys
- ✓ Observation
- ✓ Prototyping
- ✓ Software tools

Defining scope: The next step in project scope management is to provide a detailed definition of the work required for the project. Reviewing the project charter, requirements documents, and organizational process assets to create a scope statement. Developing a detailed description of the product and project.

Key inputs for preparing the project scope statement include the project charter, requirements documentation, and organizational process assets such as policies and procedures related to scope statements as well as project files and lessons learned from previous, similar projects. As time progresses, the scope of a project should become clearer and more specific.

Tools and techniques used are expert judgement, decision making, data analysis, interpersonal and team skills and product analysis.

The main outputs of scope definition are the project scope statement and project documents updates.

Project Scope Statement (PSS)

PSS is also called scope document or statement of work (SOW).

PSS is output of defining scope process that specifies what work will be done and what work is excluded. It is a primary tool for stakeholders and teammates to refer back to and use as a guideline to accurately measure project success.

Good scope definition is very important to project success because it helps improve the accuracy of time, cost, and resource estimates, it defines a baseline for performance measurement and project control, and it aids in communicating clear work responsibilities.

The main tools and techniques used in defining scope include

- ✓ Expert judgment,
- ✓ Product analysis,
- ✓ Alternatives generation, and
- ✓ Facilitated workshops.

C) Creating the WBS: subdividing the major project deliverables into smaller, more manageable components.

After collecting requirements and defining scope, the next step in project scope management is to create a work breakdown structure. A work breakdown structure (WBS) is a deliverable oriented grouping of the work involved in a project that defines its total scope. Because most projects involve many people and many different deliverables, it is important to organize and divide the work into logical parts based on how the work will be performed.

The process of subdividing major project deliverables and project work into smaller, more manageable components. It provides what has to be delivered. WBS is a foundation document that provides the basis for planning and managing project schedules, costs, resources, and changes.

The WBS is a foundation document in project management because it provides the basis for planning and managing project schedules, costs, resources, and changes. Because the WBS defines the total scope of the project, some project management experts believe that work should not be done on a project if it is not included in the WBS. Therefore, it is crucial to develop a good WBS.

The project scope management plan, scope statement, requirements documentation, enterprise environmental factors, and organizational process assets are the primary inputs for creating a WBS.

The main tool or technique is decomposition that is, subdividing project deliverables into smaller pieces. The outputs of the process of creating the WBS are the scope baseline and project documents updates. The scope baseline includes the approved project scope statement and its associated WBS and WBS dictionary.

D) Validating scope/Verifying scope): formalizing acceptance of the project deliverables. It is very difficult to create a good scope statement and WBS for a project. It is even more difficult to verify project scope and minimize scope changes. Scope verification involves formal acceptance of the completed project scope by the stakeholders. Acceptance is often achieved by a customer inspection and then sign-off on key deliverables. This process is performed periodically throughout the project as needed.

The scope management plan, scope baseline, requirements documentation, requirements traceability matrix, validated deliverables, and work performance data are the main inputs for scope validation. The main tools for performing scope validation are inspection and group decision making techniques. The customer, sponsor, or user inspects the work after it is delivered and decides if it meets requirements.

The main outputs of scope validation are accepted deliverables, change requests, work performance information, and project documents updates.

E) Controlling scope: controlling changes to project scope throughout the life of the project

Scope control involves managing changes to the project scope while keeping project goals and business strategy in mind. Users often are not sure how they want screens to look or what functionality they will need to improve business performance. Developers are not exactly sure how to interpret user requirements, and they also have to deal with constantly changing technologies.

The goal of scope control is to influence the factors that cause scope changes, to ensure that changes are processed according to procedures developed as part of integrated change control, and to manage changes when they occur. The project management plan, requirements documentation,

requirements traceability matrix, work performance data, and organizational process assets are the main inputs to scope control.

An important tool for performing scope control is variance analysis. Variance is the difference between planned and actual performance.

For example, if a supplier was supposed to deliver five special keyboards and you received only four, the variance would be one keyboard.

The outputs of scope control include work performance information, change requests, project management plan updates, project documents updates, and organizational process assets updates.

2.2.2 Methods for Selecting Projects

Project integration management must occur within the context of the entire organization, not just within a particular project. The project manager must integrate the work of the project with the ongoing operations of the organization. The strategic plan of the organization is the base for project selection.

Strategic planning involves determining long-term objectives, predicting future trends, and projecting the need for new products and services

- ✓ Organizations often perform a **SWOT analysis**
    - Analyzing **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats
- ✓ As part of strategic planning, organizations:
    - Identify potential projects
    - Use realistic methods to select which projects to work on
    - Formalize project initiation by issuing a project charter

Strategic planning involves determining long-term objectives, predicting future trends, and projecting the need for new products and services

Organizations often perform a SWOT analysis

Analyzing Strengths, Weaknesses, Opportunities, and Threats

As part of strategic planning, organizations:

- ✓ Identify potential projects
- ✓ Use realistic methods to select which projects to work on
- ✓ Formalize project initiation by issuing a project charter

The outputs of this process are change requests, project management plan updates, and project documents updates. However, organizations need to narrow down the list of potential projects to the ones that will be of most benefit. There are usually more projects than available time and resources to implement them.

Methods for selecting projects include:

- o Focusing on broad organizational needs
- o Categorizing information technology projects
- o Performing net present value or other financial analyses
- o Using a weighted scoring model
- o Implementing a balanced scorecard

A) Focusing on Broad Organizational Needs

It is often difficult to provide strong justification for many IT projects, but everyone agrees they have a high value**.** "It is better to measure gold roughly than to count pennies precisely"**.** For example, estimating the financial value of such projects is often impossible, but everyone agrees that they have a high value. **Three** important criteria for projects:

- o There is a **need** for the project
- o There are **funds** available
- o There's a strong **will** to make the project succeed

B) Categorizing Projects

One categorization is whether the project addresses:

1. **A problem**: Problems are undesirable situations that prevent an organization from achieving its goals. These problems can be current or anticipated.

2. **An opportunity**, that are chances to improve the organization or

3. **directive**: new requirements imposed by management, government, or some external influence.

Strong requests or orders typically issued by a decision-maker in a business or organization.

4. Another categorization is how long it will take to do and when it is needed (time window)

5. Another is the overall priority of the project

C) Financial Analysis of Projects

Financial considerations are often an important consideration in selecting projects. Three primary methods for determining the projected financial value of projects:

- ✓ Net present value (NPV) analysis
- ✓ Return on investment (ROI)
- ✓ Payback analysis

2.2.3 Project Charter

After deciding what project to work on, it is important to let the rest of the organization know.

A project charter is a document that formally recognizes the existence of a project and provides direction on the project's objectives and management.

Key project stakeholders should sign a project charter to acknowledge agreement on the need and intent of the project; a signed charter is a key output of project integration management.

The following inputs are helpful in developing a project charter:

1. A project statement of work: A statement of work is a document that describes the products or services to be created by the project team. It usually includes a description of the business need for the project, a summary of the requirements and characteristics of the products or services, and organizational information, such as appropriate parts of the strategic plan, showing the alignment of the project with strategic goals.

2. **A business case:** Many projects require a business case to justify their investment. Information in the business case, such as the project objective, high-level requirements, and time and cost goals, is included in the project charter.

3. Agreements: If you are working on a project under contract for an external customer, the contract or agreement should include much of the information needed for creating a good project charter. Some people might use a contractor agreement in place of a charter; however, many

contracts are difficult to read and can often change, so it is still a good idea to create a project charter.

4. Enterprise environmental factors: These factors include relevant government or industry standards, the organization's infrastructure, and marketplace conditions. Managers should review these factors when developing a project charter.

5. Organizational process assets: Organizational process assets include formal and informal plans, policies, procedures, guidelines, information systems, financial systems, management systems, lessons learned, and historical information that can influence a project's success.

The main tools and techniques for developing a project charter are expert judgment and facilitation techniques, such as brainstorming and meeting management. Experts from inside and outside the organization should be consulted when creating a project charter to make sure it is useful and realistic.

The output of the project charter development is project charter and assumptions log (i.e., assumptions made considerations made in developing the project charter.)

Project Charter Format:

Although the format of project charters can vary tremendously, they should include at least the following basic information:

1. The project's title and date of authorization

2. A summary schedule, including the planned start and finish dates; if a summary milestone schedule is available, it should also be included or referenced

3. A summary of the project's budget or reference to budgetary documents

4. The project manager's name and contact information

5. A brief description of the project objectives, including the business need or other justification for authorizing the project

6. Project success criteria, including project approval requirements and who signs off on the project

7. A summary of the planned approach for managing the project, which should describe stakeholder needs and expectations, important assumptions, and constraints, and should refer to related documents, such as a communications management plan, as available

8. A roles and responsibilities matrix

9. A sign-off section for signatures of key project stakeholders

10. A comments section in which stakeholders can provide important comments related to the project.

2.2.4 Scope Statement

The project scope statement describes, in detail, the project's deliverables and the work required to create those deliverables. The project scope statement also provides a common understanding of the project scope among all project stakeholders and describes the project's major objectives. It also enables the project team to perform more detailed planning, guides the project team's work during execution, and provides the baseline for evaluating whether requests for changes or additional work are contained within or outside the project's boundaries. The degree and level of detail to which the project scope statement defines what work will be performed and what work is excluded can determine how well the project management team can control the overall project scope. Managing the project scope, in turn, can determine how well the project management team can plan, manage, and control the execution of the project. The detailed project scopes statement includes, either directly or by reference to other documents:

The project scope statement is the definition of the project—what needs to be accomplished. The Develop Preliminary Project Scope Statement process addresses and documents the characteristics and boundaries of the project and its associated products and services, as well as the methods of acceptance and scope control. A project scope statement includes:

- ✓ Project and product objectives
- ✓ Product or service requirements and characteristics
- ✓ Product acceptance criteria
- ✓ Project boundaries
- ✓ Project requirements and deliverables

- ✓ Project constraints
- ✓ Project assumptions
- ✓ Initial project organization
- ✓ Initial defined risks
- ✓ Schedule milestones
- ✓ Initial WBS
- ✓ Order of magnitude cost estimate
- ✓ Project configuration management requirement
- ✓ Approval requirements.

The preliminary project scope statement is developed from information provided by the initiator or sponsor. The project management team in the Scope Definition process further refines the preliminary project scope statement into the project scope statement. The project scope statement content will vary depending upon the application area and complexity of the project and can include some or all of the components identified above. During subsequent phases of multi-phase projects, the development of Preliminary Project Scope Statement process validates and refines, if required, the project scope defined for that phase.

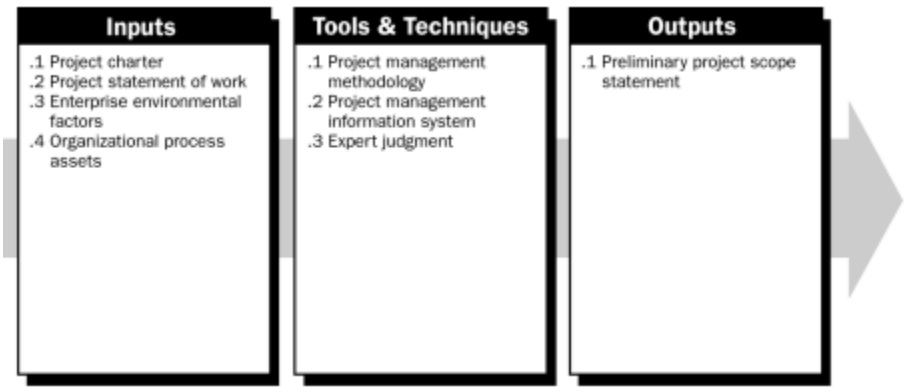


Figure 2.2 project scope statement input, tool and output

2.2.4 Work Breakdown Structure

The 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. The WBS organizes and defines the total scope of the project. The WBS subdivides the project work into smaller, more manageable pieces of work, with each descending level of the WBS representing an increasingly detailed definition of the project work. The planned work contained within the lowest-

level WBS components, which are called work packages, can be scheduled, cost estimated, monitored, and controlled. The WBS represents the work specified in the current approved project scope statement. Components comprising the WBS assist the stakeholders in viewing the deliverables of the project.

A work breakdown structure (WBS) is a deliverable oriented grouping of the work involved in a project that defines its total scope. Because most projects involve many people and many different deliverables, it is important to organize and divide the work into logical parts based on how the work will be performed.

The WBS is a foundation document in project management because it provides the basis for planning and managing project schedules, costs, resources, and changes. Because the WBS defines the total scope of the project, some project management experts believe that work should not be done on a project if it is not included in the WBS. Therefore, it is crucial to develop a good WBS.

The project scope management plan, scope statement, requirements documentation, enterprise environmental factors, and organizational process assets are the primary inputs for creating a WBS.

The main tool or technique is decomposition that is, subdividing project deliverables into smaller pieces. The outputs of the process of creating the WBS are the scope baseline and project documents updates. The scope baseline includes the approved project scope statement and its associated WBS and WBS dictionary.

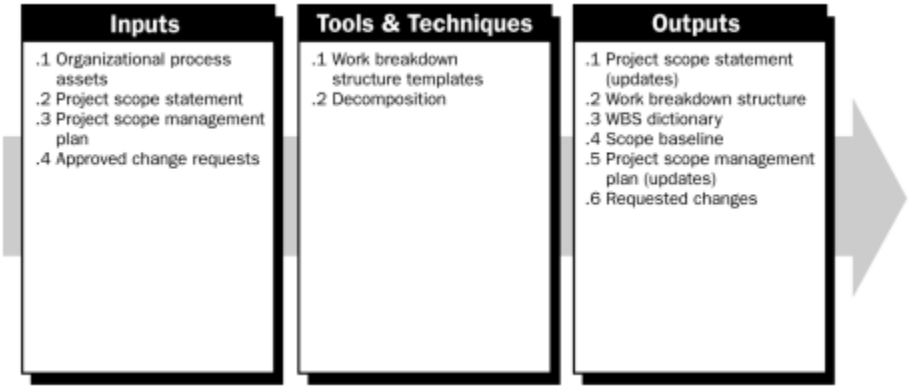


Figure 2.3 Create WBS: Inputs, Tools & Techniques, and Outputs

Inputs to create WBS

- ✓ Organizational Process Assets
- ✓ Project Scope Statement
- ✓ Project Scope Management Plan
- ✓ Approved Change Requests

Tools and Techniques to Create WBS

- ✓ **Work Breakdown Structure Templates**:

  Although each project is unique, a WBS from a previous project can often be used as a template for a new project, since some projects will resemble another prior project to some extent. For example, most projects within a given organization will have the same or similar project life cycles and, therefore, have the same or similar deliverables required from each phase. Many application areas or performing organizations have standard WBS templates.

- ✓ **Decomposition**:

  Decomposition is the subdivision of project deliverables into smaller, more manageable components until the work and deliverables are defined to the work package level. The work package level is the lowest level in the WBS, and is the point at which the cost and schedule for the work can be reliably estimated. The level of detail for work packages will vary with the size and complexity of the project.

  Decomposition may not be possible for a deliverable or subproject that will be accomplished far into the future. The project management team usually waits until the deliverable or subproject is clarified so the details of the WBS can be developed. This technique is sometimes referred to as rolling wave planning. Different deliverables can have different levels of decomposition. To arrive at a manageable work effort (i.e., a work package), the work for some deliverables needs to be decomposed only to the next level, while others need more levels of decomposition. As the work is decomposed to lower levels of detail, the ability to plan, manage, and control the work is enhanced. However, excessive decomposition can lead to non-productive management effort, inefficient use of resources, and decreased efficiency in performing the work. The project team needs to seek a balance between too little and too much in the level of WBS planning detail.

Decomposition of the total project work generally involves the following activities:

- Identifying the deliverables and related work
- Structuring and organizing the WBS
- Decomposing the upper WBS levels into lower level detailed components
- Developing and assigning identification codes to the WBS components
- Verifying that the degree of decomposition of the work is necessary and sufficient.

Outputs of WBS

1. Project Scope Statement (Updates)

If approved change requests result from the Create WBS process, then the project scope statement is updated to include those approved changes.

2. Work Breakdown Structure

The key document generated by the Create WBS process is the actual WBS. Each WBS component, including work package and control accounts within a WBS, is generally assigned a unique identifier from a code of accounts. These identifiers provide a structure for hierarchical summation of costs, schedule, and resource information. The WBS should not be confused with other kinds of breakdown structures used to present project information. Other structures used in some application areas or other Knowledge Areas include:

- Organizational Breakdown Structure (OBS). Provides a hierarchically organized depiction of the project organization arranged so that the work packages can be related to the performing organizational units.
- Bill of Materials (BOM). Presents a hierarchical tabulation of the physical assemblies, subassemblies, and components needed to fabricate a manufactured product.
- Risk Breakdown Structure (RBS). A hierarchically organized depiction of the identified project risks arranged by risk category.
- Resource Breakdown Structure (RBS). A hierarchically organized depiction of the resources by type to be used on the project.

3. WBS Dictionary

The document generated by the Create WBS process that supports the WBS is called the WBS dictionary and is a companion document to the WBS.

The detailed content of the components contained in a WBS, including work packages and control accounts, can be described in the WBS dictionary. For each WBS component, the WBS dictionary includes a code of account identifier, a statement of work, responsible organization, and a list of schedule milestones. Other information for a WBS component can include contract information, quality requirements, and technical references to facilitate performance of the work. Other information for a control account would be a charge number.

Other information for a work package can include a list of associated schedule activities, resources required, and an estimate of cost. Each WBS component is cross-referenced, as appropriate, to other WBS components in the WBS dictionary.

4. Scope Baseline

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

5. Project Scope Management Plan (Updates)

If approved change requests result from the Create WBS process, then the project scope management plan may need to be updated to include approved changes.

6.Requested Changes

Requested changes to the project scope statement and its components may be generated from the Create WBS process, and are processed for review and approval through the integrated change control process.

Approaches to Developing Work Breakdown Structures

You can use several approaches to develop a WBS:

- ✓ Using guidelines
- ✓ The analogy approaches
- ✓ The top-down approach
- ✓ The bottom-up approach
- ✓ The mind-mapping approach

2.3 Stepwise Project Planning

The first step in project scope management is planning how the scope will be managed throughout the life of the project. After reviewing the project management plan, project charter, enterprise environmental factors, and organizational process assets, the project team uses expert judgment and meetings to develop two important outputs: the scope management plan and the requirements management plan.

It provides a guidance and direction on how scope will be managed throughout the project.This process is performed once a predefined points in the project.

Organizations often have guidelines for submitting, evaluating, and approving changes to scope, and this section of the scope management plan would specify how to handle change requests for the project.

2.3.1 Overview of Project Planning

Planning is often the most difficult and unappreciated process in project management. Because planning is not always used to facilitate action, many people view planning negatively. The main purpose of project plans, however, is to guide project execution. To guide execution, plans must be realistic and useful, so a fair amount of time and effort must go into the planning process. People who are knowledgeable about the work need to plan the work.

Table 2.1 Overview of project planning process

Knowledge Area	Planning Process	Outputs
Project Integration Management	Develop project management plan	Project management plan
Project Scope Management	Plan scope management	Scope management plan Requirements management plan
	Collect requirements	Requirements documentation Requirements traceability matrix
	Define scope	Project scope statement Project documents updates
	Create WBS	Scope baseline Project documents updates
Project Time Management	Plan schedule management	Schedule management plan
	Define activities	Activity list Activity attributes Milestone list Project management plan updates

(continued)

Knowledge Area	Planning Process	Outputs
	Sequence activities	Project schedule network diagrams Project documents updates
	Estimate activity resources	Activity resource requirements Resource breakdown structure Project documents updates
	Estimate activity durations	Activity duration estimates Project documents updates
	Develop schedule	Schedule baseline Project schedule Schedule data Project calendars Project management plan updates Project documents updates
Project Cost Management	Plan cost management	Cost management plan
	Estimate costs	Activity cost estimates Basis of estimates Project documents updates
	Determine budget	Cost baseline Project funding requirements Project documents updates
Project Quality Management	Plan quality management	Quality management plan Process improvement plan Quality metrics Quality checklists Project documents updates
Project Human Resource Management	Plan human resource management	Human resource plan
Project Communications Management	Plan communications management	Communications management plan Project documents updates
Project Risk Management	Plan risk management	Risk management plan
	Identify risks	Risk register
	Perform qualitative risk analysis	Project documents updates
	Perform quantitative risk analysis	Project documents updates
	Plan risk responses	Project management plan updates Project documents updates
Project Procurement Management	Plan procurement management	Procurement management plan Procurement statement of work Procurement documents Source selection criteria Make-or-buy decisions Change requests
Project Stakeholder Management	Plan stakeholder management	Stakeholder management plan Project documents updates

Chapter review Questions

Discussion Questions

1. What is project integration management? how it differs from other project management knowledge areas?
2. Discuss about the processes involved in project integration management and the tools involved in each process?
3. How do we select potential projects for a specific organization?
4. What is project scope management?
5. Discuss about the processes involved in scope management process?
6. What tools and techniques are used in project scope management process?
7. Discuss about the common elements of project management plan?
8. Discuss the issue of scope statement in project scope management?

3. Project Scheduling

LEARNIN G OBJECTIVES

After reading this chapter, you will be able to:

- ✓ Understand the importance of project schedules and good project time
- ✓ management
- ✓ Define activities as the basis for developing project schedules
- ✓ Describe how project managers use network diagrams and dependencies
- ✓ to assist in activity sequencing
- ✓ Understand the relationship between estimating resources and project
- ✓ schedules
- ✓ Explain how various tools and techniques help project managers perform
- ✓ activity duration estimating
- ✓ Use a Gantt chart for planning and tracking schedule information, find the
- ✓ critical path for a project. and describe how critical chain scheduling and
- ✓ the Program Evaluation and Review Technique (PERT) affect schedule
- ✓ development

3.1 Time Management

Project time management, simply defined, involves the processes required to ensure timely completion of a project. Achieving timely completion of a project, however, is by no means Simple. There are seven main processes involved in project time management:

Planning schedule management involves determining the policies, procedures, and documentation that will be used for planning, executing, and controlling the project schedule. The main output of this process is a schedule management plan.

Defining activities: identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables

Sequencing activities: identifying and documenting the relationships between project activities

Estimating activity resources: estimating how many resources a project team should use to perform project activities

Estimating activity durations: estimating the number of work periods that are needed to complete individual activities

Developing the schedule: analyzing activity sequences, activity resource estimates, and activity duration estimates to create the project schedule

Controlling the schedule: controlling and managing changes to the project schedule

3.1.1. Importance of Project Schedules

Managers often cite the need to deliver projects on time as one of their biggest challenges and the main cause of conflict. Perhaps part of the reason that schedule problems are so common is that time is easily measured and remembered. You can debate scope and cost overruns and make actual numbers appear closer to estimates, but once a project schedule is set, people remember the projected completion date, and anyone can quickly estimate schedule performance by subtracting the original time estimate from how long it really took to complete the project. People often compare planned and actual project completion times without taking into account the approved changes in the project. Time is the variable that has the least amount of flexibility. Time passes no matter what happens on a project.

Individual work styles and cultural differences may also cause schedule conflicts. One dimension of this team-building tool deals with attitudes toward structure and deadlines. Some people prefer detailed schedules and emphasize task completion. Others prefer to keep things open and flexible. Different cultures and even entire countries have different attitudes about schedules. For example, in some countries businesses close for several hours every afternoon to have siestas. Countries may have different holidays, which means not much work will be done at certain times of the year. Cultures may also have different perceptions of work ethic—some may value hard work and strict schedules while others may value the ability to remain relaxed and flexible. With all the possibilities for schedule conflicts, it is important for project managers to use good project time management.

3.1.2. Schedules and Activities

A) Schedule

Project time management, involves the processes required to ensure timely completion of a project.

Project scheduling in a project refers to roadmap of all activities to be done with specified order and within time slot assigned to each activity.

For scheduling a project, it is necessary to break down the project tasks into smaller, manageable form (WBS), find out various task and correlate them, estimate time frame required for each task, divide time into work units, assign adequate number of work units for each sub task, calculate total start to finish time.

It is about planning how the schedule will be managed throughout the life of the project. This process helps in planning, developing, managing and controlling the project schedule. Provides guidance and direction on how the project schedule will be managed throughout the project life cycle.

Where Do Schedules Come From?

Basic document that initiate a project schedule:

- ✓ Project charter (includes start and end dates and budget information)
- ✓ Scope statement and WBS helps to define what will be done in a project.
- ✓ After reviewing the PMP, project charter, enterprise environmental factors, and organizational process assets, the project team uses expert judgment, analytical techniques, and meetings to develop the schedule management plan.

In general, a schedule management plan includes the following information:

Project schedule model development: Many projects include a schedule model, which contains **project activities** with estimated durations, dependencies, and other planning information that can be used to produce a project schedule.

The scheduling methodology and the scheduling tool to use when developing the project schedule model: Some projects will use critical path or critical chain methodologies, for example, while simpler projects might focus only on milestones.

Level of accuracy and units of measure: This section discusses how accurate schedule estimates should be and determines whether time is measured in hours, days, or another unit.

Control thresholds: Variance thresholds, such as ±10%, are established for monitoring schedule performance.

Rules of performance measurement: For example, earned value management (EVM) will be used.

Reporting formats: This section describes the format and frequency of schedule reports required for the project.

Process descriptions: The schedule management plan also describes how all of the schedule management processes will be performed.

Schedule development

Schedule development uses the results of all the preceding project time management processes to determine the start and end dates of the project and its activities. Project time management processes often go through several iterations before a project schedule is finalized. The ultimate goal of developing a realistic project schedule is to provide a basis for monitoring project progress for the time dimension of the project. The main outputs of this process are the project schedule, a schedule baseline, schedule data, project calendars, project management plan updates, and project documents updates. Some project teams create a computerized model to create a network diagram, enter resource requirements and availability by time period, and adjust other information to quickly generate alternative schedules. See Appendix A for information on using Project 2013 to assist in schedule development. Several tools and techniques assist in schedule development:

- ✓ A Gantt chart is a common tool for displaying project schedule information.
- ✓ Critical path analysis is a very important tool for developing and controlling project schedules.
- ✓ Critical chain scheduling is a technique that focuses on limited resources when creating a project schedule.
- ✓ PERT analysis is a means for considering schedule risk on projects.

Gantt Charts

Gantt Charts Gantt charts provide a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in calendar form. Gantt charts are sometimes referred to as bar charts because the activities' start and end dates are shown as horizontal bars.

The activities on the Gantt chart are driven by the deliverables on the WBS, and should coincide in turn with the activity list and milestone list. Notice that the Gantt chart for the software launch project contains milestones, summary tasks, individual task durations, and arrows showing task dependencies.

- ✓ Symbols include:
    - Black diamonds: milestones
    - Thick black bars: summary tasks
    - Lighter horizontal bars: durations of tasks
    - Arrows: dependencies between tasks

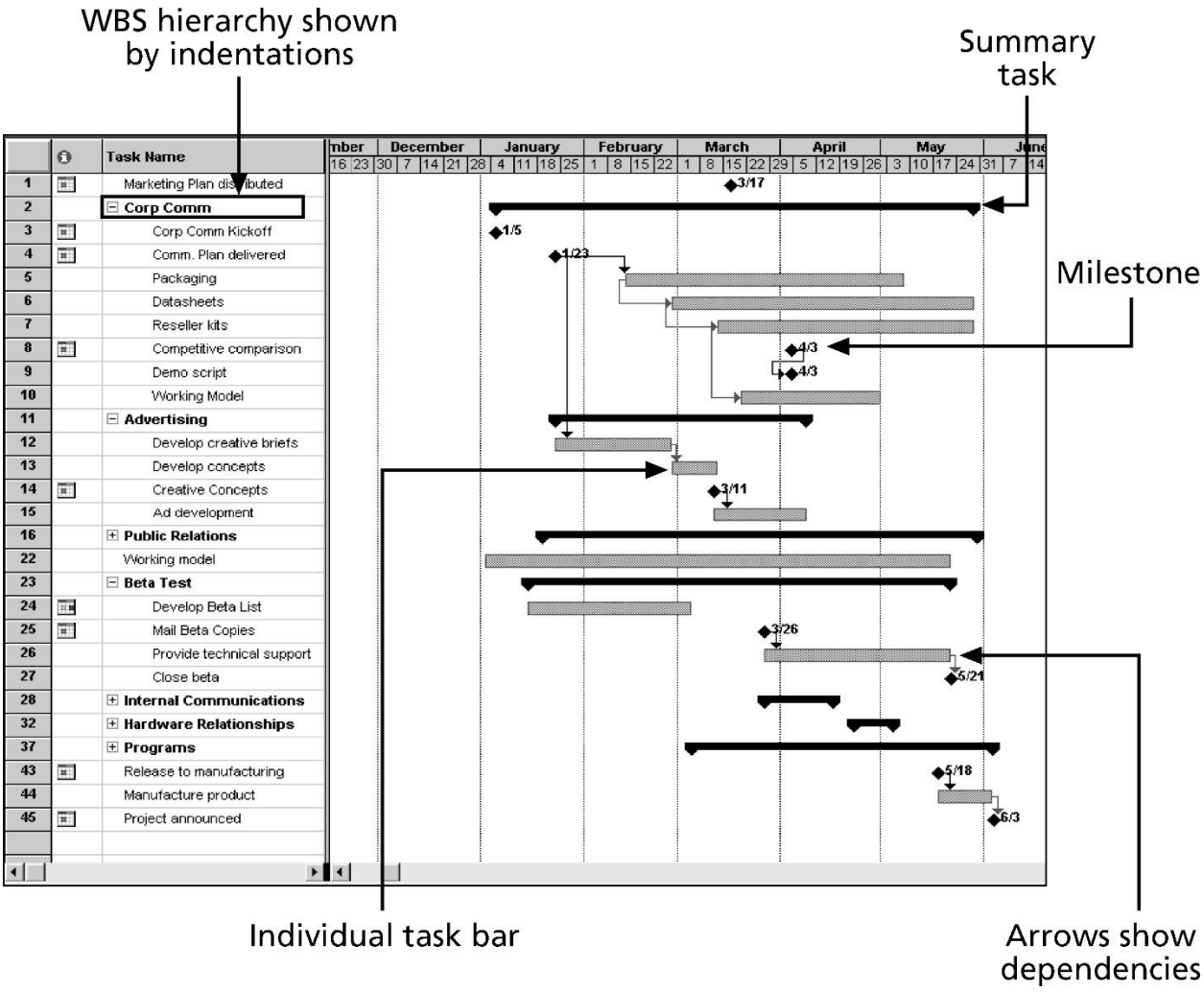


Figure 3.1 Gant char for project X

Adding Milestones to Gantt Charts

Milestones can be a particularly important part of schedules, especially for large projects. Many people like to focus on meeting milestones, so you can create them to emphasize important events or accomplishments on projects. Normally, you create milestones by entering tasks with zero duration. In Microsoft Project, you can mark any task as a milestone by checking the appropriate box in the Advanced tab of the Task Information dialog box. The duration of the task will not change to zero, but the Gantt chart will show the milestone symbol to represent that task based on its start date. See Appendix A for more information.

To make milestones meaningful, some people use the SMART criteria to help define them. The SMART criteria are guidelines suggesting that milestones should be:

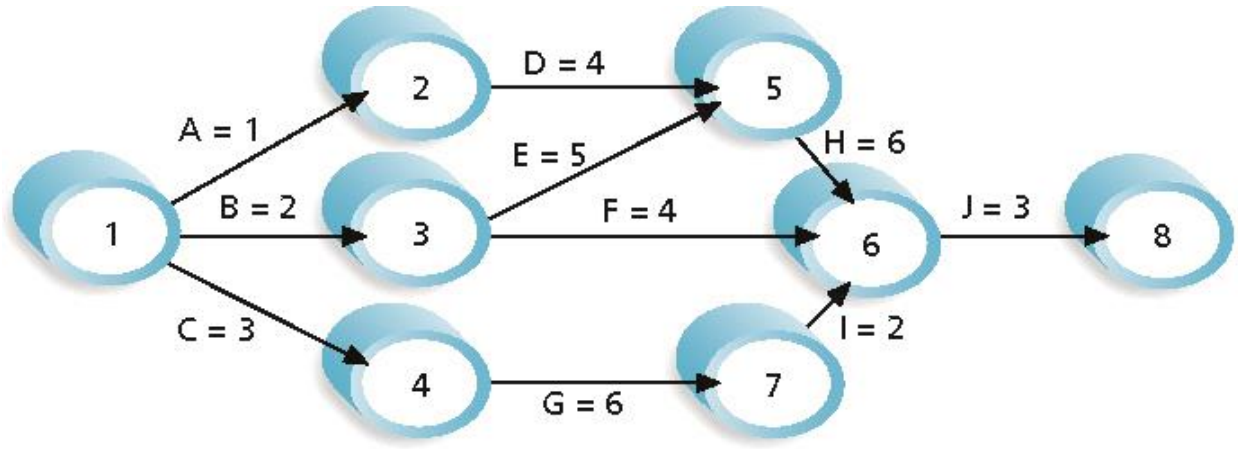
- ✓ Specific
- ✓ Measurable
- ✓ Assignable
- ✓ Realistic
- ✓ Time-framed

Critical Path Method

Many projects fail to meet schedule expectations. Critical path method (CPM)—also called critical path analysis—is a network diagramming technique used to predict total project duration. This important tool helps you combat project schedule overruns. A critical path for a project is the series of activities that determine the earliest time by which the project can be completed. It is the longest path through the network diagram and has the least amount of slack or float. Slack or float is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date. Normally, several tasks are done in parallel on projects, and most projects have multiple paths through a network diagram. The longest path or the path that contains the critical tasks is what drives the completion date for the project. You are not finished with the project until you have finished all the tasks.

Calculating the Critical Path

To find the critical path for a project, you must first develop a good network diagram, which in turn requires a good activity list based on the WBS. Once you create a network diagram, you must also estimate the duration of each activity to determine the critical path. Calculating the critical path involves adding the durations for all activities on each path through the network diagram. The longest path is the critical path.



Note: Assume all durations are in days.

Path 1:	A-D-H-J	Length = 1+4+6+3 = 14 days
Path 2:	B-E-H-J	Length = 2+5+6+3 = 16 days
Path 3:	B-F-J	Length = 2+4+3 = 9 days
Path 4:	C-G-I-J	Length = 3+6+2+3 = 14 days

Since the critical path is the longest path through the network diagram, Path 2, B-E-H-J, is the critical path for Project X.

Figure 3.2 Determining the Critical Path for Project X

☞ Note that each path starts at the first node (1) and ends at the last node (8) on the AOA network diagram. This figure also shows the length or total duration of each path through the network diagram. These lengths are computed by adding the durations of each activity on the path. Because path B-E-H-J has the longest duration at 16 days, it is the critical path for the project. What does the critical path really mean? Even though the critical path is the longest path, it represents the shortest time required to complete a project. If one or more activities on the critical path take longer than planned, the whole project schedule will slip unless the project manager takes corrective action.

Using Critical Path Analysis to Make Schedule Trade-Offs

It is important to know the critical path throughout the life of a project so the project manager can make trade-offs. If a task on the critical path is behind schedule, the project manager must be aware of the problem and decide what to do about it. Should the schedule be renegotiated with stakeholders?

Should more resources be allocated to other items on the critical path to make up for that time? Is it acceptable for the project to finish behind schedule? By keeping track of the critical path, the project manager and the team take a proactive role in managing the project schedule.

A technique that can help project managers make schedule trade-offs is determining the free slack and total slack for each project activity.

Free slack or free float is the amount of time an activity can be delayed without delaying the early start date of any immediately following activities.

The early start date is the earliest possible time an activity can start based on the project network logic.

Total slack or total float is the amount of time an activity can be delayed from its early start without delaying the planned project finish date.

Project managers calculate free slack and total slack by doing a forward and backward pass through a network diagram. A forward pass determines the early start and early finish dates for each activity. The early finish date is the earliest possible time an activity can finish based on the project network logic. The project start date is equal to the early start date for the first network diagram activity. The early start plus the duration of the first activity is equal to the early finish date of the first activity. It is also equal to the early start date of each subsequent activity unless an activity has multiple predecessors. When an activity has multiple predecessors, its early start date is the latest of the early finish dates of those predecessors. For example, Tasks D and E immediately precede Task H in Figure 3.2. The early start date for Task H, therefore, is the early finish date of Task E, because it occurs later than the early finish date of Task D. A backward pass through the network diagram determines the late start and late finish dates for each activity in a similar fashion. The late start date is the latest possible time an activity might begin without delaying the project finish date. The late finish date is the latest possible time an activity can be completed without delaying the project finish date.

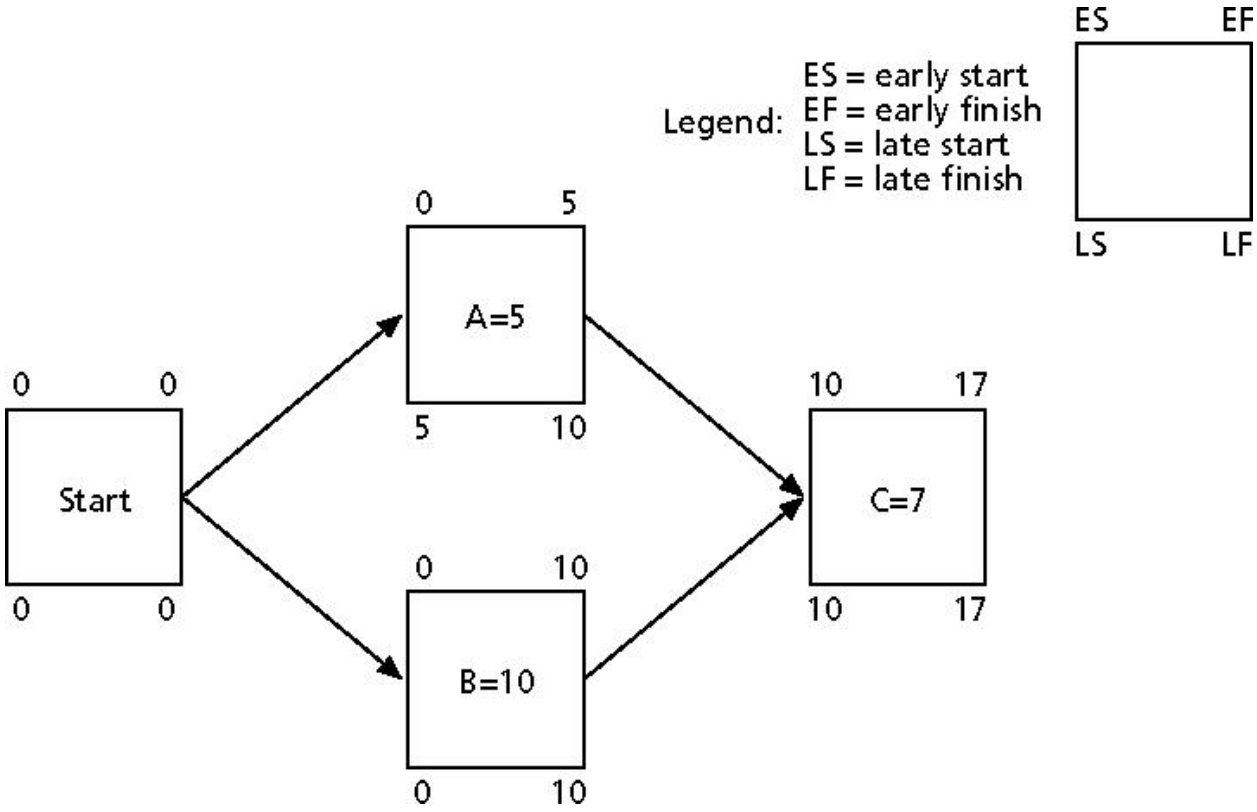


Figure 3.3 Calculating Early and Late Start and Finish Dates

Critical Chain Scheduling

Another technique that addresses the challenge of meeting or beating project finish dates is an application of the Theory of Constraints called critical chain scheduling. An important concept in critical chain scheduling is the availability of scarce resources. Some projects cannot be done unless a particular resource is available to work on one or several tasks. For example, if a television network wants to produce a show centered around a particular celebrity, it must first check the availability of that celebrity. As another example, if a particular piece of equipment is needed full time to complete each of two tasks that were originally planned to occur simultaneously, critical chain scheduling acknowledges that you must either delay one of those tasks until the equipment is available or find another piece of equipment in order to meet the schedule. Other important concepts related to critical chain scheduling include multitasking and time buffers. Although many people are proud to say they are good at multitasking, multitasking is not a good thing to do if you want to finish a project in a timely manner. Multitasking occurs when a resource works on more than one task at a time. This situation occurs frequently on projects. People are assigned to multiple tasks within the same project or different tasks on multiple projects.

For example, suppose someone is working on three different tasks—Task 1, Task 2, and Task 3—for three different projects, and each task takes 10 days to complete. If the person did not multitask, and instead completed each task sequentially starting with Task 1, then Task 1 would be completed after day 10, Task 2 would be completed after day 20, and Task 3 would be completed after day 30, as shown in Figure 3.4. However, because many people in this situation try to please all three parties who need their tasks completed, they often work on the first task for some time, then the second, then the third, then go back to the first task, and so on, as shown in Figure 6-10b. In this example, the tasks were all half-done one at a time, then completed one at a time. Task 1 is now completed at the end of day 20 instead of day 10, Task 2 is completed at the end of day 25 instead of day 20, and Task 3 is still completed on day 30. This example illustrates how multitasking can delay task completion. Multitasking also often involves wasted setup time, which increases total duration.

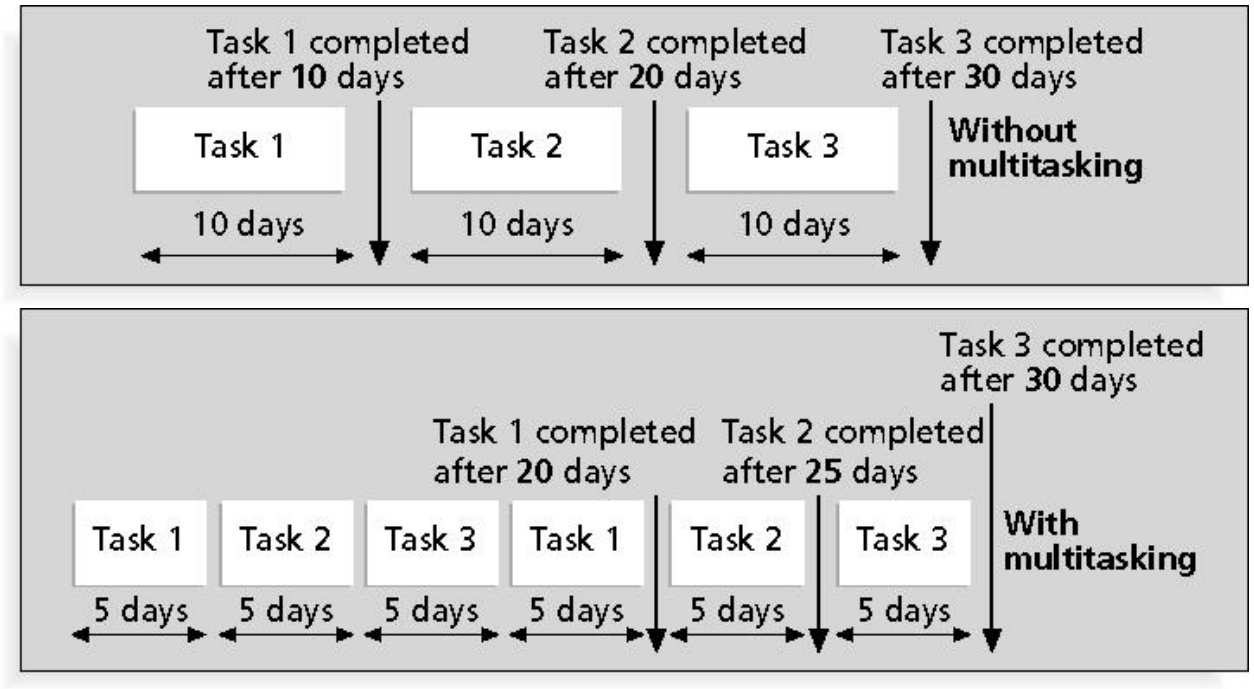


Figure 3.4 Multitasking Example

Critical chain scheduling assumes that resources do not multitask or at least minimize multitasking. Someone should not be assigned to two tasks simultaneously on the same project when critical chain scheduling is in effect. Likewise, critical chain theory suggests that projects be prioritized so that people who are working on more than one project at a time know which tasks take priority. Preventing multitasking avoids resource conflicts and wasted setup time caused by shifting between multiple tasks over time. An essential concept to improving project finish dates with critical chain scheduling is to change the way people make task estimates. Many people add a safety or buffer— additional time to complete a task—to an estimate to account for various factors. These factors include the negative effects of multitasking, distractions, and interruptions, fear that estimates will be reduced, and Murphy's Law. Murphy's Law states that if something can go wrong, it will. Critical chain scheduling removes buffers from individual tasks and instead creates a project buffer, which is time added before the project's due date. Critical chain scheduling also protects tasks on the critical chain from being delayed by using feeding buffers, which consist of time added before tasks on the critical chain if they are preceded by other tasks that are not on the critical path.

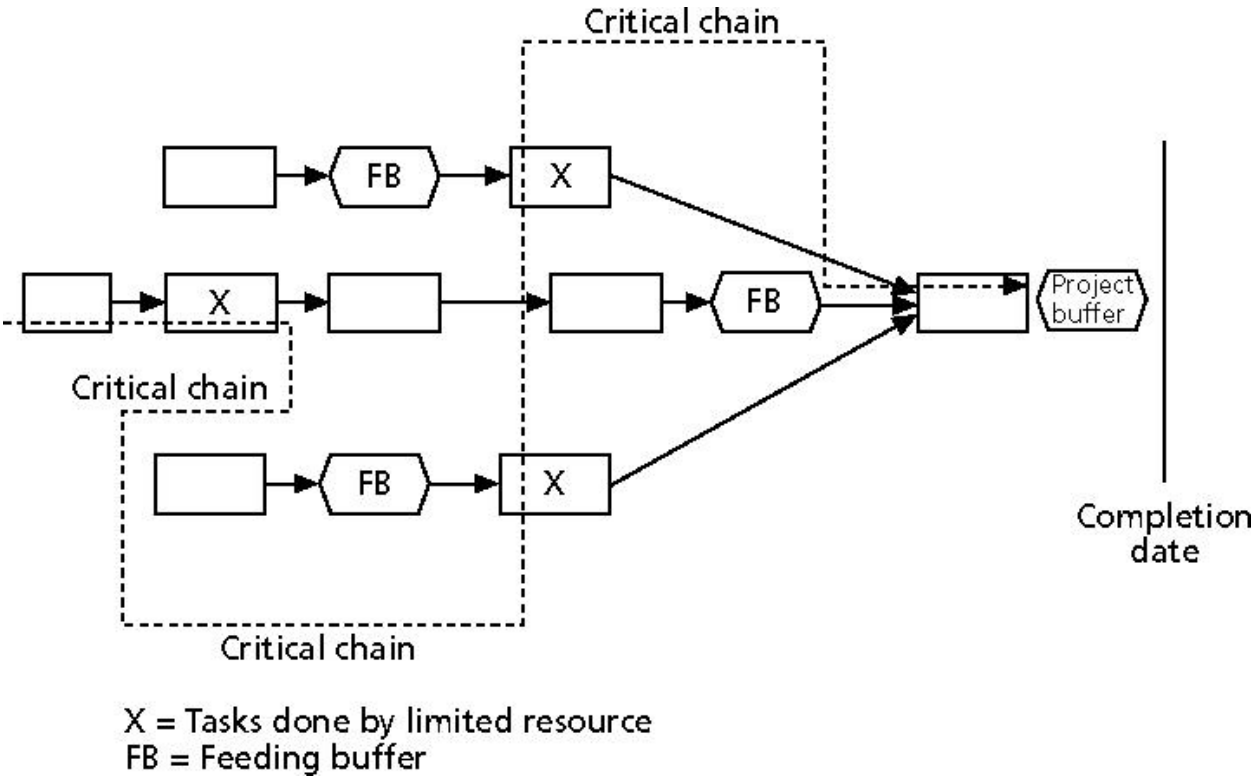


Figure 3.5 Example of Critical Chain Scheduling

Program Evaluation and Review Technique (PERT)

When there is a high degree of uncertainty about the individual activity duration estimates, the network analysis Program Evaluation and Review Technique (PERT) can be used to estimate project duration. PERT applies the critical path method (CPM) to a weighted average duration estimate. This approach was developed at about the same time as CPM, in the late 1950s, and it also uses network diagrams, which are still sometimes referred to as PERT charts. PERT uses probabilistic time estimates—duration estimates based on using optimistic, most likely, and pessimistic estimates of activity durations—instead of one specific or discrete duration estimate, as CPM does. To use PERT, you calculate a weighted average for the duration estimate of each project activity using the following formula:

$$\text{PERT weighted average} = \frac{\text{optimistic time} + 4\text{X most likely time} + \text{pessimistic time}}{6}$$

By using the PERT weighted average for each activity duration estimate, the total project duration estimate takes into account the risk or uncertainty in the individual activity estimates. Suppose that Sue Johnson's project team in the opening case used PERT to determine the schedule for the online registration system project. The team would have to collect numbers for the optimistic, most likely, and pessimistic duration estimates for each project activity. Suppose that one of the activities was to design an input screen for the system. Someone might estimate that it would take about two weeks or 10 workdays to do this activity. Without using PERT, the duration estimate for that activity would be 10 workdays. Using PERT, the project team would also need to estimate the pessimistic and optimistic times for completing this activity. Suppose an optimistic estimate is that the input screen can be designed in eight workdays, and a pessimistic time estimate is 24 workdays. Applying the PERT formula, you get the following:

$$\text{PERT weighted average} = \frac{8 \text{ workdays} + 4 \text{ X } 10 \text{ workdays} + 24 \text{ workdays}}{6} = \textbf{12 days}$$

Instead of using the most likely duration estimate of 10 workdays, the project team would use 12 workdays when doing critical path analysis. These additional two days could help the project team get the work completed on time. These additional two days could help the project team get the work completed on time.

The main advantage of PERT is that it attempts to address the risk associated with duration estimates. Because many projects exceed schedule estimates, PERT may help in developing schedules that are more realistic. PERT's main disadvantages are that it involves more work than CPM because it requires several duration estimates, and there are better probabilistic methods for assessing schedule risk.

B) Defining Activities

The goal of defining activities is to ensure that the project team completely understands all the work it must do as part of the project scope so the team can start scheduling the work. For example, a WBS item might be "Produce study report".

An activity list is a tabulation of activities to be included on a project schedule that includes:

- ✓ The activity names
- ✓ An activity identifier or number
- ✓ A brief description of the activity

Activity attributes provide more information such as predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity.

A milestone is a significant event that normally has no duration. It often takes several activities and a lot of work to complete a milestone, but the milestone itself is like a marker to help in identifying necessary activities. They're useful tools for setting schedule goals and monitoring progress. Examples include obtaining customer sign-off on key documents or completion of specific products

3.1.3. Sequencing and Scheduling Activity

After defining project activities, the next step in project time management is sequencing them or determining their dependencies. It Involves reviewing activities and determining dependencies.

Inputs to the activity sequencing process include the schedule management plan, activity list and attributes, project scope statement, milestone list, and organizational process assets. The sequencing process involves evaluating the reasons for dependencies and the different types of dependencies. A dependency or relationship is the sequencing of project activities or tasks. You must determine dependencies in order to use critical path analysis.

Three types of Dependencies

- ✓ **Mandatory dependencies**: inherent in the nature of the work being performed on a project, sometimes referred to as hard logic.
- ✓ **Discretionary dependencies**: defined by the project team; sometimes referred to as soft logic and should be used with care since they may limit later scheduling options.
- ✓ **External dependencies**: involve relationships between project and non-project activities.
- ✓ For example, the installation of a new operating system and other software may depend on delivery of new hardware from an external supplier.

As with activity definition, it is important that project stakeholders work together to define the activity dependencies in their project. If you do not define the sequence of activities, you cannot use some of the most powerful scheduling tools available to project managers: network diagrams and critical path analysis. Network diagrams are the preferred techniques for showing activity sequencing.

3.2 Project Network Diagrams

A network diagram is a schematic display of the logical relationships among, or sequencing of. project activities. Some people refer network diagrams as project schedule network diagrams or PERT charts.

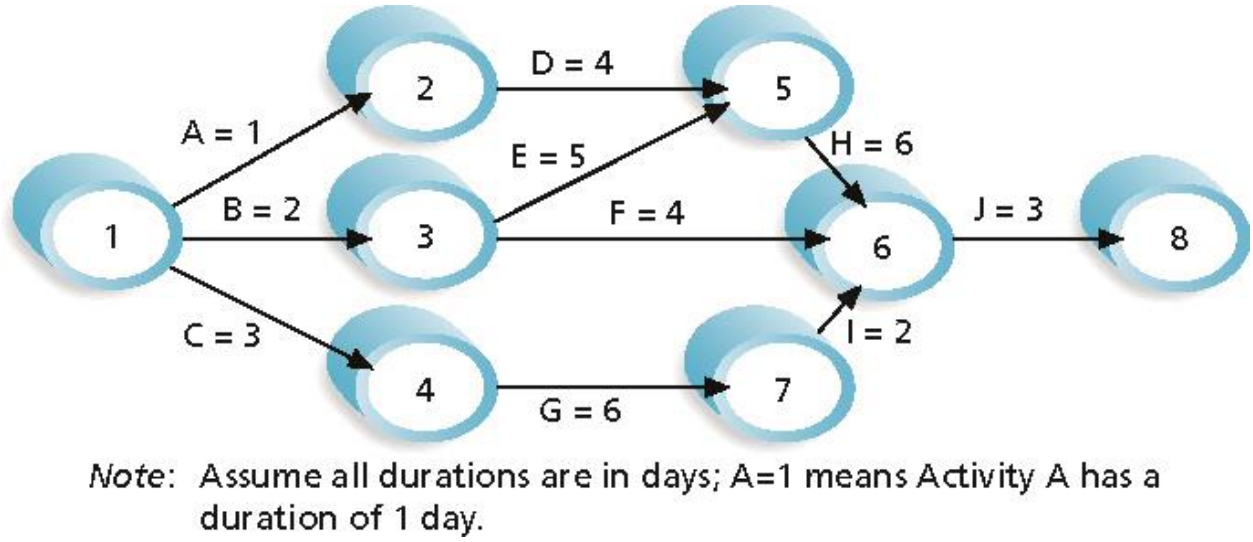


Figure 3.6 Activity-on-Arrow (AOA) Network Diagram for Project X

Note the main elements on this network diagram. The letters A through J represent activities with dependencies that are required to complete the project. These activities come from the WBS and activity definition process described earlier. The arrows represent the activity sequencing or relationships between tasks. For example, Activity A must be done before Activity D, and Activity D must be done before Activity H.

The format of this network diagram uses the activity-on-arrow (AOA) approach or the arrow diagramming method (ADM)—a network diagramming technique in which activities are represented by arrows and connected at points called nodes to illustrate the sequence of activities. A node is simply the starting and ending point of an activity. The first node signifies the start of a project, and the last node represents the end. Keep in mind that the network diagram represents activities that must be done to complete the project. It is not a race to get from the first node to the last node. Every activity on the network diagram must be completed in order to finish the project. Note also that not every item on the WBS needs to be shown on the network diagram; only activities with dependencies need to be shown. However, some people like to have start and end milestones and to list every activity. It is a matter of preference. For large projects with hundreds of activities, it might be simpler to include only activities with dependencies on a network diagram. Sometimes it is enough to put summary tasks on a network diagram or to break down the project into several smaller network diagrams.

Assuming that you have a list of the project activities and their start and finish nodes, follow these steps to create an AOA network diagram:

1. Find all of the activities that start at Node 1. Draw their finish nodes, and draw arrows between Node 1 and each of the finish nodes. Put the activity letter or name on the associated arrow. If you have a duration estimate, write it next to the activity letter or name. For example, For example, in Figure 3.1, A = 1 means that the duration of Activity A is one day, week, or other standard unit of time. Be sure to put arrowheads on all arrows to signify the direction of the relationships.

2. Continue drawing the network diagram, working from left to right. Look for bursts and merges. Bursts occur when two or more activities follow a single node. A merge occurs when two or more nodes precede a single node. For example, in Figure 3.1, Node 1 is a burst because it goes into Nodes 2, 3, and 4. Node 5 is a merge preceded by Nodes 2 and 3.

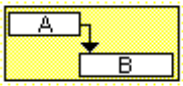
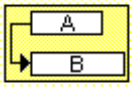
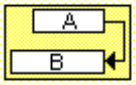
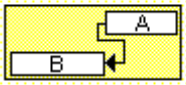
3. Continue drawing the AOA network diagram until all activities are included.

4. As a rule of thumb, all arrowheads should face toward the right, and no arrows should cross on an AOA network diagram. You may need to redraw the diagram to make it look presentable.

Even though AOA or ADM network diagrams are generally easy to understand and create, a different method is more commonly used: the precedence diagramming method. The precedence diagramming method (PDM) is a network diagramming technique in which boxes represent activities. It is particularly useful for visualizing certain types of time relationships.

Task dependencies

The nature of the dependencies between linked tasks. You link tasks by defining a dependency between their finish and start dates. For example, the "Contact caterers" task must finish before the start of the "Determine menus" task. There are four kinds of task dependencies in Microsoft Project:

Task dependency	Example	Description
Finish-to-start (FS)		Task (B) cannot start until task (A) finishes.
Start-to-start (SS)		Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)		Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)		Task (B) cannot finish until task (A) starts.

The four types of dependencies or relationships between activities include:

1. Finish-to-start dependency: A relationship in which the "from" activity or predecessor must finish before the "to" activity or successor can start. For example, you cannot provide user training until after software or a new system has been installed. Finish-to-start is the most common type of relationship or dependency, and AOA network diagrams use only finish-to-start dependencies.
2. Start-to-start dependency: A relationship in which the "from" activity cannot start until the "to" activity or successor is started. For example, on IT projects, a group of activities might start simultaneously, such as the many tasks that occur when a new system goes live.
3. Finish-to-finish dependency: A relationship in which the "from" activity must be finished before the "to" activity can be finished. One task cannot finish before another finishes. For example, quality control efforts cannot finish before production finishes, although the two activities can be performed at the same time.
4. Start-to-finish dependency: A relationship in which the "from" activity must start before the "to" activity can be finished. This type of relationship is rarely used, but it is appropriate in some cases. For example, an organization might strive to stock raw materials just in time for the manufacturing process to begin. A delay in starting the manufacturing process should delay completion of stocking the raw materials. Another example would be a babysitter who wants to finish watching a young child but is dependent on the parent's arrival. The parent must show up or "start" before the babysitter can finish the task.

☞ The precedence diagramming method is used more often than AOA network diagrams and offers a number of advantages over the AOA technique. First, most project management software uses the precedence diagramming method. Second, using this method avoids the need to use dummy activities. Dummy activities have no duration and no resources, but are occasionally needed on AOA network diagrams to show logical relationships between activities. These activities are represented with dashed arrow lines and have zeros for their duration estimates. Third, the precedence diagramming method shows different dependencies among tasks, whereas AOA network diagrams use only finish-to-start dependencies.

Chapter review Questions

Discussion Questions

1. What is time management? And why it is very crucial and serious?
2. Discuss about schedule management and the processes involved in it?
3. Discuss about the tools and techniques used in project time management processes?
4. Discuss about the tools used to develop schedule?
5. Discuss about the critical path method and PERT with example?

4. Project Cost Management

LEARNING OBJECTIVES

After reading this chapter, you will be able to:

- ✓ Develop a justification for project cost management and its importance in achieving project success
- ✓ Explain basic project cost management principles, concepts, and terms
- ✓ Describe the process of planning cost management
- ✓ Discuss different types of cost estimates and methods for preparing them
- ✓ Using an example of an information technology (IT) project, list and describe the processes of determining a budget and preparing a cost estimate

4.0 Introduction

Project Cost Management includes the processes involved in planning, estimating, budgeting, and controlling costs so that the project can be completed within the approved budget.

Project Cost Management is primarily concerned with the cost of the resources needed to complete schedule activities. However, Project Cost Management should also consider the effect of project decisions on the cost of using, maintaining, and supporting the product, service, or result of the project. For example, limiting the number of design reviews can reduce the cost of the project at the expense of an increase in the customer's operating costs. This broader view of Project Cost Management is often called life-cycle costing. Life-cycle costing, together with value engineering techniques, can improve decision-making and is used to reduce cost and execution time and to improve the quality and performance of the project deliverable.

4.1. Importance and Principles of Project Cost Management

IT projects have a poor track record in meeting budget goals. A 2011 study published in the Harvard Business Review examined IT change initiatives in almost 1,500 projects and reported an average cost overrun of 27 percent. Cost overrun is the additional percentage or dollar amount by which actual costs exceed estimates. The study was considered the largest ever to analyze IT projects. The projects ranged from enterprise resource planning to management information and

customer relationship management systems. Most projects incurred high expenses, with an average cost of $167 million; the largest project cost $33 billion.

The most important finding in the study, however, was the discovery of a large number of gigantic overages when analyzing the project overrun data. One in six of all projects studied contained a "black swan": a high-impact event that is rare and unpredictable, but not improbable in retrospect. These IT black swan projects had an average cost overrun of 200 percent and a schedule overrun of almost 70 percent. "This highlights the true pitfall of IT change initiatives: It's not that they're particularly prone to high cost overruns on average, as management consultants and academic studies have previously suggested.

Obviously, IT projects have room for improvement in meeting cost goals.

What is cost?

A popular cost accounting textbook states, "Accountants usually define cost as a resource sacrificed or foregone to achieve a specific objective."6 Webster's dictionary defines cost as "something given up in exchange." Costs are often measured in monetary amounts, such as dollars, that must be paid to acquire goods and services. (For convenience, the examples in this chapter use dollars for monetary amounts.) Because projects cost money and consume resources that could be used elsewhere, it is very important for project managers to understand project cost management. Many IT professionals, however, often react to cost overrun information with a smirk. They know that many of the original cost estimates for IT projects are low or based on unclear project requirements, so naturally there will be cost overruns. Not emphasizing the importance of realistic project cost estimates from the outset is only one part of the problem. In addition, many IT professionals think that preparing cost estimates is a job for accountants. On the contrary, preparing good cost estimates is a demanding, important skill that many professionals need to acquire, including project managers.

Another perceived reason for cost overruns is that many IT projects involve new technology or business processes. Any new technology or business process is untested and has inherent risks. Thus, costs grow and failures are to be expected, right? Wrong. Using good project cost management can change this false perception.

What is project cost management?

. Project cost management includes the processes required to ensure that a project team completes a project within an approved budget. Notice two crucial phrases in this definition: “a project” and “approved budget.” Project managers must make sure their projects are well defined, have accurate schedule and cost estimates, and have a realistic budget that they were involved in approving. It is the project manager’s job to satisfy project stakeholders while continuously striving to reduce and control costs. There are four processes for project cost management:

1. Planning cost management involves determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost. The main output of this process is a cost management plan.
2. Estimating costs involves developing an approximation or estimate of the costs of the resources needed to complete a project. The main outputs of the cost estimating process are activity cost estimates, basis of estimates, and project documents updates.
3. Determining the budget involves allocating the overall cost estimate to individual work items to establish a baseline for measuring performance. The main outputs of the cost budgeting process are a cost baseline, project funding requirements, and project documents updates.
4. Controlling costs involves controlling changes to the project budget. The main outputs of the cost control process are work performance information, cost forecasts, change requests, and project management plan updates, and project documents updates. To understand each of the project cost management processes, you must first understand the basic principles of cost management. Many of these principles are not unique to project management; however, project managers need to understand how these principles relate to their specific projects

Principles of Project Cost Management

Many IT projects are never initiated because IT professionals do not understand the importance of basic accounting and finance principles. Therefore, IT project managers need to be able to present and discuss project information both in financial terms and technical terms. In addition to net present value analysis, return on investment, and payback analysis, project managers must understand several other cost management principles, concepts, and terms.

profits are revenues minus expenditures. To increase profits, a company can increase revenues, decrease expenses, or try to do both. Life cycle costing allows you to see a big-picture view of the cost of a project throughout its life cycle. Cash flow analysis is a method for determining the estimated annual costs and benefits for a project and the resulting annual cash flow. Tangible and intangible costs and benefits are categories for determining how well an organization can define the estimated costs and benefits for a project. Tangible costs or benefits can easily be measured in dollars.

Direct costs can be directly related to creating the products and services of the project. You can attribute direct costs to a certain project. For example, direct costs include the salaries of people working full time on the project and the cost of hardware and software purchased specifically for the project. Project managers should focus on direct costs because they can be controlled.

Indirect costs are not directly related to the products or services of the project, but are indirectly related to performing the project. For example, indirect costs would include the cost of electricity, paper towels, and other necessities in a large building that houses 1,000 employees who work on many projects. Sunk cost is money that has been spent in the past. Consider it gone, like a sunken ship that can never be raised. When deciding what projects to invest in or continue, you should not include sunk costs.

Learning curve theory states that when many items are produced repetitively, the unit cost of those items decreases in a regular pattern as more units are produced. For example, suppose that a Surveyor Pro project would potentially produce 1,000 handheld devices that could run the new software and access information via satellite. The cost of the first handheld unit would be much higher than the cost of the thousandth unit.

Reserves are dollar amounts included in a cost estimate to mitigate cost risk by allowing for future situations that are difficult to predict. Contingency reserves allow for future situations that may be partially planned for (sometimes called known unknowns) and are included in the project cost baseline.

4.2. Resource Planning

The first step in project cost management is planning how the costs will be managed throughout the life of the project. Project costs, like project schedules, grow out of the basic documents that initiate a project, like the project charter. The project manager and other stakeholders use expert

judgment, analytical techniques, and meetings to produce the cost management plan.

The cost management plan, like the scope and schedule management plans, can be informal and broad or formal and detailed, based on the needs of the project. In general, a cost management plan includes the following information:

- ✓ Level of accuracy: Activity cost estimates normally have rounding guidelines, such as rounding to the nearest $100. There may also be guidelines for the amount of contingency funds to include, such as 10 or 20 percent.
- ✓ Units of measure: Each unit used in cost measurements, such as labor hours or days, should be defined.
- ✓ Organizational procedures links: Many organizations refer to the work breakdown structure (WBS) component used for project cost accounting as the control account (CA). Each control account is often assigned a unique code that is used in the organization's accounting system. Project teams must understand and use these codes properly.
- ✓ Control thresholds: Similar to schedule variance, costs often have a specified amount of variation allowed before action needs to be taken, such as 10 percent of the baseline cost.
- ✓ Rules of performance measurement: If the project uses EVM, as described later in this chapter, the cost management plan would define measurement rules, such as how often actual costs will be tracked and to what level of detail.
- ✓ Reporting formats: This section would describe the format and frequency of cost reports required for the project.
- ✓ Process descriptions: The cost management plan would also describe how to perform all of the cost management processes

4.3. Cost Estimating

Project managers must take cost estimates seriously if they want to complete projects within budget constraints. After developing a good resource requirements list, project managers and their project teams must develop several estimates of the costs for these resources. For example, if an activity for a project is to perform a particular type of test, the list of activity resource requirements would describe the skill level of the people needed to perform the test, the number of people and

hours suggested to perform the test, the need for special software or equipment, and other requirements. All of this information is required to develop a good cost estimate.

Types of Cost Estimates

The main outputs of project cost management are cost estimates and basis of estimates. Project managers normally prepare several types of cost estimates for most projects.

Three basic types of estimates include the following:

- ✓ A rough order of magnitude (ROM) estimate provides an estimate of what a project will cost. A ROM estimate can also be referred to as a ballpark estimate, a guesstimate, a swag, or a broad gauge. This type of estimate is done very early in a project or even before a project is officially started. Project managers and top management use this estimate to help make project selection decisions. The time frame for this type of estimate is often three or more years prior to project completion. A ROM estimate's accuracy is typically 250 percent to 1100 percent, meaning the project's actual costs could be 50 percent below the ROM estimate or 100 percent above. For example, the actual cost for a project with a ROM estimate of $100,000 could range from $50,000 to $200,000. For IT project estimates, this accuracy range is often much wider. Many IT professionals automatically double estimates for software development because of the history of cost overruns on IT projects.
- ✓ A budgetary estimate is used to allocate money into an organization's budget. Many organizations develop budgets at least two years into the future. Budgetary estimates are made one to two years prior to project completion. The accuracy of budgetary estimates is typically 210 percent to 125 percent, meaning the actual costs could be 10 percent less or 25 percent more than the budgetary estimate. For example, the actual cost for a project with a budgetary estimate of $100,000 could range from $90,000 to $125,000.
- ✓ A definitive estimate provides an accurate estimate of project costs. Definitive estimates are used for making many purchasing decisions for which accurate estimates are required and for estimating final project costs. For example, if a project involves purchasing 1,000 personal computers from an outside supplier in the next three months, a definitive estimate

would be required to aid in evaluating supplier proposals and allocating the funds to pay the chosen supplier. Definitive estimates are made one year or less prior to project completion. A definitive estimate should be the most accurate of the three types of estimates.

The accuracy of this type of estimate is normally 25 percent to 110 percent, meaning the actual costs could be 5 percent less or 10 percent more than the definitive estimate. For example, the actual cost for a project with a definitive estimate of $100,000 could range from $95,000 to $110,000.

Cost Estimation Tools and Techniques

As you can imagine, developing a good cost estimate is difficult. Fortunately, several tools and techniques are available to assist in creating one. Some of these tools and techniques include expert judgment, analogous cost estimating, bottom-up estimating, three-point estimating, parametric estimating, the cost of quality, project management estimating software, vendor bid analysis, and reserve analysis.

Typical Problems with IT Cost Estimates

- ✓ Estimates are done too quickly
- ✓ Lack of estimating experience
- ✓ Human beings are biased toward underestimation
- ✓ Management desires accuracy

4.4 Cost Budgeting

Determining the budget involves allocating the project cost estimate to individual material resources or work items over time. These material resources or work items are based on the activities in the WBS for the project. The project management plan, project documents, business documents, agreements, enterprise environmental factors and organizational process assets are all inputs for determining the budget. The main goal of the cost budgeting process is to produce a cost baseline for measuring project performance and to determine project funding requirements. The process may also result in project documents updates, such as items being added, removed, or modified in the scope statement or project schedule.

4.5 Cost Control

Controlling project costs includes monitoring cost performance, ensuring that only appropriate project changes are included in a revised cost baseline, and informing project stakeholders of authorized changes to the project that will affect costs.

The project management plan, project documents, project funding requirements, work performance data, and organizational process assets are inputs for controlling costs. Outputs of this process are work performance information, cost forecasts, change requests, project management plan updates, and project documents updates. Several tools and techniques assist in project cost control, including expert judgment, data analysis, project management information systems, and the to-complete performance index.

Earned Value Management

Earned value management (EVM) is a project performance measurement technique that integrates scope, time, and cost data. Given a cost performance baseline, project managers and their teams can determine how well the project is meeting scope, time, and cost goals by entering actual information and then comparing it to the baseline. As defined in Chapter 4, a baseline is a starting point, a measurement, or an observation that is documented so that it can be used for future comparison. Actual information includes whether or not a WBS item was completed, approximately how much of the work was completed, when the work actually started and ended, and how much the completed work actually cost. Earned value management involves calculating three values for each activity or summary activity from a project's WBS.

1. The planned value (PV) is the authorized budget assigned to scheduled

work. Suppose that a project included a summary activity of purchasing and installing a

new web server. Suppose further that, according to the plan, it would take one week and cost a total of $10,000 for the labor hours, hardware, and software. Therefore, the planned value (PV) for the activity that week is $10,000.

2. The actual cost (AC) is the realized cost incurred for the work performed on an activity during a specific time period. For example, suppose that it actually took two weeks and cost $20,000 to purchase and install the new web server. Assume that $15,000 of these actual costs were incurred

during Week 1 and $5,000 was incurred during Week 2. These amounts are the actual cost (AC) for the activity each week.

3. The earned value (EV) is the measure of work performed expressed in terms of the budget authorized for that work. It cannot be greater than the authorized PV budget for a component as it

Table 4.1earned value calculation

Activity	Week 1
Earned value (EV)	5,000
Planned value (PV)	10,000
Actual cost (AC)	15,000
Cost variance (CV)	−10,000
Schedule variance (SV)	−5,000
Cost performance index (CPI)	33%
Schedule performance index (SPI)	50%

Term	Formula
Earned value (EV)	EV = PV of all completed work
Cost variance (CV)	CV = EV − AC
Schedule variance (SV)	SV = EV − PV
Cost performance index (CPI)	CPI = EV/AC
Schedule performance index (SPI)	SPI = EV/PV
Estimate at completion (EAC)	EAC = BAC/CPI
Estimated to Complete (ETC)	ETC = EAC − AC

$$CV = 5{,}000 - 15{,}000 = -10{,}000$$
$$SV = 5{,}000 - 10{,}000 = -5{,}000$$
$$CPI = 5{,}000/15{,}000 = 33\%$$
$$SPI = 5{,}000/10{,}000 = 50\%$$

is calculated as the sum of the PV of the completed work. the earned value after one week is $5,000.18.

- ☞ Note that the formulas for variances and indexes start with EV, the earned value. Variances are calculated by subtracting the actual cost or planned value from EV, and indexes are

calculated by dividing EV by the actual cost or planned value. After you total the EV, AC, and PV data for all activities on a project, you can use the CPI and SPI to project how much it will cost and how long it will take to finish the project based on performance to date. Given the budget at completion and original time estimate, you can divide by the appropriate index to calculate the estimate at completion (EAC) and estimated time to complete, assuming that performance remains the same. There are no standard acronyms for the terms estimated time to complete or original time estimate. Cost variance (CV) is the earned value minus the actual cost. If cost variance is a negative number, it means that performing the work cost more than planned. If cost variance is a positive number, performing the work cost less than planned. Schedule variance (SV) is the earned value minus the planned value. A negative schedule variance means that it took longer than planned to perform the work, and a positive schedule variance means that the work took less time than planned.

The cost performance index (CPI) is the ratio of earned value to actual cost; it can be used to estimate the projected cost of completing the project. If the CPI is equal to one, or 100 percent, then the planned and actual costs are equal—the costs are exactly as budgeted. If the CPI is less than one or less than 100 percent, the project is over budget. If the CPI is greater than one or more than 100 percent, the project is under budget. The schedule performance index (SPI) is the ratio of earned value to planned value; it can be used to estimate the projected time to complete the project. Similar to the cost performance index, an SPI of one, or 100 percent, means the project is on schedule. If the SPI is greater than one or 100 percent, then the project is ahead of schedule. If the SPI is less than one or 100 percent, the project is behind schedule.

- ☞ Note that in general, negative numbers for cost and schedule variance indicate problems in those areas. Negative numbers mean the project is costing more than planned or taking longer than planned. Likewise, a CPI and an SPI of less than one or less than 100 percent also indicate problems.

Chapter Review Questions

Discussion Questions

1. What is cost and cost management?
2. Discuss about project cost management and importance of it?
3. Discuss about project cost management processes and the tools and techniques involved in each process?
4. Discuss about cost budgeting and the techniques used in developing cost budgeting?

5. Project Quality Management

Learning Objectives

After reading this chapter, you will be able to:

- ✓ Develop a justification for project quality management and its importance in achieving project success for information technology (IT) products and services
- ✓ Define project quality management and understand how quality relates to various aspects of IT projects
- ✓ Describe quality management planning and how quality and scope management are related
- ✓ Discuss the importance of managing quality and quality assurance
- ✓ Explain the main outputs of the quality control process
- ✓ List and describe the tools and techniques for quality control
- ✓ Summarize the contributions of noteworthy quality experts to modern
- ✓ quality management
- ✓ Describe how leadership, the cost of quality, organizational influences, expectations, cultural differences, and maturity models relate to improving quality in IT projects
- ✓ Discuss how software can assist in project quality management

5.1 Quality of IS Projects

Many aspects of our daily lives depend on high-quality IT products. Food is produced and distributed with the aid of computers; cars have computer chips to track performance; children use computers to help them learn in school; corporations depend on technology for many business functions; and millions of people rely on technology for entertainment and personal communications. Computing everywhere and the Internet of things, are expanding our reliance on IT to smart appliances and devices (TVs, refrigerators, thermostats, etc.), pay-as-you-go services, and much more. Many IT projects develop mission-critical systems that are used in life-and-death situations, such as navigation systems on aircraft and computer components built into medical equipment. Financial institutions and their customers also rely on high-quality information systems. Customers get very upset when systems provide inaccurate financial data or reveal

information to unauthorized users that could lead to identity theft. When one of these systems does not function correctly, it is much more than a slight inconvenience.

What is quality management

Project quality management is a difficult knowledge area to define. The International Organization for Standardization (ISO) defines quality as "the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs" (ISO8042:1994) or "the degree to which a set of inherent characteristics fulfils requirements" (ISO9000:2000). Many people spent many hours developing these definitions, yet they are still vague. Other experts define quality based on conformance to requirements and fitness for use. Conformance to requirements means that the project's processes and products meet written specifications. For example, if the project scope statement requires delivery of 100 computers with specific processors and memory, you could easily check whether suitable computers had been delivered. Fitness for use means that a product can be used as it was intended. If these computers were delivered without monitors or keyboards and were left in boxes on the customer's shipping dock, the customer might not be satisfied because the computers would not be fit for use. The customer may have assumed that the delivery included monitors and keyboards, unpacking the computers, and installation so they would be ready to use. The purpose of project quality management is to ensure that the project will satisfy the needs for which it was undertaken. Recall that project management involves meeting or exceeding stakeholder needs and expectations. The project team must develop good relationships with key stakeholders, especially the main customer for the project, to understand what quality means to them. After all, the customer ultimately decides if quality is acceptable. Many technical projects fail because the project team focuses only on meeting the written requirements for the main products being created and ignores other stakeholder needs and expectations for the project. For example, the project team should know what successfully delivering 100 computers means to the customer.

Quality, therefore, must be on an equal level with project scope, time, and cost. If a project's stakeholders are not satisfied with the quality of the project management or the resulting products of the project, the project team will need to adjust scope, time, and cost to satisfy the stakeholder. Meeting only written requirements for scope, time, and cost is not sufficient. To achieve

stakeholder satisfaction, the project team must develop a good working relationship with all stakeholders and understand their stated or implied needs.

5.2 Stages of IS Quality Management

Project quality management involves three main processes:

1. Planning quality management includes identifying which quality requirements and standards are relevant to the project and how to satisfy them. Incorporating quality standards into project design is a key part of quality planning. For an IT project, quality standards might include allowing for system growth, planning a reasonable response time for a system, or ensuring that the system produces consistent and accurate information. Quality standards can also apply to IT services. For example, you can set standards for how long it should take to get a reply from a help desk or how long it should take to ship a replacement part for a hardware item under warranty. The main outputs of planning quality management are a quality management plan, quality metrics, project management plan updates, and project documents updates. A metric is a standard of measurement. Examples of common metrics include failure rates of products, availability of goods and services, and customer satisfaction ratings.

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

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

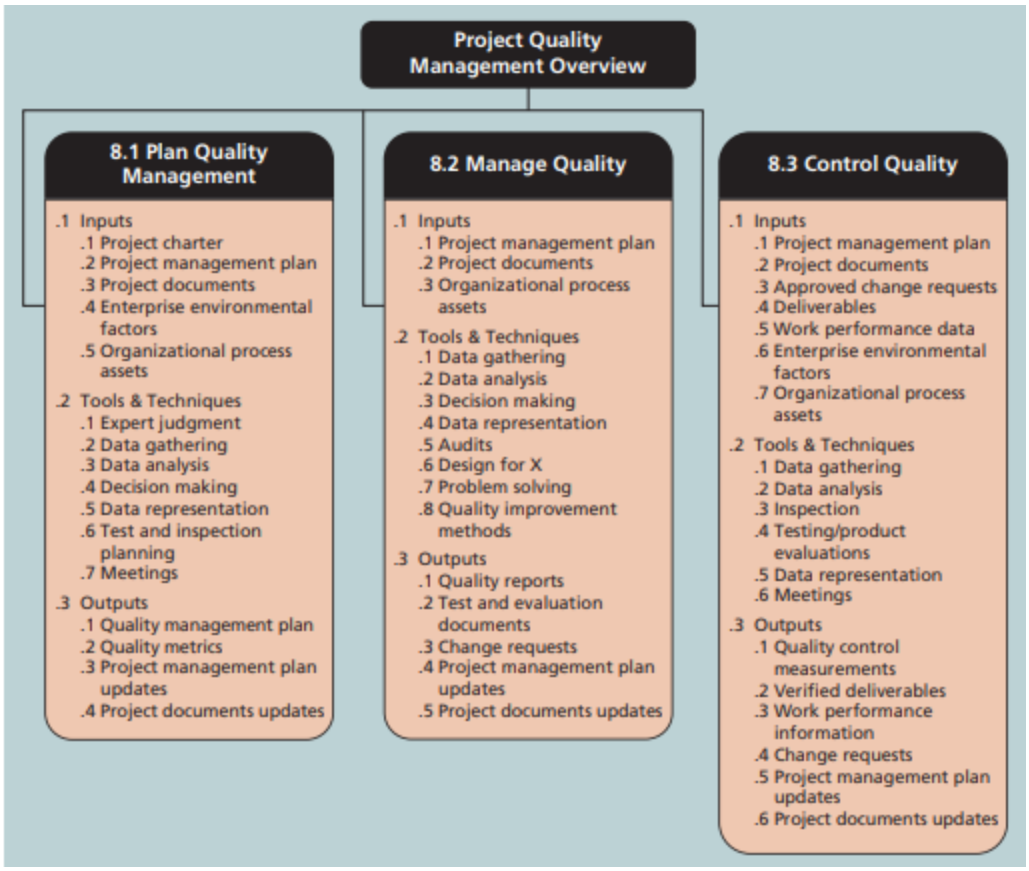


Figure 5.1 Quality management stages overview

5.2.1 Quality Planning

Project managers today have a vast knowledge base of information related to quality, and the first step to ensuring project quality management is planning. Planning quality management implies the ability to anticipate situations and prepare actions that bring about the desired outcome. The current thrust in modern quality management is the prevention of defects through a program of selecting the proper materials, training and indoctrinating people in quality, and planning a process that ensures the appropriate outcome. In project quality management planning, it is important to identify relevant quality standards for each unique project and to design quality into the products of the project and the processes involved in managing the project. Several tools and techniques are available for planning quality management. For example, design of experiments is a technique that helps identify which variables have the most influence on the overall outcome of a process. Understanding which variables affect outcome is a very important part of quality planning. For example, computer chip designers might want to determine which combination of materials and equipment will produce the most reliable chips at a reasonable cost.

You can also apply design of experiments to project management issues such as cost and schedule trade-offs. Junior programmers or consultants cost less than senior programmers or consultants, but you cannot expect them to complete the same level of work in the same amount of time. An appropriately designed experiment to compute project costs and durations for various combinations of junior and senior programmers or consultants can allow you to determine an optimal mix of personnel, given limited resources. Refer to the section on the Taguchi method later in this chapter for more information.

Quality planning also involves communicating the correct actions for ensuring quality in a format that is understandable and complete. In quality planning for projects, it is important to describe key factors that directly contribute to meeting the customer's requirements. Organizational policies related to quality, the particular project's scope statement and product descriptions, and related standards and regulations are all important input to the quality planning process. Important scope aspects of IT projects that affect quality include functionality and features, system outputs, performance, and reliability and maintainability.

Functionality is the degree to which a system performs its intended function.

Features are the system's special characteristics that appeal to users. It is important to clarify what functions and features the system must perform, and what functions and features are optional. System outputs are the screens and reports the system generates. It is important to define clearly what the screens and reports look like for a system.

Performance addresses how well a product or service performs the customer's intended use. To design a system with high-quality performance, project stakeholders must address many issues.

Reliability is the ability of a product or service to perform as expected under normal conditions.

Maintainability addresses the ease of performing maintenance on a product. Most IT products cannot reach 100 percent reliability, but stakeholders must define their expectations.

5.2.2 Quality Assurance

It is one thing to develop a plan for ensuring the quality of a project; it is another to ensure delivery of high-quality products and services. The term quality assurance is often used to describe the activities related to satisfying the relevant quality standards for a project. Managing quality includes all of the quality assurance activities plus product design and process improvements.

Important inputs for managing quality are the quality management plan, project documents, and organizational process assets. Many companies understand the importance of managing quality and have entire departments dedicated to it. They have detailed processes in place to make sure their products and services conform to various quality requirements. They also know they must offer those products and services at competitive prices. To be successful in today's competitive business environment, good companies develop their own best practices and evaluate other organizations' best practices to continuously improve the way they do business. The Japanese word for improvement or change for the better is kaizen; a kaizen approach has been used in many organizations since the end of World War II. Another popular term, lean, involves evaluating processes to maximize customer value while minimizing waste. Kanban, is a technique often used in lean.

Several tools used in quality planning can also be used in managing quality. Design of experiments, as described under quality planning, can also help ensure and improve product quality. Benchmarking generates ideas for quality improvements by comparing specific project practices or product characteristics to those of other projects or products within or outside the performing organization. For example, if a competitor has an EIS with an average downtime of only one hour a week, that might be a benchmark for which to strive.

An important tool for managing quality is a quality audit. A quality audit is a structured review of specific quality management activities that help identify lessons learned and that could improve performance on current or future projects.

Important inputs for performing quality assurance are the quality management plan, process improvement plan, quality metrics, quality control measurements, and project documents.

5.2.3 Quality Control

The main goal of quality control is to improve quality, the main outcomes of this process are acceptance decisions, rework, and process adjustments.

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

For example, the executive who sponsored development of the EIS in the chapter's opening case was obviously not satisfied with the system and hired an outside consultant, Scott Daniels, to lead a team to address and correct the quality problems.

Rework is action taken to bring rejected items into compliance with product requirements, specifications, or other stakeholder expectations. Rework often results in requested changes and validated defect repair, and it results from recommended defect repair or corrective or preventive actions. Rework can be very expensive, so the project manager must strive to do a good job of quality planning and quality assurance to avoid this need. Because the EIS did not meet all of the stakeholders' expectations for quality in the opening case, the medical instruments company was spending additional money for rework.

Process adjustments correct or prevent further quality problems based on quality control measurements. Process adjustments often result in updates to organization process assets and the project management plan. For example, Scott Daniels, the consultant in the opening case, might recommend that the medical instruments company purchase a faster server for the EIS to correct the response-time problems. This change would require changes to the project management plan because it would require more project-related work. The company also hired Scott to develop a plan to help prevent future IT project quality problems.

Two approaches are used for quality control:

- ✓ **Quality Review**: Principal method of validating the quality of a process or product

A team examines part or all of a process or system and its documentation to find potential problem

Types of review:

  - Inspections for defect removal(product)
  - Reviews for progress assessment (prod., process)
  - Quality reviews (product, standards)
- ✓ **Testing:** Identify what to review
  - Plan the review:
    - Select review techniques
    - Identify the review team
    - Select appropriate review checklist

        - Decide how much to review
    - Perform the review
    - Close the review

5.3 Quality Standards

Modern quality management requires customer satisfaction, prefers prevention to inspection, and recognizes management responsibility for quality. Several noteworthy people helped develop the following theories, tools, and techniques that define modern quality management.

ISO Standards

The International Organization for Standardization (ISO) is a network of national standards institutes that work in partnership with international organizations, governments, industries, businesses, and consumer representatives. ISO 9000, a quality system standard developed by the ISO, is a three-part, continuous cycle of planning, controlling, and documenting quality in an organization. According to the ISO website (www.iso.org) in January 2018, "The ISO 9000 family addresses various aspects of quality management and contains some of ISO's best-known standards. The standards provide guidance and tools for companies and organizations who want to ensure that their products and services consistently meet customer's requirements, and that quality is consistently improved." The ISO quality management standards and guidelines have earned a global reputation as the basis for establishing quality management systems. Standards continue to be updated, and new standards are developed as needed. For example, in 2013, ISO collaborated with the International Electrotechnical Commission (IEC) to publish a standard to help organizations integrate information security and service management.

ISO continues to offer standards to provide a framework for the assessment of software processes. The overall goals of a standard are to encourage organizations that are interested in improving quality of software products to employ proven, consistent, and reliable methods for assessing the state of their software development processes. They can also use their assessment results as part of coherent improvement programs. One of the outcomes of assessment and consequent improvement programs is reliable, predictable, and continuously improving software processes.

5.4 Tools and Techniques For Quality Control

- ✓ **Cause-and-effect diagrams** trace complaints about quality problems back to the responsible production operations.
- ✓ **A control chart** is a graphic display of data that illustrates the results of a process over time.
- ✓ **A check sheet** is used to collect and analyze data. It is sometimes called a tally sheet or checklist, depending on its format.
- ✓ **A scatter diagram** helps to show if there is a relationship between two variables.
- ✓ **A histogram** is a bar graph of a distribution of variables.
- ✓ **A Pareto chart** is a histogram that can help you identify and prioritize problem areas.
- ✓ **Flowcharts** are graphic displays of the logic and flow of processes that help you analyze how problems occur and how processes can be improved.

6. Project Human Resources Management

Learning Objectives

After reading this chapter, you will be able to:

- ✓ Explain the importance of good resource management on projects, including the current state of the global IT workforce and future implications for IT
- ✓ Define project resource management and understand its processes
- ✓ Summarize key concepts for managing people by understanding theories of motivation, influence, and power; how people and teams can become more effective; emotional intelligence; and leadership
- ✓ Discuss resource management planning and be able to create a human resource plan, project organizational chart, responsibility assignment matrix, and resource histogram
- ✓ Describe the process of estimating activity resources
- ✓ Discuss issues that are typically involved in resource acquisition, particularly as they involve resource assignments, resource loading, and resource leveling
- ✓ Assist in team development with training, team-building activities, and reward systems
- ✓ Explain and apply several tools and techniques to help manage a project team and summarize general advice on managing teams

6.0 introduction

Many corporate executives have said, "People are our most important asset." People determine the success and failure of organizations and projects. Most project managers agree that managing human resources effectively is one of the toughest challenges they face. Managing people is a vital component of project resource management, especially in the IT field—in which qualified people are often hard to find and keep. It is important to understand global IT workforce issues and their implications for the future.

6.1. What is Project Human Resources Management?

Project human resource management is a subset of project management that includes the processes required to make the most effective use of the people involved within a project. Processes including Organizational planning, Staff acquisition, Team development.

Project resource management includes the processes required to make the most effective use of the human and physical resources (facilities, equipment, materials, supplies, etc.) involved with a project. Human resource management includes all project stakeholders: sponsors, customers, project team members, support staff, suppliers supporting the project, and so on. Physical resources include facilities, equipment, materials, and supplies. Project resource management includes the following four processes:

1. **Planning resource management** involves deciding how to estimate, acquire, manage, and use project resources. The main outputs are a resource management plan, team charter, and project documents updates.

2**. Estimating activity resources** involves estimating human and physical resources needed to complete project work. Outputs include resource requirements, basis of estimates, a resource breakdown structure, and project documents updates.

3. Acquiring resources includes obtaining team members, facilities, equipment, materials, supplies, and other resources as needed. Outputs include physical and project team assignments, resource calendars, change requests, and updates to several documents.

4**. Developing the project team** involves building individual and group skills to enhance project performance. Team-building skills are often a challenge for many project managers. The main outputs of this process are team performance assessments, change requests, and updates to several documents.

5. Managing the project team involves tracking team member performance, motivating team members, providing timely feedback, resolving issues and conflicts, and coordinating changes to help enhance project performance. Outputs of this process include change requests, project management plan updates, project documents updates, and organizational process assets updates.

6. Controlling resources ensures that a project's physical resources are available as planned, monitoring the planned versus actual resource utilization, and taking corrective action when

needed. Outputs include work performance information, change requests, and updates to the project management plan and project documents.

6.2 Managing People

Industrial-organizational psychologists and management theorists have devoted extensive research and thought to the field of managing and leading people at work.

Psychosocial issues that affect how people work and how well they work include **motivation, influence and power**, **effectiveness**, **emotional intelligence**, and **leadership**. This section reviews the contributions of Abraham Maslow, Frederick Herzberg, David McClelland, and Douglas McGregor to an understanding of motivation; the work of H. J. Thamhain and D. L. Wilemon on influencing workers and reducing conflict; the effect of power on project teams; Stephen Covey's work on how people and teams can become more effective; Howard Gardner and Daniel Goleman's focus on emotional intelligence; and recent research on leadership. The final part of this section looks at some implications and recommendations for project managers.

Motivation Theories

Psychologists, managers, coworkers, teachers, parents, and most people in general struggle to understand what motivates people to do what they do. Intrinsic motivation causes people to participate in an activity for their own enjoyment. some people love to read, write, or play an instrument because it makes them feel good. Extrinsic motivation causes people to do something for a reward or to avoid a penalty.

Maslow's Hierarchy of Needs

Abraham Maslow, a highly respected psychologist who rejected the dehumanizing negativism of psychology in the 1950s, is best known for developing a hierarchy of needs.

Maslow argued that both schools of thought failed to recognize unique qualities of human behavior: love, self-esteem, belonging, self-expression, and creativity. He argued that these unique qualities enable people to make independent choices, which gives them full control of their destiny.

The bottom four needs in Maslow's hierarchy—physiological, safety, social, and esteem—are referred to as deficiency needs, and the highest level, self-actualization, is considered a growth need. Only after meeting deficiency needs can people act upon growth needs. Self-actualized

people are problem-focused, have an appreciation for life, are concerned about personal growth, and are able to have peak experiences.

Figure 6.1 Maslow's Hierarchy of Needs

Herzberg's Motivation-Hygiene Theory

Frederick Herzberg is best known for distinguishing between motivational factors and hygiene factors when considering motivation in work settings. He referred to factors that cause job satisfaction as motivators and factors that could cause dissatisfaction as hygiene factors.

He distinguished between

Motivational factors: achievement, recognition, the work itself, responsibility, advancement, and growth, which produce job satisfaction

Hygiene factors: cause dissatisfaction if not present, but do not motivate workers to do more. Examples include larger salaries, more supervision, and a more attractive work environment.

He argued that people want to actualize themselves by being able to use their creativity and work on challenging projects. They need stimuli to grow and advance, in accordance with Maslow's hierarchy of needs. Factors such as achievement, recognition, responsibility, advancement, and growth produce job satisfaction and are work motivators.

McClelland's Acquired-Needs Theory

David McClelland proposed that a person's specific needs are acquired or learned over time and shaped by life experiences. The main categories of acquired needs include achievement, affiliation, and power. Normally, one or two of these needs are dominant in people.

- ✓ **Achievement**: People who have a high need for achievement (nAch) seek to excel, and tend to avoid both low-risk and high-risk situations to improve their chances for achieving something worthwhile. Achievers need regular feedback and often prefer to work alone or with other high achievers. Managers should give high achievers challenging projects with achievable goals. Achievers should receive frequent performance feedback, and although money is not an important motivator to them, it is an effective form of feedback.
- ✓ **Affiliation**: People with a high need for affiliation (nAff) desire harmonious relationships with other people and need to feel accepted by others. They tend to conform to the norms of their work group and prefer work that involves significant personal interaction. Managers should try to create a cooperative work environment to meet the needs of people with a high need for affiliation.
- ✓ **Power:** People with a need for power (nPow) desire either personal power or institutional power. People who need personal power want to direct others and can be seen as bossy. People who need institutional power or social power want to organize others to further the goals of the organization. Management should provide such employees with the opportunity to manage others, emphasizing the importance of meeting organizational goals.

McGregor's Theory X and Theory Y

Douglas McGregor was one of the great popularizers of a human relations approach to management, and he is best known for developing Theory X and Theory Y.

McGregor found that although many managers spouted the right ideas, they actually followed a set of assumptions about worker motivation that he called Theory X (sometimes referred to as

classical systems theory). People who believe in Theory X assume that workers dislike and avoid work if possible, so managers must use coercion, threats, and various control schemes to have workers make adequate efforts to meet objectives. They assume that the average worker wants to be directed and prefers to avoid responsibility, has little ambition, and wants security above all else.

McGregor suggested a different series of assumptions about human behavior that he called Theory Y (sometimes referred to as human relations theory). Managers who believe in Theory Y assume that employees do not inherently dislike work, but consider it as natural as play or rest. The most significant rewards are the satisfaction of esteem and self-actualization needs, as described by Maslow. McGregor urged managers to motivate people based on Theory Y notions.

Influence and Power

Many people working on a project do not report directly to project managers, and project managers often do not have control over project staff who report to them.

H. J. Thamhain and D. L. Wilemon investigated the approaches that project managers use to deal with workers and how those approaches relate to project success. They identified nine influence bases that are available to project managers:

1. Authority: the legitimate hierarchical right to issue orders

2. Assignment: the project manager's perceived ability to influence a worker's later work assignments

3. Budget: the project manager's perceived ability to authorize others' use of discretionary funds

4. Promotion: the ability to improve a worker's position

5. Money: the ability to increase a worker's pay and benefits

6. Penalty: the project manager's perceived ability to dispense or cause punishment

7. Work challenge: the ability to assign work that capitalizes on a worker's enjoyment of doing a particular task, which taps an intrinsic motivational factor

8. Expertise: the project manager's perceived special knowledge that others deem important

9. Friendship: the ability to establish friendly personal relationships between the project manager and others

Influence is related to power, which is the ability to influence behavior to get people to do things they would not otherwise do. Power is much stronger than influence, because it is often used to force people to change their behavior. There are five main types of power, according to French and Raven's classic study, "The Bases of Social Power."

- ✓ **Coercive power** involves using punishment, threats, or other negative approaches to get people to do things they do not want to do.
- ✓ **Legitimate power** is getting people to do things based on a position of authority.
- ✓ **Expert power** involves using personal knowledge and expertise to get people to change their behavior
- ✓ **Reward power** involves using incentives to induce people to do things. Rewards can include money, status, recognition, promotions, and special work assignments.
- ✓ **Referent power** is based on a person's own charisma. People who have referent power are held in very high regard; others will do what they say based on that regard.

Covey and Improving Effectiveness

Stephen Covey, author of The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change, expanded on the work done by Maslow, Herzberg, and others to develop an approach for helping people and teams become more effective. Covey's first three habits of effective people—be proactive, begin with the end in mind, and put first things first—help people achieve a private victory by becoming independent. After achieving independence, people can then strive for interdependence by developing the next three habits—think win/win; seek first to understand, then to be understood; and synergize. (Synergy is the concept that the whole is equal to more than the sum of its parts.) Finally, everyone can work on Covey's seventh habit—sharpen the saw—to develop and renew their physical, spiritual, mental, social, and emotional selves.

Project managers can apply Covey's seven habits to improve effectiveness on projects, as follows:

1. Be proactive. Covey, like Maslow, believes that people have the ability to be proactive and choose their responses to different situations. Project managers must be proactive in anticipating and planning for problems and inevitable changes on projects.

2. Begin with the end in mind. Covey suggests that people focus on their values, what they want to accomplish, and how they want to be remembered in their lives. He suggests writing a mission statement to help achieve this habit. Many organizations and projects have mission statements that help them focus on their main purpose.

3. Put first things first. Covey developed a time management system and matrix to help people prioritize their time. He suggests that most people need to spend more time doing things that are important, but not urgent.

4. Think win/win. Covey presents several paradigms of interdependence; think win/win is the best choice in most situations. When you use a win/win paradigm, parties in potential conflict work together to develop new solutions that benefit all parties. Project managers should strive to use a win/win

approach in making decisions, but in competitive situations they sometimes must use a win/lose paradigm.

5. Seek first to understand, then to be understood. Empathic listening is listening with the intent to understand. It is more powerful than active listening because you set aside your personal interests and focus on truly understanding the other person.

6. Synergize. A project team can synergize by creating collaborative products that are much better than a collection of individual efforts. Covey also emphasizes the importance of valuing differences in others to achieve synergy. Synergy is essential to many highly technical projects;

7. Sharpen the saw. When you practice sharpening the saw, you take time to renew yourself physically, spiritually, mentally, and socially. The practice of self-renewal helps people avoid burnout. Project managers must make sure that they and their project teams have time to retrain, reenergize, and occasionally even relax to avoid burnout.

Emotional Intelligence

As the title suggests, Howard Gardner's book **Frames of Mind**: The Theory of Multiple Intelligences introduced the concept of using more than one way to think of and measure human intelligence. Gardner suggested the need to develop both interpersonal intelligence (the capacity to understand the motivations, intentions, and desires of others) and intrapersonal intelligence (the capacity to understand oneself, one's feelings, and motivations).

The concept emotional intelligence—knowing and managing one's own emotions and understanding the emotions of others for improved performance.

Leadership

A leader focuses on long-term goals and big-picture objectives while inspiring people to reach those goals. Leadership is a soft skill, and there is no one best way to be a leader.

6.3. Organizational Planning

To develop a resource management plan for a project, you must identify and document project resources, roles, responsibilities, skills, and reporting relationships. The project resource management plan can be separated into a human resource management plan and a physical resource management plan. The human resource plan often includes an organizational chart for the project, detailed information on roles and responsibilities, and a staffing management plan. In addition, project teams can create a team charter to provide guidance on how they will operate.

Organizational planning involves identifying, documenting, and assigning project roles, responsibilities, and reporting relationships. Outputs and processes include:

- ✓ project organizational charts
- ✓ work definition and assignment process
- ✓ responsibility assignment matrixes
- ✓ resource histograms

Project Organizational Charts

Organizations have many types of structures (functional, matrix, etc.). It can be very difficult to manage such a diverse group of people, so it is important to provide a clear organizational structure for a project. After identifying important skills and the types of people needed to staff a project, the project manager should work with top management and project team members to create an organizational chart for the project.

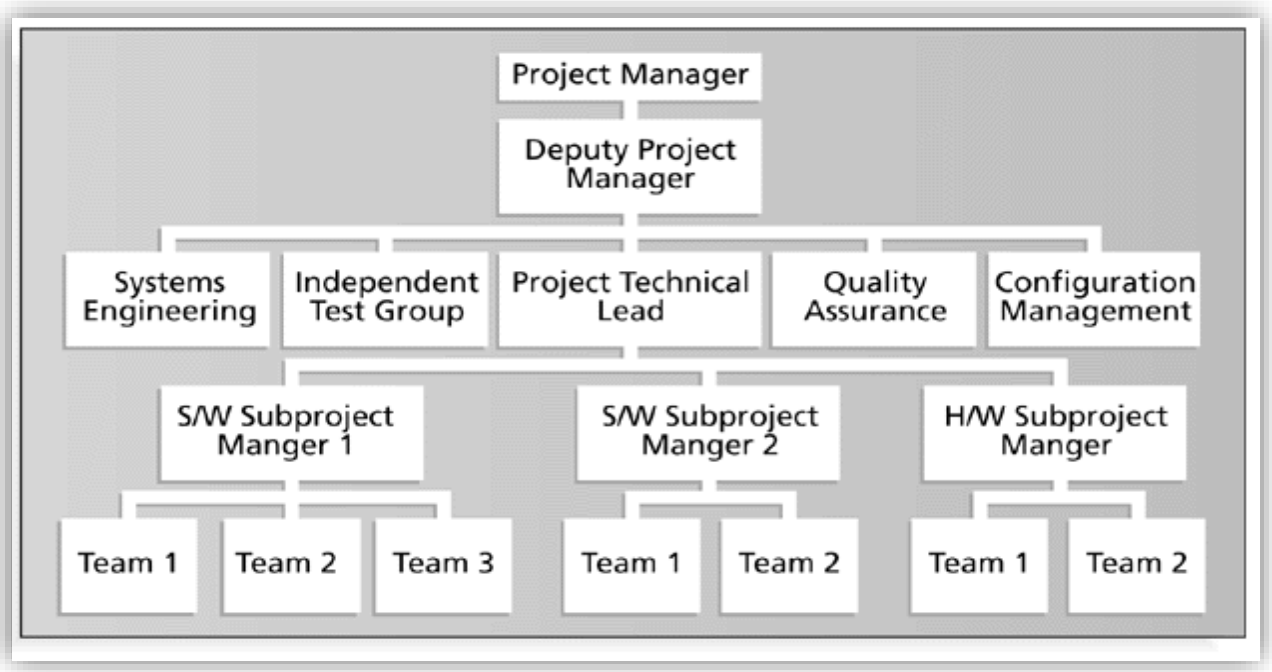


Figure 6.0.2 Sample Organizational Chart for A Large It Project

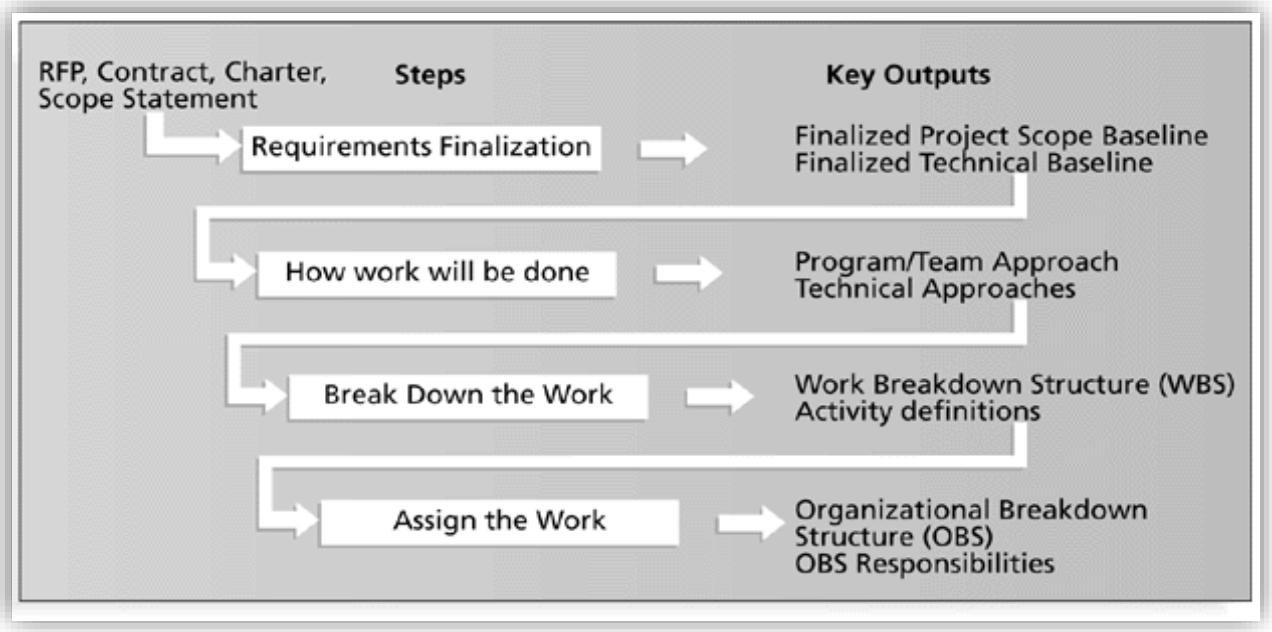


Figure 6.0.3 Work Definition and Assignment Process

Responsibility Assignment Matrix (RAM)

A responsibility assignment matrix (RAM) maps the work of the project, as described in the WBS, to the people responsible for performing the work.

Some organizations use **RACI** charts to show four key roles for project stakeholders:

- ✓ **R**esponsibility: Who does the task?
- ✓ **A**ccountability: Who signs off on the task or has authority for it?
- ✓ **C**onsultation: Who has information necessary to complete the task?
- ✓ **I**nformed: Who needs to be notified of task status and results?

Table 6.1 Sample Responsibility Assignment Matrix (RAM)

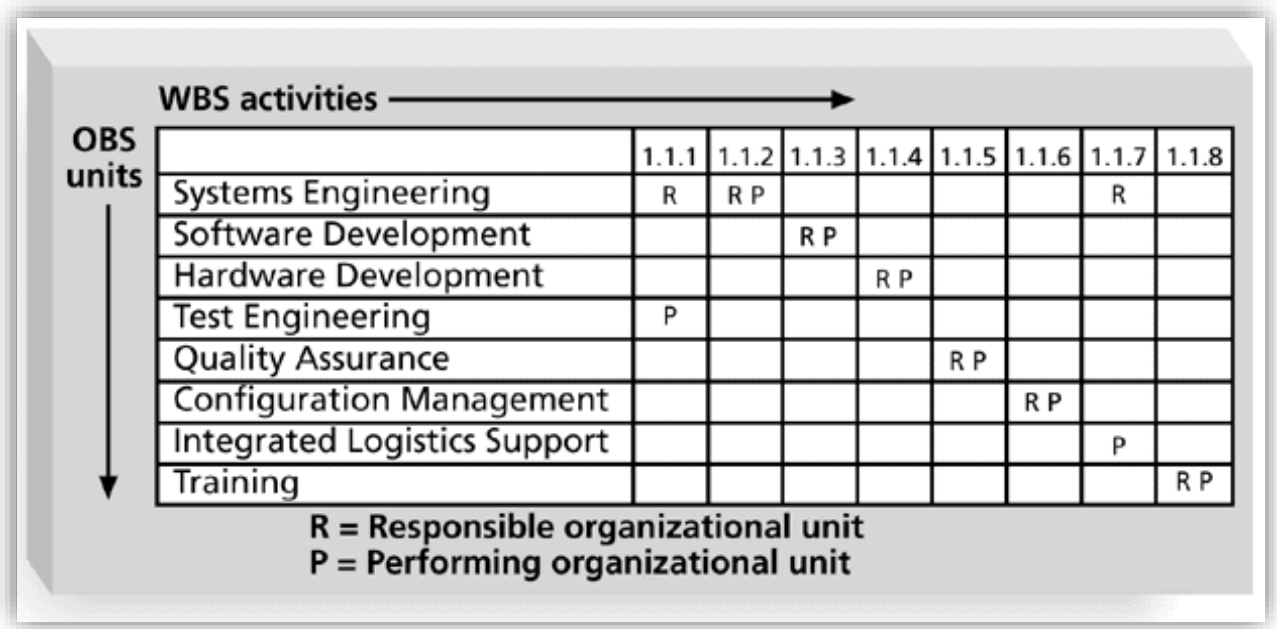


Table 6.2 RAM Showing Stakeholder Roles

Items	Stakeholders A	B	C	D	E
Unit Test	S	A	I	I	R
Integration Test	S	P	A	I	R
System Test	S	P	A	I	R
User Acceptance Test	S	P	I	A	R

A = Accountable
P = Participant
R = Review Required
I = Input Required
S = Sign-off Required

6.4. Issues in Project Staff Acquisition and Team Development

A staffing management plan describes when and how people will be added to the project team and taken off it. The staffing management plan often includes a resource histogram, which is a column chart that shows the number of resources assigned to a project over time.

Staffing plans and good hiring procedures are important in staff acquisition, as are incentives for recruiting and retention. Some companies give their employees one dollar for every hour a new person they helped. Some organizations allow people to work from home as an incentive

Research shows that people leave their jobs because they don't make a difference, don't get proper recognition, aren't learning anything new, don't like their coworkers, and want to earn more money.

Resource Loading and Leveling

Resource loading refers to the amount of individual resources an existing project schedule requires during specific time periods. Resource histograms show resource loading Over-allocation means more resources than are available are assigned to perform work at a given time.

Resource Leveling

Resource leveling is a technique for resolving resource conflicts by delaying tasks. The main purpose of resource leveling is to create a smoother distribution of resource usage and reduce over-allocation.

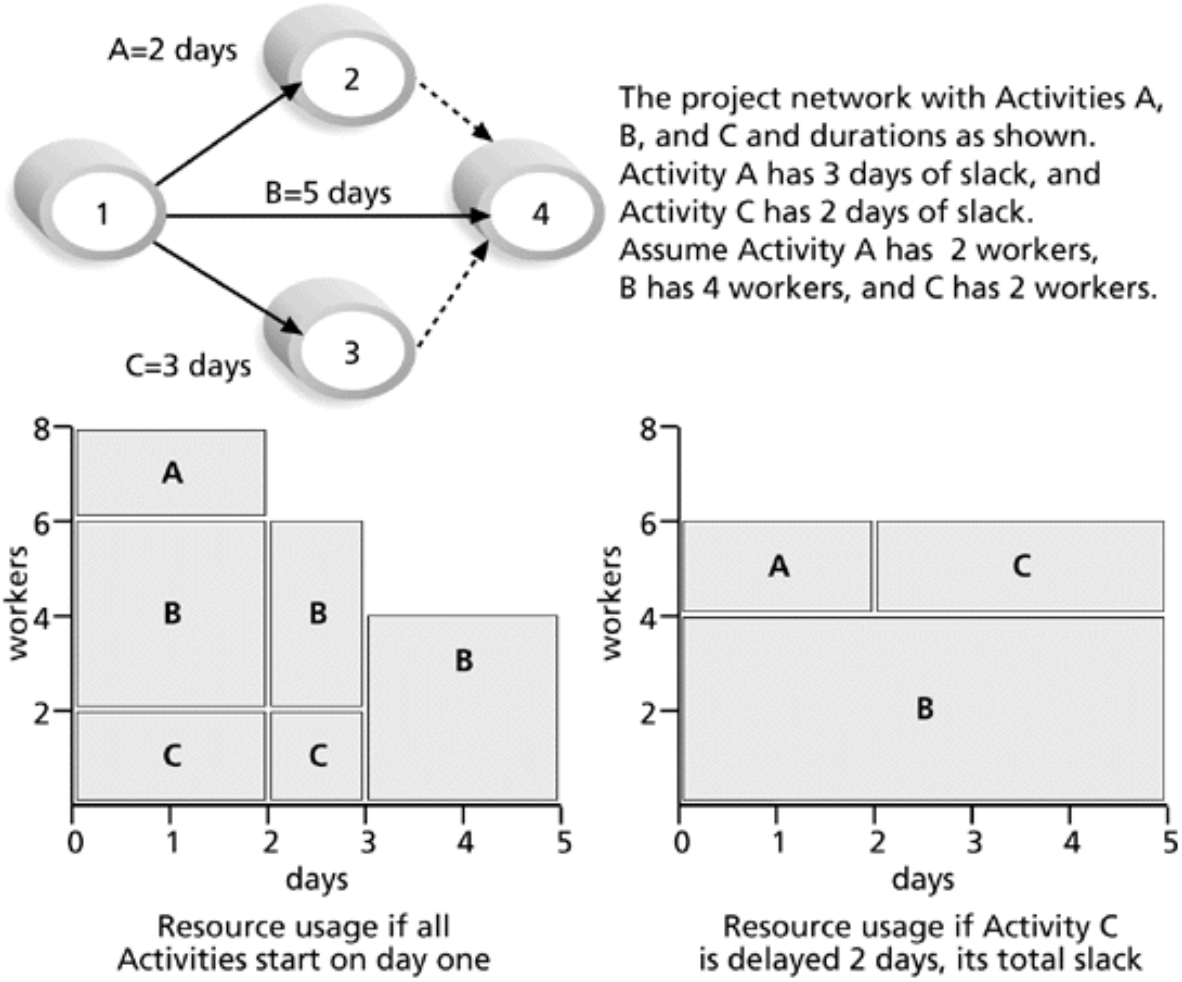


Figure 6.4 Resource Leveling Example

Team Development

It takes teamwork to successfully complete most projects. Training can help people understand themselves, each other, and how to work better in teams.

Team building activities includes physical challenges and psychological preference indicator tools.

The main goal of team development is to help people work together more effectively to improve project performance. First published in 1965 and modified in the 1970s, Dr. Bruce Tuckman's

model of team development remains relevant today. The Tuckman model describes five stages of team development:

1. **Forming** involves the introduction of team members, either at the initiation of the team or as new members are introduced. This stage is necessary, but little work is actually achieved.

2. **Storming** occurs when team members have different opinions for how the team should operate. People test each other, and there is often conflict within the team.

3. **Norming** is achieved when team members have developed a common working method, and cooperation and collaboration replace the conflict and mistrust of the previous phase.

4. **Performing** occurs when the emphasis is on reaching the team's goals rather than working on team process. Relationships are settled, and team members are likely to build loyalty toward each other. At this stage, the team is able to manage tasks that are more complex and cope with greater change.

5. **Adjourning** involves the break-up of the team after it successfully reaches its goals and completes the work.

It is important for people to understand and value each other's differences to work effectively as a team. Three common exercises used in mental team building include the Myers-Briggs Type Indicator, Wilson Learning Social Styles Profile, and the DISC Profile.

7. Project Communication Management

Learning Objectives

After reading this chapter, you will be able to:

- ✓ Discuss the role of soft skills in IT project management, and highlight the importance of good communications as one means of achieving project success
- ✓ Review key concepts related to communications
- ✓ Explain the elements of planning project communications and how to create a communications management plan
- ✓ Describe how to manage communications, including communication technologies, media, and performance reporting
- ✓ Discuss methods for controlling communications to ensure that information needs are met throughout the life of the project
- ✓ List various methods for improving project communications, such as running effective meetings, using various technologies effectively, and using templates

7.0 introduction

Many experts agree that the greatest threat to the success of any project, especially IT projects, is a failure to communicate. Many problems in other knowledge areas, such as an unclear scope or unrealistic schedules, indicate problems with communication. It is crucial for project managers and their teams to make good communication a priority, especially with top management and other key stakeholders. The IT field is constantly changing, and these changes come with a great deal of technical jargon. When computer professionals communicate with people who aren't as proficient with or knowledgeable about computers—a group that includes many business professionals and senior managers—technical jargon can often complicate matters and create confusion. Even though most people use computers today, the gap between users and developers increases as

technology advances. This gap in knowledge and experience causes some of the communication problems between technical professionals and their business colleagues. Of course, not every computer professional is a poor communicator, but most people in any field can improve their communication skills.

Keys to Good Communications

Project managers say they spend as much as 90 percent of their time communicating. Just as it is difficult to understand people and their motivations, it is also difficult to communicate with people effectively. Several important concepts can help, such as:

- ✓ focusing on individual and group communication needs,
- ✓ using formal and informal methods for communicating,
- ✓ providing important information in an effective and timely manner,
- ✓ setting the stage for communicating bad news, and
- ✓ understanding communication channels.

The goal of project communications management is to ensure timely and appropriate generation, collection; dissemination, storage, and disposition of project information. There are three main processes in project communications management:

- ✓ Planning communications management involves determining the information and communications needs of the stakeholders. Who needs what information? When will they need it? How will the information be given to them? The outputs of this process include a communications management plan and project documents updates.
- ✓ Managing communications involves creating, distributing, storing, retrieving, and disposing of project communications based on the communications management plan. The main outputs of this process are project communications, project documents updates, project management plan updates, and organizational process assets updates
- ✓ Controlling communications involves monitoring and controlling project communications to ensure that stakeholder communication needs are met.

7.1. Communications Planning

Because communication is so important on projects, every project should include a communications management plan a document that guides project communications. The communications management plan should address the following items:

- ✓ Stakeholder communications requirements
- ✓ Information to be communicated, including format, content, and level of detail
- ✓ Who will receive the information and who will produce it
- ✓ Suggested methods or technologies for conveying the information
- ✓ Frequency of communication
- ✓ Escalation procedures for resolving issues
- ✓ Revision procedures for updating the communications management plan
- ✓ A glossary of common terminology

7.2. Information Distribution

Managing communications is a large part of a project manager's job. Getting project information to the right people at the right time and in a useful format is just as important as developing the information in the first place. The stakeholder communications analysis serves as a good starting point for managing communications. Project managers and their teams must decide who receives particular information, but they must also determine the best way to create and distribute the information. Is it sufficient to send written reports for project information? Is text appropriate,

or would visuals or even videos communicate the information better? Are meetings alone effective in distributing some project information? Are meetings and written communications both required for project information? What is the best way to provide information to virtual team members?

During project execution, project teams must address important considerations for managing information, and they often end up updating business processes through improved communications.

After answering key questions related to project communications, project managers and their teams must decide on the best way to create and distribute the information. Important considerations include the use of technology, the appropriate methods and media to use, and performance reporting.

Using Technology to Enhance Information Creation and Distribution

Technology can facilitate the process of creating and distributing information, when used effectively. Most people and businesses rely on e-mail, instant messaging, websites, telephones, cell phones, texting, and other technologies to communicate. Using a project management information system, you can create and organize project documents, schedules, meeting minutes, and customer requests, and make them available in an electronic format.

Selecting the Appropriate Communication Methods and Media

There are three broad classifications for communication methods:

1. *Interactive communication*: As the name implies, two or more people interact to exchange information via meetings, phone calls, or video conferencing. This method is usually the most effective way to ensure common understanding.
2. *Push communication*: Information is sent or pushed to recipients without their request via reports, e-mails, faxes, voice mails, and other means. This method ensures that the information is distributed, but does not ensure that it was received or understood.
3. *Pull communication*: Information is sent to recipients at their request via Web sites, bulletin boards, e-learning, knowledge repositories like blogs, and other means.

7.3. Performance Reporting

Another important tool for managing project communications is performance reporting. Performance reporting keeps stakeholders informed about how resources are being used to achieve project objectives. It also motivates workers to have some progress to report

Performance reports are normally provided as progress reports or status reports. Many people use the two terms interchangeably, but some people distinguish between them as follows:

- ✓ **Progress reports** describe what the project team has accomplished during a certain period. Many projects have each team member prepare a monthly report or sometimes a weekly progress report. Team leaders often create consolidated progress reports based on the information received from team members.

- ✓ **Status reports** describe where the project stands at a specific point in time. Status reports address where the project stands in terms of the triple constraint, meeting scope, time, and cost goals. How much money has been spent to date? How long did it take to do certain tasks?

Is work being accomplished as planned? Status reports can take various formats depending on the stakeholders' needs. As described in Chapter 2, when using agile project management, progress is communicated via daily Scrum meetings and burndown charts.

Forecasts predict future project status and progress based on past information and trends. How long will it take to finish the project based on how things are going? How much more money will be needed to complete the project?

7.4. Administrative Closure

This details all the activities, interactions, and related roles and responsibilities of the project team members and other stakeholders involved in executing administrative closure procedure for the project. It is concerned with generating, gathering, and disseminating information to formalize phase or project completion. A project or phase of a project requires closure

Administrative closure produces

- ✓ project archives
- ✓ formal acceptance
- ✓ lessons learned

7.5. Suggestions for Improving Project communications

Good communication is vital to the management and success of IT projects. So far in this chapter, you have learned that project communications management can ensure that essential information reaches the right people at the right time, that feedback and reports are appropriate and useful, and that there are formalized processes for planning, managing, and controlling communications.

Developing Better Communication Skills

Some people seem to be born with great communication skills. Others seem to have a knack for picking up technical skills. It is rare to find someone with a natural ability for both. Both types of skills, however, can be developed. Most IT professionals enter the field because of their technical skills. Most find, however, that communication skills are the key to advancing in their careers, especially if they want to become good project managers.

Communication skills training usually includes role-playing activities in which participants learn concepts such as building rapport.

Running Effective Meetings

expectations, roles, relationships, and commitment to the project. However, a poorly run meeting can have a detrimental effect on a project.

The following guidelines can help improve time spent at meetings:

1. Determine if a meeting can be avoided
2. Define the purpose and intended outcome of the meeting.
3. Determine who should attend the meeting
4. Provide an agenda to participants before the meeting
5. Prepare handouts and visual aids, and make logistical arrangements ahead of time
6. Run the meeting professionally.
7. Set the ground rules for the meeting.
8. Build relationships

Using E-Mail, Instant Messaging, Texting, Kanban Boards, and Collaborative Tools Effectively

Because most people use e-mail and other electronic communication tools now, communications should improve, right? Not necessarily. In fact, few people have received any training or guidelines on when or how to use e-mail, instant messaging, texting, video conferencing, kanban boards, or other collaborative tools, such as Microsoft SharePoint portals, Google Docs, or wikis.

Using Templates for Project Communications

Many intelligent people have a hard time writing a performance report or preparing a 10-minute technical presentation for a customer review. Some people in these situations are too embarrassed to ask for help. To make it easier to prepare project communications, project managers need to provide examples and templates for common project communications such as project descriptions, project charters, monthly performance reports, and issue logs.

8. Project Risk Management

Learning Objectives

After reading this chapter, you will be able to:

- ✓ Explain the concept of risk as it relates to project management, and list the advantages of managing project risks according to best practices
- ✓ Discuss the elements of planning risk management and the contents of a risk management plan
- ✓ List common sources of risks on information technology (IT) projects
- ✓ Describe the process of identifying risks and create a risk register and risk report
- ✓ Discuss qualitative risk analysis and explain how to calculate risk factors, create probability/impact matrixes, and apply the Top Ten Risk Item Tracking technique to rank risks
- ✓ Explain quantitative risk analysis and how to apply decision trees, simulation, and sensitivity analysis to quantify risks
- ✓ Provide examples of using different risk response planning strategies to address both negative and positive risks
- ✓ Discuss how to monitor risks

8.1. The Importance of Project Risk Management

Project risk management is the art and science of identifying, analyzing, and responding to risk throughout the life of a project and in the best interests of meeting project objectives. A frequently overlooked aspect of project management, risk management can often result in significant improvements in the ultimate success of projects. Risk management can have a positive impact on selecting projects, determining their scope, and developing realistic schedules and cost estimates. It helps project stakeholders understand the nature of the project, involves team members in defining strengths and weaknesses, and helps to integrate the other project management knowledge areas. Good project risk management often goes unnoticed, unlike crisis management, which indicates an obvious danger to the success of a project. The crisis, in turn, receives the intense interest of the entire project team. Resolving a crisis has much greater visibility, often accompanied by rewards from management, than successful risk management.

In contrast, when risk management is effective, it results in fewer problems, and for the few problems that exist, it results in more expeditious resolutions.

Basic dictionary definition states that risk is "the possibility of loss or injury." This definition highlights the negativity often associated with risk and points out that uncertainty is involved. Project risk management involves understanding potential problems that might occur on the project and how they might impede project success, this type of risk as a negative risk or threat. However, there are also positive risks or opportunities, which can result in good outcomes for a project. A general definition of a project risk, therefore, is an uncertainty that can have a negative or positive effect on meeting project objectives.

Managing negative risks involves a number of possible actions that project managers can take to avoid, lessen, change, or accept the potential effects of risks on their projects. Positive risk management is like investing in opportunities. It is important to note that risk management is an investment—costs are associated with it.

Several risk experts suggest that organizations and individuals should strive to find a balance between risks and opportunities in all aspects of projects and their personal lives. The idea of striving for balance suggests that different organizations and people have different attitudes toward risk. Some organizations or people have a neutral tolerance for risk, some have an aversion to risk, and others are risk-seeking. These three preferences are part of the utility theory of risk.

Risk utility is the amount of satisfaction or pleasure received from a potential payoff.

The goal of project risk management can be viewed as minimizing potential negative risks while maximizing potential positive risks. The term known risks is sometimes used to describe risks that the project team has identified and analyzed. Known risks can be managed proactively. However, unknown risks, or risks that have not been identified and analyzed, cannot be managed.

As you can imagine, good project managers know it is good practice to take the time to identify and manage project risks. **Six major processes** are involved in risk management:

1. **Planning risk management** involves deciding how to approach and plan risk management activities for the project. The main output of this process is a risk management plan.

2**. Identifying risks** involves determining which risks are likely to affect a project and documenting the characteristics of each. The main outputs of this process are a risk register, risk report, and project documents updates.

3. **Performing qualitative risk** analysis involves prioritizing risks based on their probability of occurrence and impact. After identifying risks, project teams can use various tools and techniques to rank risks and update information in the risk register. The main outputs are project documents updates.

4. **Performing quantitative risk analysis** involves numerically estimating the effects of risks on project objectives. The main outputs of this process are project documents updates.

5. **Planning risk responses** involves taking steps to enhance opportunities and reduce threats to meeting project objectives. Using outputs from the preceding risk management processes, project teams can develop risk response strategies that often result in change requests, updates to the project management plan and project documents.

6. Implementing risk responses, just as it sounds, involves implementing the risk response plans. Outputs include change requests and project documents updates.

7. Monitoring risk involves monitoring identified and residual risks, identifying new risks, carrying out risk response plans, and evaluating the effectiveness of risk strategies throughout the life of the project. The main outputs of this process include work performance information, change requests, and updates to the project management plan, project documents, and organizational process assets.

8.2. Common Sources of Risk in IT projects

Several studies have shown that IT projects share some common sources of risk. Many organizations develop their own risk questionnaires. Broad categories of risks described on these questionnaires might include the following:

- ✓ **Market risk**: If the IT project will create a new product or service, will it be useful to the organization or marketable to others? Will users accept and use the product or service? Will someone else create a better product or service faster, making the project a waste of time and money?

- ✓ **Financial risk**: Can the organization afford to undertake the project? How confident are stakeholders in the financial projections? Will the project meet NPV, ROI, and payback estimates? If not, can the organization afford to continue the project? Is this project the best way to use the organization's financial resources?
- ✓ **Technology risk**: Is the project technically feasible? Will it use mature, leading-edge, or bleeding-edge technologies? When will decisions be made on which technology to use? Will hardware, software, and networks function properly? Will the technology be available in time to meet project objectives? Could the technology be obsolete before a useful product can be created? You can also break down the technology risk category into hardware, software, and network technology, if desired.
- ✓ **People risk**: Does the organization have people with appropriate skills to complete the project successfully? If not, can the organization find such people? Do people have the proper managerial and technical skills? Do they have enough experience? Does senior management support the project? Is there a project champion? Is the organization familiar with the sponsor or customer for the project? ow good is the relationship with the sponsor or customer?
- ✓ **Structure/process risk**: What degree of change will the new project introduce into user areas and business procedures? How many distinct user groups does the project need to satisfy? With how many other systems does the new project or system need to interact? Does the organization have processes in place to complete the project successfully?

8.3. Risk Identification

Identifying risks is the process of understanding what potential events might hurt or enhance a particular project. It is important to identify potential risks early, but you must also continue to identify risks based on the changing project environment. Also remember that you cannot manage risks if you do not identify them first. By understanding common sources of risks and reviewing a project's project management plan, project documents, agreements, procurement documents, enterprise environmental factors, and organizational process assets project managers and their teams can identify many potential risks.

Another consideration for identifying risks is the likelihood of advanced discovery, which is often viewed at a program level rather than a project level.

Suggestions for Identifying Risks

There are several tools and techniques for identifying risks. Project teams often begin this process by reviewing project documentation, recent and historical information related to the organization, and assumptions that might affect the project. After identifying potential risks at the initial meeting, the project team might then use different information-gathering techniques to further identify risks. Four common techniques include brainstorming, the Delphi technique, interviewing, and root cause analysis.

- ✓ ***Brainstorming*** is a technique by which a group attempts to generate ideas or find a solution for a specific problem by amassing ideas spontaneously and without judgment. This approach can help the group create a comprehensive list of risks to address later during qualitative and quantitative risk analysis.
- ✓ **The Delphi technique** is an approach to gathering information that helps prevent some of the negative group effects found in brainstorming. The basic concept of the Delphi technique is to derive a consensus among a panel of experts who make predictions about future developments.
- ✓ **Interviewing** is a fact-finding technique for collecting information in face-to-face, phone, email, or instant-messaging discussions. Interviewing people with similar project experience is an important tool for identifying potential risks
- ✓ Another technique is a **SWOT analysis** of strengths, weaknesses, opportunities, and threats, which is often used in strategic planning. SWOT analysis can also be used during risk identification by having project team's focus on the broad perspectives of potential risks for particular projects

8.4. Risk Quantification

A) Performing Qualitative Risk Analysis

Qualitative risk analysis involves assessing the likelihood and impact of identified risks to determine their magnitude and priority. This section describes how to use a probability/ impact matrix to produce a prioritized list of risks. It also provides examples of using the Top Ten Risk Item Tracking technique to produce an overall ranking for project risks and to track trends in qualitative risk analysis.

The following methods are used for qualitative risk analysis.

- ✓ **Using Probability/Impact Matrixes to Calculate Risk Factors**

A project manager can chart the probability and impact of risks on a probability/ impact matrix or chart, which lists the relative probability of a risk occurring and the relative impact of the risk occurring. Many project teams would benefit from using this simple technique to help them identify risks that need attention. To use this approach, project stakeholders list the risks they think might occur on their projects. They then label a risk as having a high, medium, or low probability of occurrence and a high, medium, or low impact if it does occur.

- ✓ **Top Ten Risk Item Tracking**

Top Ten Risk Item Tracking is a qualitative risk analysis tool. In addition to identifying risks, it maintains an awareness of risks throughout the life of a project by helping to monitor risks. Using this tool involves establishing a periodic review of the project's most significant risk items with management; similar reviews can also occur with the customer.

The main output of qualitative risk analysis is updating the risk register. The ranking column of the risk register should be filled in, along with a numeric value or rating of high, medium, or low for the probability and impact of the risk event. Additional information is often added for risk events, such as identification of risks that need more attention in the near term or those that can be placed on a watch list. A watch list is a list of risks that have low priority but are still identified as potential risks.

B) Performing Quantitative Risk Analysis

Quantitative risk analysis often follows qualitative risk analysis, yet both processes can be done together or separately. On some projects, the team may only perform qualitative risk analysis. The nature of the project and availability of time and money affect which risk analysis techniques are used. Large, complex projects involving leading-edge technologies often require extensive quantitative risk analysis. This section focuses on using the quantitative risk analysis and modeling techniques of decision tree analysis, simulation, and sensitivity analysis.

Decision Trees and Expected Monetary Value

A decision tree is a diagramming analysis technique used to help select the best course of action when future outcomes are uncertain. A common application of decision tree analysis involves

calculating expected monetary value. Expected monetary value (EMV) is the product of a risk event probability and the risk event's monetary value.

Sensitivity Analysis

Many people are familiar with using sensitivity analysis to see the effects of changing one or more variables on an outcome. For example, many people perform a sensitivity analysis to determine their monthly payments for a loan given different interest rates or periods of the loan. What will your monthly mortgage payment be if you borrow $100,000 for 30 years at a 6 percent rate? What will the payment be if the interest rate is 7 percent? What will the payment be if you decide to pay off the loan in 15 years at 5 percent?

Simulation

A more sophisticated technique for quantitative risk analysis is simulation, which uses a representation or model of a system to analyze its expected behavior or performance. Most simulations are based on some form of Monte Carlo analysis. Monte Carlo analysis simulates a model's outcome many times to provide a statistical distribution of the calculated results.

8.5. Risk Response Development and Control

After an organization identifies and quantifies risks, it must develop an appropriate response to them. Developing a response to risks involves developing options and defining strategies for reducing negative risks and enhancing positive risks.

The five basic response strategies for negative risks are as follows:

- ✓ **Risk avoidance or eliminating** a specific threat, usually by eliminating its causes. Of course, not all risks can be eliminated, but specific risk events can be. For example, a project team may decide to continue using a specific piece of hardware or software on a project because the team knows it works. Other products that could be used on the project may be available, but if the project team is unfamiliar with them, they could cause significant risk. Using familiar hardware or software eliminates this risk.
- ✓ **Risk acceptance** or accepting the consequences if a risk occurs. For example, a project team planning a big project review meeting could take an active approach to risk by having a contingency or backup plan and contingency reserves if the team cannot get approval for a

specific meeting site. On the other hand, the team could take a passive approach and accept whatever facility the organization provides.

- ✓ **Risk transference** or shifting the consequence of a risk and responsibility for its management to a third party. For example, risk transference is often used in dealing with financial risk exposure. A project team may purchase special insurance or warranty protection for specific hardware needed for a project. If the hardware fails, the insurer must replace it within a specified period of time.
- ✓ **Risk mitigation** or reducing the impact of a risk event by reducing the probability of its occurrence. Suggestions for reducing common sources of risk on IT projects were provided at the beginning of this chapter. Other examples of risk mitigation include using proven technology, having competent project personnel, using various analysis and validation techniques, and buying maintenance or service agreements from subcontractors.
- ✓ **Risk escalation** or notifying a higher-level authority. If the risk is outside of the scope of the project or the proposed response is outside of the project manager's authority, it would make sense to escalate the risk to a higher-level manager within the organization.

The main executing process performed as part of project risk management is implementing risk responses as defined in the process to plan risk responses. Key outputs include change requests and project documents updates (i.e. issue log, lessons-learned register, project team assignments, risk register, and risk report).

Monitoring Risks

Monitoring risks involves ensuring the appropriate risk responses are performed, tracking identified risks, identifying and analyzing new risk, and evaluating the effectiveness of risk management throughout the entire project. Project risk management does not stop with the initial risk analysis. Identified risks may not materialize, or their probabilities of occurrence or loss may diminish.

Tools and techniques for monitoring risks include data analysis, audits, and meetings. Outputs include work performance information, change requests, and updates to the project management plan, project documents, and organizational process assets.

9. Project Procurement Management

Learning Objectives

After reading this chapter, you will be able to:

- ✓ Explain the importance of project procurement management and the increasing use of outsourcing for information technology (IT) projects
- ✓ Describe the work involved in planning procurements for projects, including determining the proper type of contract to use and preparing a procurement management plan, statement of work, source selection criteria, and make-or-buy analysis
- ✓ Discuss how to conduct procurements and strategies for obtaining seller responses, selecting sellers, and awarding contracts
- ✓ Describe the process of controlling procurements by managing procurement relationships and monitoring contract performance

9.0 introduction

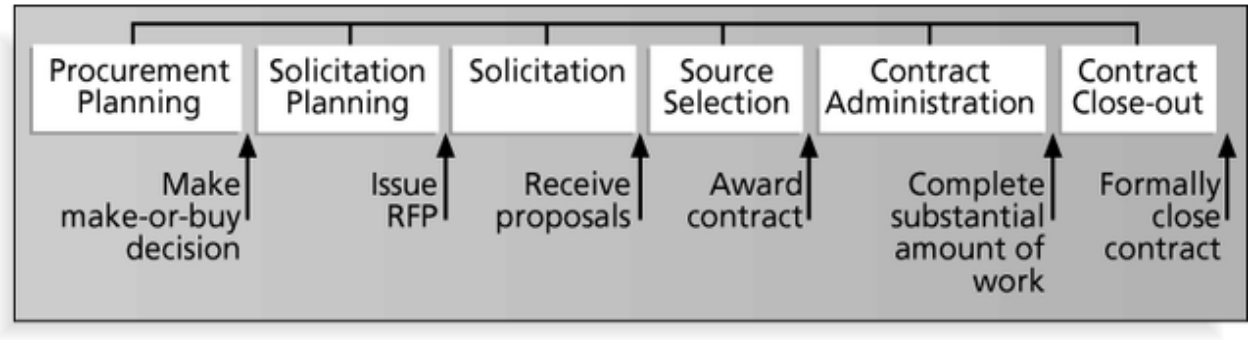


Figure 9.1 procurement overview

9.1. Importance of Project Procurement Management

Procurement means acquiring goods and services from an outside source. The term procurement is widely used in government; many private companies use the terms purchasing and outsourcing. Organizations or individuals who provide procurement services are referred to as suppliers, vendors, contractors, subcontractors, or sellers; of these terms, suppliers is the most widely used. Many IT projects involve the use of goods and services from outside the organization. The Project Management Institute defines an outside source as a source outside the project team, so the same

organization can be a supplier to the project team, or the project team can be a supplier to another group in the organization.

In fact, many IT departments in organizations are in direct competition with outside vendors, and they are subject to the same kind of requirements definition, statements of work, and bids. The rules and methods of sound project procurement practices are good to follow regardless of who provides the services to whom.

Organizations are turning to outsourcing to accomplish the following:

- ✓ **Access skills and technologies**: Organizations can gain access to specific skills and technologies when they are required by using outside resources. As mentioned earlier, a shortage of qualified personnel is the main reason that companies outsource IT services. A project may require experts in a particular field for several months, or it might require specific technologies from an outside source. Planning for this procurement ensures that the needed skills and technologies will be available for the project.
- ✓ **Reduce both fixed and recurrent costs**: Outsourcing suppliers often can use economies of scale that may not be available to the client alone, especially for hardware and software. It can also be less expensive to outsource some labor costs to other organizations in the same country or offshore. Companies can use outsourcing to reduce labor costs on projects by avoiding the costs of hiring, firing, and reassigning people to projects or paying their salaries when they are between projects.
- ✓ **Allow the client organization to focus on its core business**: Most organizations are not in business to provide IT services, yet many have spent valuable time and resources on IT functions when they should have focused on core competencies such as marketing, customer service, and new product design. By outsourcing many IT functions, employees can focus on jobs that are critical to the success of the organization.
- ✓ **Provide flexibility**. Outsourcing to provide extra staff during periods of peak workloads can be much more economical than trying to staff entire projects with internal resources. Many companies cite better flexibility in staffing as a key reason for outsourcing.
- ✓ **Increase accountability**. A well-written contract—a mutually binding agreement that obligates the seller to provide specified products or services and obligates the buyer to pay for them—can clarify responsibilities and sharpen focus on key deliverables of a project. Because

contracts are legally binding, there is more accountability for delivering the work as stated in the contract.

Project procurement management includes the processes required to acquire goods and services for a project from outside the performing organization. Organizations can be either the buyer or the seller of products or services under a contract or other agreement. There are three main processes in project procurement management:

1. Planning procurement management involves determining what to procure and when and how to do it. In procurement planning, one must decide what to outsource, determine the type of contract, and describe the work for potential sellers. Sellers are providers, contractors, or suppliers who provide goods and services to other organizations. Outputs of this process include a procurement management plan, procurement strategy, bid documents, procurement statement of work, source selection criteria, make-or-buy decisions, independent cost estimates, change request, project documents updates, and organizational process assets updates.

2. Conducting procurements involves obtaining seller responses, selecting sellers, and awarding contracts. Outputs include selected sellers, agreements, change requests, and updates to the project management plan, project documents, and organizational process assets.

3. Controlling procurements involves managing relationships with sellers, monitoring contract performance, making changes as appropriate, and closing out contracts. The main outputs of this process include closed procurements, work performance information, procurement documentation updates, change requests, project management plan updates, project documents updates, and organizational process assets.

9.2. Procurement Planning

Planning procurements involves identifying which project needs can best be met by using products or services outside the organization. It involves deciding whether to procure, how to procure, what to procure, how much to procure, and when to procure. An important output of this process is the make-or-buy decision, in which an organization decides whether it should make certain products and perform certain services inside the organization, or if it is better to buy those products and services from an outside organization. If there is no need to buy products or services from outside the organization, then further procurement management is not needed. Inputs needed for planning procurements include the project charter, business documents, the project management plan,

project documents enterprise environmental factors, and organizational process assets, such as types of contracts.

Types of Contracts

Contract type is an important consideration in procurement management. Different types of contracts can be used in different situations. **Three broad** categories of contracts are fixed price or lump sum, cost reimbursable, and time and material. A single contract can actually include all three of these categories if it makes sense for a particular procurement. For example, you could have a contract with a seller that includes purchasing specific hardware for a fixed price or lump sum, some services that are provided on a cost-reimbursable basis, and other services that are provided on a time-and-material basis. Project managers and their teams must understand and decide which approaches to use to meet their project needs. It is also important to understand when and how to take advantage of unit pricing in contracts.

Cost reimbursable contracts

Cost plus incentive fee (CPIF): the buyer pays the seller for allowable performance costs plus a predetermined fee and an incentive bonus

Cost plus fixed fee (CPFF): the buyer pays the seller for allowable performance costs plus a fixed fee payment usually based on a percentage of estimated costs

Cost plus percentage of costs (CPPC): the buyer pays the seller for allowable performance costs plus a predetermined percentage based on total costs

Tools and Techniques for Planning Procurement Management

Several tools and techniques are available to help project managers and their teams in planning procurement management, including make-or-buy analysis (a type of data gathering), expert judgment, and market research (a type of data gathering).

Make-or-Buy Analysis: is a general management technique used to determine whether an organization should make a product or perform a service inside the organization or buy it from someone else. This form of analysis involves estimating the internal costs of providing a product or service and comparing the estimate to the cost of outsourcing.

Expert Judgment Experts both from inside and outside an organization can provide excellent advice in planning purchases and acquisitions. Project teams often need to consult experts within their organization as part of good business practice.

Market Research Market research is very important in planning procurements. Many potential suppliers are often available for goods and services, so the project team must choose suppliers carefully.

The procurement management plan is a document that describes how the procurement processes will be managed, from developing documentation for making outside purchases or acquisitions to contract closure. Like other project plans, contents of the procurement management plan will vary with project needs. The following materials can be included in a procurement management plan:

- ✓ Guidelines for types of contracts to be used in different situations
- ✓ Standard procurement documents or templates to be used, if applicable
- ✓ Guidelines for creating contract work breakdown structures, statements of work, and other procurement documents
- ✓ Roles and responsibilities of the project team and related departments, such as the purchasing or legal department
- ✓ Guidelines for using independent estimates to evaluate sellers
- ✓ Suggestions for managing multiple providers
- ✓ Processes for coordinating procurement decisions with other project areas, such as scheduling and performance reporting
- ✓ Constraints and assumptions related to purchases and acquisitions
- ✓ Lead times for purchases and acquisitions
- ✓ Risk mitigation strategies for purchases and acquisitions, such as insurance contracts and bonds
- ✓ Guidelines for identifying prequalified sellers and organizational lists of preferred sellers
- ✓ Procurement metrics to assist in evaluating sellers and managing contracts

9.3. Solicitation

Solicitation Planning: Describing requirements for the products or services desired from the procurement and identifying potential sources or sellers (contractors, suppliers, or providers who provide goods and services to other organizations).

Solicitation: Obtaining information, quotes, bids, offers, or proposals from sellers, as appropriate.

Statement of Work The statement of work (SOW) is a description of the work required for the procurement. Some organizations use the term statement of work for a document that describes internal work as well.

Procurement or Bid Documents

Planning procurements also involves preparing the documents needed for potential sellers to bid on a project and determining the evaluation criteria for the contract award. The project team often uses standard forms and expert judgment as tools to help create relevant procurement documents and evaluation criteria.

9.4. Source Selection

Source Selection: Choosing from among potential suppliers through a process of evaluating potential sellers and negotiating the contract.

Involves:

- ✓ Evaluating proposals or bids from sellers.
- ✓ Choosing the best one.
- ✓ Negotiating the contract.
- ✓ Awarding the contract.

It is very important for organizations to prepare some form of evaluation criteria for source selection, preferably before they issue a formal RFP. Organizations use criteria to rate or score proposals, and they often assign a weight to each criterion to indicate its importance.

Some IT projects also require potential sellers to deliver a technical presentation as part of their proposal. The proposed project manager should lead the potential seller's presentation team. When the outside project manager leads the proposal presentation, the organization can build a relationship with the potential seller from the beginning. Visits to contractor sites can also help the buyer get a better feeling for the seller's capabilities and management style.

Be careful in selecting suppliers and writing their contracts

- ✓ Many dot-com companies were created to meet potential market needs, but many went out of business, mainly due to poor business planning, lack of senior management operations experience, lack of leadership, and lack of visions.
- ✓ Check the stability of suppliers
- ✓ Even well-known suppliers can impede project success. Be sure to write and manage contracts well with all suppliers.

Seller selection process

- ✓ Organizations often do an initial evaluation of all proposals and bids and then develop a short list of potential sellers for further evaluation.
- ✓ Sellers on the short list often prepare a best and final offer
- ✓ Final output is a contract signed by the buyer and the selected seller.

9.5. Contract Administration

Contract Administration: Managing the relationship with the selected seller.

Contract administration ensures that the seller's performance meets contractual requirements. Contracts are legal relationships, so it is important that legal and contracting professionals be involved in writing and administering contracts. Many project managers ignore contractual issues, which can result in serious problems

Suggestions on change control for contracts

Changes to any part of the project need to be reviewed, approved, and documented by the same people in the same way that the original part of the plan was approved. Evaluation of any change should include an impact analysis. How will the change affect the scope, time, cost, and quality of the goods or services being provided? Changes must be documented in writing. Project team members should also document all important meetings and telephone calls. Project managers and teams should stay closely involved to make sure the new system will meet business needs and work in an operational environment. Have backup plans. Use tools and techniques, such as a contract change control system, buyer-conducted performance reviews, inspections and audits, and so on.

9.6. Contract Close-out

Contract Closeout: Completing and settling each contract, including resolving any open items.

Involves completing and settling contracts and resolving any open items.

The project team should:

- ✓ Determine if all work was completed correctly and satisfactorily.
- ✓ Update records to reflect final results.
- ✓ Archive information for future use.
- ✓ The contract itself should include requirements for formal acceptance and closure.

10. Project Management Process Groups

Learning Objectives

After reading this chapter, you will be able to:

- ✓ Describe the five project management process groups, the typical level of activity for each, and the interactions among them
- ✓ Relate the project management process groups to the project management knowledge areas
- ✓ Discuss how organizations develop information technology (IT) project management methodologies to meet their needs

10.1 Introduction to Project Management Process Groups

Project management is an integrative endeavor. Decisions and actions taken in one knowledge area at a certain time usually affect other knowledge areas. Managing these interactions often requires making trade-offs among the project's scope, time, and cost. A project manager may also need to make trade-offs between knowledge areas, such as between managing risk and resources. Consequently, you can view project management as a number of related processes.

A process is a series of actions directed toward a particular result. Project management process groups progress from initiating activities to planning activities, executing activities, monitoring and controlling activities, and closing activities.

One project might have concept, development, implementation, and close-out phases, and another might have initial, intermediate, and final phases. But all projects and all project phases need to include all five process groups. You cannot equate process groups with project phases. For example, project managers and teams need to reexamine the business need for the project, part of monitoring and controlling activities, during every phase of the project life cycle to determine if the project is worth continuing.

- ✓ **Initiating** processes include defining and authorizing a project or project phase. Initiating processes take place during each phase of a project. For example, in the close-out phase, initiating processes are used to ensure that the project team completes all the work, that someone documents lessons learned, and that the customer accepts the work.

- ✓ **Planning** processes include devising and maintaining a workable scheme to ensure that the project addresses the organization's needs. Projects include several plans, such as the scope management plan, schedule management plan, cost management plan, and procurement management plan. These plans define each knowledge area as it relates to the project at a particular point in time. For example, a project team must develop a plan to define the work needed for the project, to schedule activities related to that work, to estimate costs for performing the work, and to decide what resources to procure to accomplish the work. To account for changing conditions on the project and in the organization, project teams often revise plans during each phase of the project life cycle. The project management plan, which is described in Chapter 4, coordinates and encompasses information from all other plans.
- ✓ **Executing** processes include coordinating people and other resources to carry out the various plans and create the products, services, or results of the project or phase. Examples of executing processes include directing and managing project work, managing project knowledge, acquiring resources, and conducting procurements.
- ✓ **Monitoring and controlling** processes include regularly measuring and monitoring progress to ensure that the project team meets the project objectives. The project manager and staff monitor and measure progress against the plans and take corrective action when necessary. A common monitoring and controlling process is reporting performance, where project stakeholders can identify any necessary changes that may be required to keep the project on track.
- ✓ **Closing** processes include formalizing acceptance of the project or project phase and ending it efficiently. Administrative activities are often involved in this process group, such as archiving project files, documenting lessons learned, and receiving formal acceptance of the delivered work as part of the phase or project

10.2. Project Initiation

In project management, initiating includes recognizing and starting a new project. An organization should put considerable thought into project selection to ensure that it initiates the right kinds of projects for the right reasons. It is better to have a moderate or even small amount of success on an important project than huge success on a project that is unimportant. The selection of projects for initiation is therefore crucial, as is the selection of project managers. Ideally, the project

manager would be involved in initiating a project, but often the project manager is selected after many initiation decisions have already been made.

To officially initiate the project management intranet site project, Erica knew that the main tasks were to identify all of the project stakeholders and to develop the project charter. The main outputs are a project charter and a stakeholder register. Additionally, outputs useful for initiating projects are a stakeholder management strategy and a formal project kick-off meeting. The following are included in the initiation process group:

- ✓ Identifying Project Stakeholders
- ✓ Drafting the Project Charter
- ✓ Holding a Project Kick-Off Meeting

The Initiating Process Group includes the following project management processes:

- ✓ **Develop Project Charter**
- ✓ **Develop Preliminary Project Scope Statement**: This is the process necessary for producing a preliminary high-level definition of the project using the Project Charter with other inputs to the initiating processes.

10.3. Project Planning

Planning is often the most difficult and unappreciated process in project management. Because planning is not always used to facilitate action, many people view planning negatively. The main purpose of project plans, however, is to guide project execution. To guide execution, plans must be realistic and useful, so a fair amount of time and effort must go into the planning process. People who are knowledgeable about the work need to plan the work. There are many potential outputs from the planning process group, and every knowledge area is included.

The Planning Process Group includes the following project management processes:

- ✓ 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 Resource Planning
- ✓ Communications Planning
- ✓ Risk Management Planning
- ✓ Risk Identification
- ✓ Qualitative Risk Analysis
- ✓ Quantitative Risk Analysis
- ✓ Risk Response Planning
- ✓ Plan Purchases and Acquisitions
- ✓ Plan Contracting

10.4. Project Executing

Executing the project involves taking the necessary actions to complete the activities in the project plan. The products of the project are created during project execution, and it usually takes the most resources to accomplish this process. The Executing Process Group includes the following project management processes:

- ✓ Direct and mange project execution
- ✓ Perform Quality Assurance
- ✓ Acquire Project Team
- ✓ Develop Project Team
- ✓ Information Distribution
- ✓ Request Seller Responses
- ✓ Select Sellers

10.5. Project Controlling and Configuration Management

Monitoring and controlling is the process of measuring progress toward project objectives, monitoring deviation from the current plan, and taking corrective action to match progress with the current plan. Monitoring and controlling is done throughout the life of a project and involves all 10 project management knowledge areas. The Monitoring and Controlling Process Group includes the following project management processes:

- ✓ 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

10.6. Project Closing

The closing process involves gaining stakeholder and customer acceptance of the final products and services and then bringing the project or project phase to an orderly end. It includes verifying that all of the deliverables are complete, and it often includes a final project report and presentation.

Even though many IT projects are canceled before completion, it is still important to formally close any project and reflect on what can be learned to improve future projects. The Closing Process Group includes the following project management processes:

- ✓ Close Project
- ✓ Contract Closure

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