**2. THE PROJECT MANAGEMENT AND INFORMATION TECHNOLOGY CONTEXT**

**Week 2 Topics**

- A systems views of project management.

- Understanding organizations

- Stakeholder management

- Project phases and project life cycle

- Context of information technology projects.

**Objectives:**

After reading this chapter; you will be able to:

1. Describe the systems view of project management and how It applies to information technology projects

2. Understand organizations, including the four frames, organizational structures and organizational culture

3. Explain why stakeholder management and top management commitment are critical for a project's success

4. Understand the concept of a project phase and the project life cycle and distinguish between project development and product development.

5. Discuss the unique attributes and diverse nature of information technology projects

**Introduction**

Many of the theories and concepts of project management are not difficult to understand.

What *is,* difficult is implementing them in various environments. Project managers must consider many different issues when managing projects. Just as each project is unique, so is its environment. This chapter discusses some of the components involved in understanding the project environment, such as using a systems approach, understanding organizations, managing stakeholders, matching product life cycles to the project environment, and understanding the context of information technology projects.

**Systems view of project management**

Even though projects are temporary and intended to provide a unique product or service,

you cannot run projects in isolation. If project managers lead projects in Isolation, it is unlikely that those projects will ever truly serve the needs of the organization. Therefore, projects must operate in a broad organizational environment, and project managers need to consider projects within the greater organizational context. To handle complex situations effectively project managers need to take a holistic view of a project and understand how it relates to the larger organization. Systems thinking describe this holistic View of carrying out projects within the context of the organization.

**Systems approach**

The term systems approach emerged in the 1950s to describe a holistic and analytical

approach to solving complex problems that includes using a systems philosophy, systems analysis, and systems management. A systems philosophy is an overall model for thinking about things as systems. Systems are sets of interacting components working within an environment to fulfill some purpose.

For example the human body is system consisting of many subsystems - the nervous system, the skeletal system, the circulatory system, the digestive system, and so on. Systems analysis is a problem-solving approach that requires defining the scope of the system, dividing it into its components and then identifying and evaluating its problems, opportunities constraints, and needs. Once this is completed, the systems analyst then' Examines alternative solutions for improving the current situation identifies an optimum, or at least satisfactory, solution or action plan and examines plan against the entire system. Systems management addresses the business, technological, and organizational issues associated with creating maintaining, and making a change to a system.

Using a systems approach is critical to successful project management. Top management and project managers must follow a systems philosophy to understand how projects relate to the whole organization. They must use systems analysis to address needs with a problem-solving approach. They must use systems management to identify key business, technological, and organizational issues related to each project in order to identify and satisfy key stakeholders and do what is best for the entire organization.

**Understanding Organizations**

The systems approach requires that project managers always view their projects in the

context of the larger organization. Organizational issues are often the most difficult part of working on and managing projects. For example, many people believe that most projects fail because of company politics. Project managers often do not spend enough time identifying all the stakeholders involved in projects, especially the people opposed to the projects. Similarly, they often do not consider the political context of a project or the culture of the organization. To improve the success rate of information technology projects, it is important for project managers to develop a better understanding of people as well as organizations.

**Four Frames of Organizations**

Organizations can be viewed as having four different frames: structural, human

resources, political and symbolic:

• The structural frame deals with how the organization is structured (usually depicted in an organizational chart) and focuses on different groups' roles and responsibilities in order to meet the goals and policies set by top management. This frame is very rational and focuses on coordination and control.

• The human resources frame focuses on producing harmony between the needs of the organization and the needs of the people. It recognizes that there are often mismatches between the needs of the organization and the needs of individuals and groups and works to resolve any potential problem.

• The political frame addresses organizational and personal politics. Politics in organizations take the form of competition among groups or individuals for power and leadership. The political frame assumes that organizations are coalitions composed of varied individuals and interest groups. Often, important decisions need to be made based on allocation of scarce resources. Competition for scarce resources makes conflict a central issue in organizations. Project managers must pay attention to politics and power if they are to be effective

• The symbolic frame focuses on symbols and meanings. What is most important about any event in an organization is not what actually happened, but what it means. Was it a good sign for CEO kick of meeting for a project, or was it a threat? Symbolic frame also relates to the company's culture. How many hours do they work? How do they run' meetings?

**Organizational Structures**

Many discussions of organizations focus on organizational structure. Three general

classifications of organizational structures are functional, project, and matrix. Most companies today involve all three structures somewhere in the organization, but one is usually most common.

• A **functional organizational structure** is the hierarchy most people think of when picturing an organizational chart. Functional managers or vice presidents in specialties such as engineering, manufacturing, information technology (IT), and human resources (HR) report to the chief executive officer (CEO). Their staffs have specialized skills in their respective disciplines. For example, most colleges and universities have very strong functional organizations. Only faculty in the Business department teach business courses; faculty in the History department teach history; faculty in the Art department teach art, and so on.

• A **project organizational structure** also has a hierarchical structure, but instead of functional managers or vice presidents reporting to the CEO, program managers report to the CEO. Their staffs have a variety of skills needed to complete the projects within their programs. An organization that uses this structure earns their revenue primarily from performing projects for other groups under contract. For example, many defense, architectural, engineering, and consulting companies use a project organizational structure. These companies often hire people specifically to work on particular projects.

• A **matrix organizational structure** represents the middle ground between functional and project structures. Personnel often report to both a functional manager and one or more project managers. For example, information technology personnel at many companies often split their time between two or more projects, but they report to their manager in the Information Technology department. Project managers in matrix organizations have staff from various functional areas working on their projects, organizational structures can be strong, weak, or balanced, based on the amount of control exerted by the project managers.

**Organizational culture**

**Organizational culture** is a set of shared assumptions, values, and behaviors that

characterize the functioning of an organization.

It often includes elements of all four frames described above, Organizational culture is very powerful, and many people believe the underlying causes of many companies' problems are not in the organizational structure or staff; they are in the culture. It is also important to note that the same organization can have different sub-cultures. The information technology department may have a different organizational culture than the finance department, for example. Some organizational cultures make it easier to manage projects.

There are ten characteristics of organizational culture:

1. Member identity: The degree to which employees identify with the organization as a whole rather than with their type of job or profession.

2. Group emphasis: The degree to which work activities are organized around groups or teams, rather than individuals. An organizational culture that emphasizes group work is best for managing projects.

3. People focus: The degree to which management's decisions take into account the effect of outcomes on people within the organization. A project manager might assign tasks to certain people without considering their individual needs.

4. Unit integration: The degree to which units or departments within an organization are encouraged to coordinate with each other. Most project managers strive for strong unit integration to deliver a successful product, service, or result. An organizational culture with strong unit integration makes the project manager's job easier.

5. Control: The degree to which rules, policies, and direct supervision are used to oversee and control employee behavior. Experienced project managers know it is often best to balance the degree of control to get good project results.

6. Risk tolerance: The degree to which employees encouraged to be aggressive, innovative, and risk seeking. An organization with higher risk tolerance is often best for project management since projects often involve new technologies, ideas, and processes.

7. Reward criteria: The degree to which employees are rewarded, such as promotions and salary increase, according to performance.

8. Conflict tolerance: The degree to which employees are encouraged to air conflicts and criticism openly. It is very important for the all project stakeholders to have good communications, so it is best to work in an organization where people feel comfortable discussing conflict openly.

9. Means-ends orientation: The degree to which management focuses on outcomes rather than on techniques and processes used to achieve results. An organization with a balanced approach in this area is often best for project work.

10. Open-systems focus: .The degree to which the organization monitors and respond to changes in external environment.

**Stakeholder Management**

Stakeholders can be internal to the organization, external to the organizations, involved in

the project, or simply affected by project. Internal stakeholders generally include the project sponsors the project team, support staff and internal customers for the project. Other internal stakeholders include top management, other function managers and other project managers. Since organizations have limited resources, projects affected top management, other functional managers and other project manager by using some of the organization's limited resources. Thus, while additional internal stakeholders may not be directly involved in the project, they are still stakeholders because the project affects them in some way. External project stakeholders include the project's customers (if they are external to the organization), competitors, suppliers, and other external groups

potentially involved in or affected by the project, such as government officials or concerned citizens.

Since the purpose of project management is to meet project requirements and satisfy stakeholders, it is critical that project managers take adequate time to identify, understand, and manage relationships with all project stakeholders.

Using the four frames of organizations to think about project stakeholders can help you meet their expectations.

**Importance of Top Management Commitment**

People in to management positions, of course, are key stakeholders in project. A very

important factor in helping project managers successfully lead projects is the level of commitment and support they receive from top management. Some projects have a senior manager ca11ed a **champion** who acts as a key proponent for a project.

Top management commitment is crucial to project managers for the following reasons:

• Project managers need adequate resources. The best way to a project is to withhold the required money, human resources, and Visibility for the project.

• Project managers often require approval for unique project needs in a timely manner.

For example, on large information technology projects, top management must understand that unexpected problem may result from the nature of the products being produced and the specific skills of the people on the project team.

• Project managers must have cooperation from people m other parts of the organization. Since most information technology projects cut across functional areas, top management must help project managers to deal with the political issues that often arise in these types of situations.

• Project managers often need someone to mentor and coach them on leadership issues.

Many information technology project managers come from technical positions and are inexperienced as manager. Senior managers should take the time to pass on advice on how to be good leaders. They should encourage new project managers to take classes to develop leadership skills and allocate the time and funds for them to do so.

**Project Phases and the Project Life Cycle**

Since projects operate as part of a system and involve uncertainty, it is good practice to

divide projects into several phases.

A **project life** cycle is a collection of project phases. Some organizations specify a set of life cycles for use on all of their projects, while others follow common industry practices based on the types of projects involved. In general, project life cycles define what work will be performed in each phase, what deliverables will be produced and when, who is involved in each phase, and how management will control and approve work produced in each phase.

A **deliverable** is a product or service, such as a report, a training session, a piece of hardware, or a segment of software code, produced or provided as part of a project Management, for detailed information on deliverables.

In early phases of a project life cycle, resource needs are usually lowest and the level of uncertainty is highest. Project stakeholders have the greatest opportunity to influence the final characteristics of the project's products, services, or results during the early phases of a project life cycle. Project phases vary by project or industry, but some general phases

in traditional project management are often called the concept, development, implementation, and dose-out phases. The first two phases (concept and development) focus on planning and are often referred to as project feasibility. The last two phases (implementation and close-out) focus on delivering the actual work and are often referred to as project acquisition. A project should successfully complete each phase before moving on to the next. This project life cycle approach provides better management control and appropriate links to the ongoing operations of the organization.

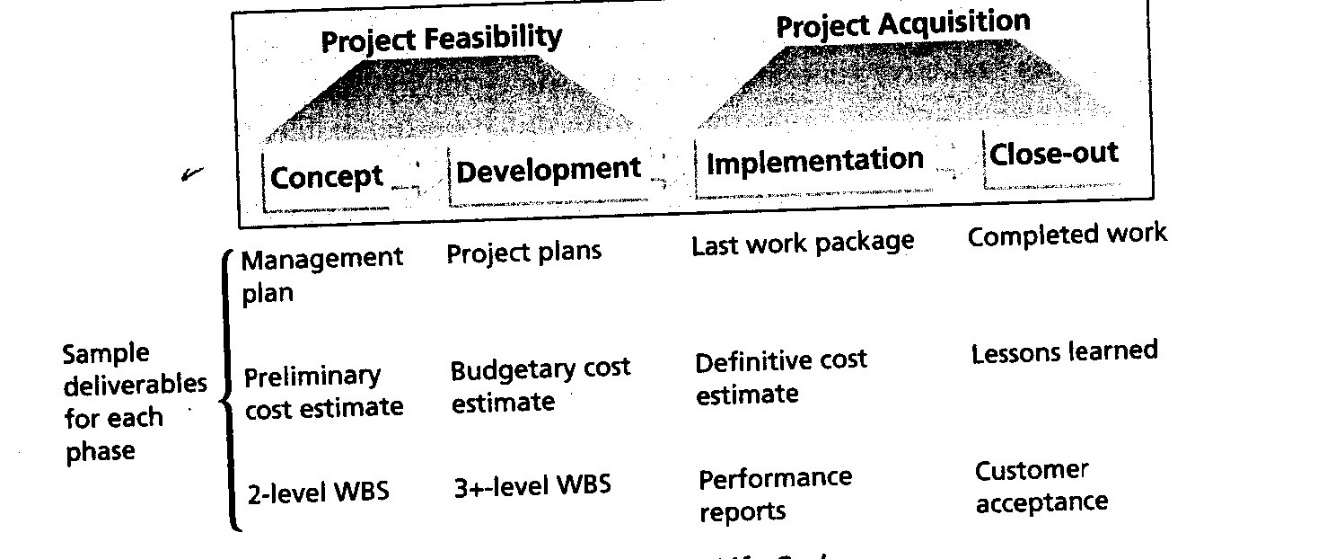


Figure provides a summary framework for the general phases of the traditional project life cycle. In the concept phase of a project, managers usually briefly describe the project- they develop a very high-level or summary plan for the project, which describes the need for the project and basic underlying concepts.

A preliminary or rough cost estimate is developed in this first phase, and an overview of the work involved is created. A work breakdown structure (WBS) outlines project work and is a deliverable-oriented document that defines the total scope of the project.

After the concept phase is completed, the next project phase-development begins.

In the development phase, the project team creates more detailed project plans, a more accurate cost estimate, and a more thorough WBS.

The third phase of the traditional project life cycle is implementation. In this phase the project team creates a definitive or very accurate cost estimate, delivers the required work and provides performance reports to stakeholders.

The last phase of the traditional project life cycle is closeout phase. In the close-out phase, all of the work is completed and *'*and there should be some sort acceptance of the entire project. The project team should document their experiences on the project in a lessons learnt report.

**Product Life Cycles**

All products follow some type of life cycle-cars, buildings, even amusement parks.

Most of information technology professionals are familiar with the concept of a product life cycle, especially for developing software. Software development projects are one subset of information technology projects.

In general, information technology projects involve researching, analyzing and then purchasing and installing new hardware and software with little or no actual software development required.

A systems development life cycle (SDLC) is a framework for describing phases involved in developing information systems. Some popular models of a systems development life cycle include the waterfall model, the spiral model, the incremental build model, the prototyping model, and the Rapid Application Development (RAD) model. These life cycle models are examples of a predictive life cycle, meaning that the scope of the project can be clearly articulated and the schedule and cost can be accurately predicted. The project team spends a large portion of the project effort attempting to clarify the requirements of the entire system and then producing a design.

Below are brief descriptions of several predictive SDLC models:

• The waterfall life cycle model has well-defined, linear stages of systems development and support. This life cycle model assumes that requirements will remain stable after they are defined.

• The spiral life cycle model was developed based on experience with various refinements of the waterfall model as applied to large government software projects. It recognizes the fact that most software is developed using an iterative or spiral approach rather than a linear approach.

• The incremental build life cycle model provides for progressive development of operational software, with each release providing added capabilities.

• The prototyping life cycle model is used for developing software prototypes to clarify user requirements for operational software. It requires heavy user involvement, and developers use a model to generate functional requirements and physical design specifications simultaneously. Developers can throwaway or keep prototypes, depending on the project.

• The Rapid Application Development (RAD) life cycle model uses an approach in which developers work with an evolving prototype. This life cycle model also requires heavy user involvement and helps produce systems quickly without sacrificing quality. Developers use RAD tools such as CASE (Computer Aided Software Engineering), JRP (Joint Requirements Planning), and JAD (Joint Application Design) to facilitate rapid prototyping and code generation.,)

**The Context of Information Technology Projects**

Software development projects can follow several different product life cycles based on

the project context. There are several other issues related to managing information technology projects. In fact, several groups have recognized the additional knowledge that information technology project managers must possess by creating separate certification programs specifically for them.

**i. Nature of information technology projects**

Unlike projects in many other industries, projects labeled as information technology

projects can be very diverse. Some involve a small number of people installing off-the- shelf hardware and associated software. Others involve hundreds of people analyzing several organizations' business processes and then developing new software in a collaborative effort with users to meet business needs. Even for small hardware-oriented projects, there is a wide diversity in the types of hardware that could be involved- personal computers, mainframe computers, network equipment, kiosks, or small mobile devices, to name a few. The network equipment might be wireless, phone-based, cable- based, or require a satellite connection. The nature of software development projects is even more diverse than hardware-oriented projects. A software development project might include developing a simple, stand-alone Excel or Access application or a sophisticated, global e-commerce system using state-of-the-art programming languages. Information technology projects also support every possible industry and business function.

Because of the nature of information technology projects, the people involved come from very diverse backgrounds and possess different skill sets. Many companies purposely hire graduates with degrees in other fields such as business, mathematics, or the liberal arts to provide different perspectives on information technology projects. Even with these different educational backgrounds, there are some common job titles for people working on most information technology projects, such as business analyst, programmer, network specialist, database analyst, quality assurance expert, technical writer, security specialist, hardware engineer, software engineer, and system architect. Within the category of programmer, there are several other job titles used to describe the specific technologies

the programmer uses, such as Java programmer, XML programmer, *C/C++* programmer, and so on.

**ii. Diverse Technologies**

Many of the job titles for information technology professionals reflect the different

technologies required to hold that position. Unfortunately, hardware specialists might not understand the language of database analysts, and vice versa. Security specialists may have a hard time communicating with business analysts.

It is also unfortunate that people within the same information technology Job function often do not understand each other because each uses different technology.

For example, someone with the title of programmer can often use several different programming languages. However, a COBOL programmer cannot become much help on a Java project. These highly specialized positions also make it difficult for project managers to form and lead project teams.

Another problem with diverse technologies is that many of them change rapidly. A project team might be close to finishing a project when they discover a new technology that can greatly enhance the project and better meet long-term business needs. New technologies have also shortened the timeframe many businesses have to develop, produce, and distribute new products and services. This fast-paced environment requires equally fast-paced processes to manage and produce information technology projects and products.

**Discussion Questions**

1. What does it mean to take a systems view of a project?

2. How does taking a systems view of a project apply to project management?

3. Explain the four frames of organizations. How can they help project managers understand the organizational context for their projects?

4. Briefly explain the differences between functional, matrix, and project organizations.

Describe how each structure affects the management of the project.

5. Describe how organizational culture is related to project management.

6. What type of culture promotes a strong project environment?

7. Discuss the importance of top management commitment and the development of standards for successful project management. Provide examples to illustrate the importance of these items based on your experience on any type of project.

8. What are the phases in a traditional project life cycle?

9. How does a project life cycle differ from a product life cycle? Why does a project manager need to understand both?

10. What makes information technology projects different from other types of projects?

How should project managers adjust to these differences?

**3. PROJECT MANAGEMENT PROCESS GROUPS**

**Week 3 Topics**

- Project Management process groups.

**Objectives:**

After reading this chapter, you will be able to:

1. Describe the five project management process groups, the typical level of activity for each, and the interactions among them

2. Understand how the project management process groups relate to the project management knowledge areas

3. Discuss how organizations develop information technology project management methodologies to meet their needs.

**Introduction**

Project management consists of nine knowledge areas: integration, scope, time, cost

quality, human resources, communications, risk, and procurement. Another important concept to understand is that projects involve five project management process groups: initiating, planning, executing, monitoring and controlling, and closing. Tailoring these process groups to meet individual project needs increases the chance of success in managing projects.

This chapter describes each project management process group in detail. Although you will learn more about each knowledge area in other chapters, it's important first to learn how they fit into the big-picture of managing a project. Understanding how the knowledge areas and project management process groups function together will lend context to the remaining chapters.

**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-the triple constraint of project management, project manager may also need to make trade-offs between other knowledge areas, such as between risk and human 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 initiation activities to planning activities, executing activities, monitoring and controlling activities, and closing activities, Initiating processes include defining and authorizing a project or project phase, To initiate a project or just the concept phase of a project, someone must define the business need for the project, someone must sponsor the project, and someone must take on the role of project manager. Initiating processes take place during each phase of a project. Therefore, you cannot equate process groups with project phases. Recall that there can be different project phases, but all projects will include all five process groups. For example, project managers and teams should reexamine the business need for the project during every

phase of the project life cycle to determine if the project is worth continuing. Initiating processes are also required to end a project.

Someone must initiate activities to ensure that the project team completes all the work, documents lessons learned, reassigns project resources, 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. There normally is no single project plan." There are several project plans, such as the scope management plan, schedule management plan, cost management plan, procurement management plan, and so on, defining each knowledge area as it relates to the project at that point in time. For example, a project team must develop a plan to define the work that needs to be done for the project, to schedule activities related to that work, to estimate costs for performing the work, to decide what resources to procure to accomplish the work, and so on. To account for changing conditions on the project and in the organization, project teams often revise project plans during each phase of the project life cycle. The project management plan coordinates information from all other plans.

• Executing processes include coordinating people and other resources to carry out the project plans and produce the products, services, or results of the project or phase. Examples of executing processes include developing the project team, directing and managing the project team, performing quality assurance, distributing information, and selecting sellers.

• 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 performance reporting, where project stakeholders can identify any necessary changes that may require keeping 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, closing out contracts, documenting lessons learned, and receiving formal acceptance of the delivered work as part of the phase or project.

Each of the five project management process groups is characterized by the completion of certain tasks. During initiating processes for a new project, the organization recognizes that a new project exists. Often, completing a business case and project charter accomplishes this recognition. These documents identify the main stakeholders for a project, justify the project, and specify the high-level scope, time, and cost goals of the project. Usually, the project manager and key team members are also selected during the initiating process group, if they haven't been selected already in a process some organizations call pre-initiating.

Outcomes of the planning process group include completing the work break down structure and scope statement, the project schedule, and the project cost estimate. Planning processes are especially important for information technology projects. Everyone who has ever worked on a large information technology project knows the saying, “A dollar spent up front in planning is worth one hundred dollars spent after the

system is implemented.". Planning is crucial in information technology projects because once a project team implements a new system; it takes a considerable amount of effort to change the system.

The executing process group involves taking the actions necessary to complete the work described in the planning activities. The main outcome of this process group is the delivery of the actual work of the project. For example, if an information technology project involves providing new hardware, software, and training, the executing processes would include leading the project team and other stakeholders to purchase the hardware, develop and test the software, and deliver and participate in the training. The executing process group should overlap the other process groups and generally requires the most resources.

Monitoring and controlling processes measure progress toward the project objectives, monitor deviation from the plan, and take corrective action to match progress with the plan. The project manager should be monitoring progress closely to ensure that deliverables are being completed and objectives are being met. The project manager must work closely with the project team and other stakeholders and take appropriate actions to keep the project running smoothly. The ideal outcome of the monitoring and controlling process group is to complete a project successfully by delivering the agreed-upon project scope within time, cost, and quality constraints. If changes to project objectives or plans are required, monitoring and controlling processes ensure that these changes are made efficiently and effectively to meet stakeholder needs and expectations. Monitoring and controlling processes overlap all of the other project management process groups because changes can occur at any time.

During the closing processes, the project team works to gain acceptance of the end products, services, or results and bring the phase or project to an orderly end. Key outcomes of this process group are formal acceptance of the work and creation of closing documents, such as a final project report and lessons-learned report.

**Discussion Questions**

1. Briefly describe what happens in each of the five projects management process

groups (initiating, planning, executing. monitoring and controlling, and closing). On which process should team members spend the most time? Why?

2. Which process group includes information from every single knowledge area? Why?

3. Why do organizations need to tailor project management information to create their own methodologies?

4. What are some of the key outputs of each process group?

5. What are some of the typical challenges project teams face during each of the five process groups?

**4. PROJECT INTEGRATION MANAGEMENT**

**Week 4 Topics**

- What is project Integration Management?

- Strategic planning and project selection

- Scope statements

- Project management plans

- Project execution

- Monitoring and controlling project work.

- Integrated change control

- Closing projects.

- Using software to assist in project integration management

**Objectives:**

After reading this chapter, you will be able to:

1. Describe an overall framework for project integration management as it relates to the other project management knowledge areas and the project life cycle.

2. Explain the strategic planning process and apply different project selection methods

3. Explain the importance of creating a project charter to formally initiate projects.

4. Discuss the process of creating a preliminary project scope statement

5. Describe project management plan development, including content, using guidelines and templates for developing plans, and performing a stakeholder analysis to help manage relationships

6. Explain project execution, its relationship to project planning, and the factors related to successful results, and tools and techniques to assist in project execution.

7. Describe the process of monitoring and controlling project work

8. Understand the integrated change control process, planning for and managing changes on information technology projects, and developing and using a change control system

9. Explain the importance of developing and following good procedures for closing projects

10. Describe how software can assist in project integration management

**Introduction**

Someone must focus on the big picture of the project and steer the project team toward

successful completion. Someone must make the final decisions when there are conflicts among project goals or people involved. Someone must communicate key project information to top management. This someone is the project manager, and the project manager's chief means for accomplishing all these tasks is project integration management. This chapter offers an insight of project integration processes and its importance to the success of a project.

**Definition of Project Integration Management**

Project integration management involves coordinating the other entire 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.

There are seven main processes involved in project integration management:

1. Develop the project charter, which involves working with stakeholders to create the document that formally authorizes a project-the charter.

2. Develop the preliminary project scope statement, which involves further work with stakeholders, especially users of the project's products, services, or results, to develop the high-level scope requirements. The output of this process is the preliminary project scope statement.

3. Develop the project management plan, which involves coordinating all planning efforts to create a consistent, coherent document-the project management plan.

4. Direct and manage project execution, which involves carrying out the project management plan by performing the activities included in it.

The outputs of this process are deliverables, requested changes, work performance information, implemented change requests, corrective actions, preventive actions, and defect repair.

5. Monitor and control the project work, which involves overseeing project work to meet the performance objectives of the project. The outputs of this process are recommended corrective and preventive actions, forecasts, recommended defect repair, and requested changes.

6. Perform integrated change control, which involves coordinating changes that affect the project's deliverables and organizational process assets. The outputs of this process include approved and rejected change requests, approved corrective and preventive actions, approved and validated defect repair, deliverables, and updates to the project management plan and project scope statement.

7. Close the project, which involves finalizing all project activities to formally close the project. Outputs of this process include final products, services, or results, administrative and contract closure procedures, and updates to organizational process assets.

Many people consider project integration management the key to overall project success. Someone must take responsibility for coordinating all of the people, plans, and work required to complete a project.

Good project integration management is critical to providing stakeholder satisfaction. Project integration management includes interface management.

**Interface management** involves identifying and managing the points of interaction between various elements of the project. The number of interfaces can increase exponentially as the number of people involved in a project increases. Thus, one of the most important jobs of a project manager is to establish and maintain good communication and relationships across organizational interfaces. The project manager must communicate well with all project stakeholders, including customers, the project team, top management, other project managers, and opponents of the project. 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 performing organization.

**Strategic Planning and Project Selection**

Successful leaders look at the big picture or strategic plan of the organization to

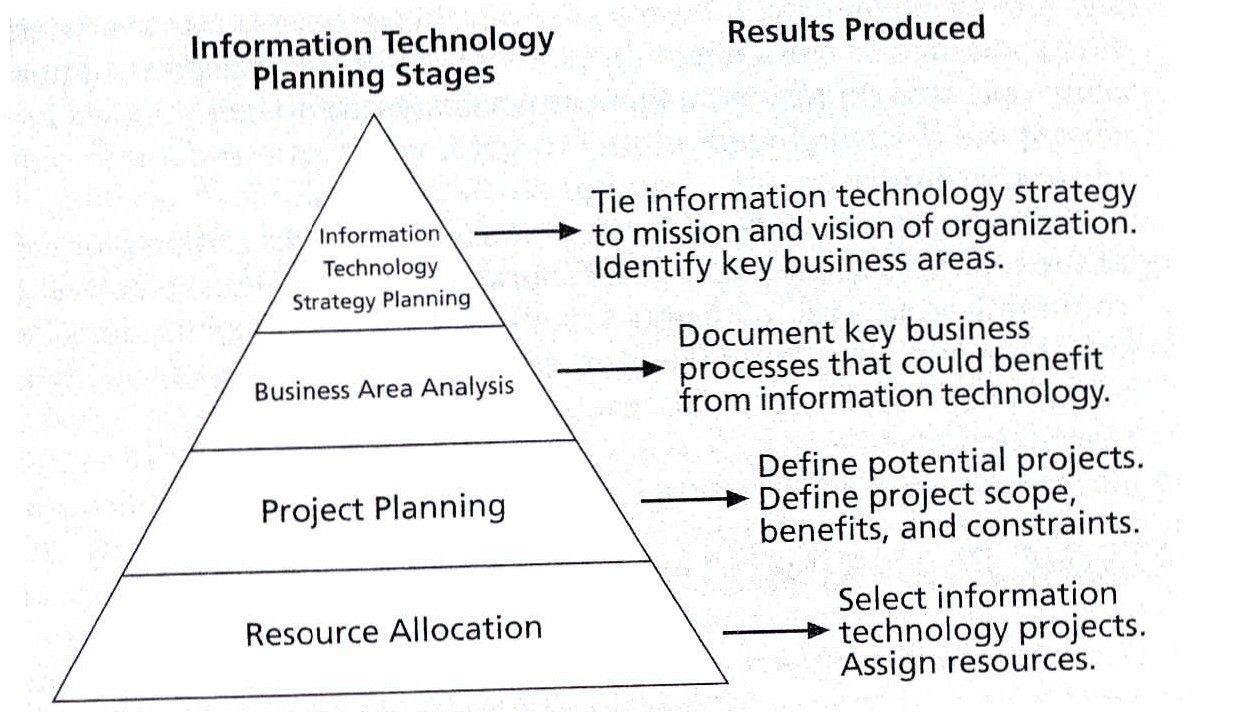
determine what types of projects will provide the most value. Therefore, project initiation starts with identifying potential projects, using realistic methods to select which projects to work on, and then formalizing their initiation by issuing some sort of project charter.

**Identifying Potential Projects**

The first step in project management is deciding what projects to do in the first place.

Some may argue that project managers should not be involved in strategic planning and project selection, but successful organizations know that current project managers can provide valuable insight into the project selection process. Figure shows a four-stage planning process for selecting information.

The first step in this process, starting at the top of the hierarchy, is to tie the information technology strategic plan to the organization's overall strategic plan. **Strategic planning** involves determining long-term objectives by analyzing the strengths and weaknesses of an organization, studying opportunities and threats in the business environment, predicting future trends, and projecting the need for new products and services. Many people are familiar with, "SWOT' analysis-analyzing Strengths, Weaknesses, Opportunities, and Threats-that is used to aid in strategic planning.



After identifying strategic goals, the next step in the planning process for selecting information technology projects is to perform a business area analysis. This analysis outlines business processes that are central to achieving strategic goals and helps determine which ones could most benefit from information technology. Then, the next step is to start defining potential information technology projects, their scope, benefits, and constraints. The last step in the planning process for selecting information technology projects is choosing which projects to do and assigning resources for working on them.

**Methods for Selecting Projects**

Organizations identify many potential projects as part of their strategic planning

processes, and often rely on experienced project managers to help them make project selection decisions. However, organizations need to narrow down the list of potential projects to those projects that will be of most benefit. Selecting projects is not an exact science, but it is a critical part of project management. Many methods exist for selecting from among possible projects. Five common techniques are:

1. Focusing on broad organizational needs

2. Categorizing information technology projects

3. Performing net present value or other financial analyses

4. Using a weighted scoring model

5. Implementing a balanced scorecard

In practice, organizations usually use a combination of these approaches to select projects. Each approach has advantages and disadvantages, and it is up to management to decide the best approach for selecting projects based on their particular organization.

**1. Focusing on Broad Organizational Needs**

Top managers must focus on meeting their organization's many needs when deciding

what projects to undertake, when to undertake them, and to what level. Projects that address broad organizational needs are much more likely to be successful because they will be important to the organization. For example, a broad organizational need might be to improve safety, increase morale, provide better communications, or improve customer service.

**2. Categorizing Information Technology Projects**

Another method for selecting projects is based on various categorizations. One type of

categorization assesses whether projects provide a response to a problem, an opportunity, or a directive.

• **Problems** are undesirable situations \tat prevent an organization from achieving its goals. These problems can be current or anticipated. For example, users of an information system may be having trouble logging onto the system or getting information in a timely manner because the system has reached its capacity. In response, the company could initiate a project to enhance the current system by adding more access lines or upgrading the hardware with a faster processor, more memory, or more storage space.

• **Opportunities** are chances to improve the organization. For example, the project can involve creating a new product that can make or break the entire company.

• **Directives** are new requirements imposed by management government or some external influence. For example, many projects involving medical technologies must meet rigorous government requirements.

**3. Performing Net Present Value Analysis, Return on Investment, and Payback**

**Analysis**

Financial considerations are often an important aspect of the project selection process,

especially during tough economic times. Many organizations require an approved

business case before pursuing projects, and financial projections are a critical component of the business case.

Three primary methods for determining the projected financial value of projects include net present value analysis, return on investment, and payback analysis. Because project managers often deal with business executives, they must understand how to speak their language, which often boils down to these important financial concepts.

**a. Net Present Value Analysis**

Everyone knows that a dollar earned today is worth more than a dollar earned five years

from now. Net present value (NPV) analysis is a method of calculating the expected net monetary gain or loss from a project by discounting all expected future cash inflows and outflows to the preset point in time. An organization should consider only projects with a. positive NPV if financial value is a key criterion for project selection. This is because a positive NPV means the return from a project exceeds the cost of capital-the return available by investing the capital elsewhere. Projects with higher NPVs are preferred to projects with lower NPVs, if all other factors are equal.

**b. Return on Investment**

Another important financial consideration is return on investment. **Return on**

**investment (ROI)** is the result of subtracting the project costs from the benefits and then dividing by the costs.

c. **Payback period**

Payback analysis is another important financial tool to use when selecting projects.

**Payback period** is the amount of time it will take to recoup, in the form of net cash inflows, the total dollars invested in a project. In other words, payback analysis determines how much time will lapse before accrued benefits overtake accrued and continuing costs. Payback occurs when the net discounted cumulative benefits and costs reach zero.

4. **Using a weighted Scoring Model**

A weighted scoring model is a tool that provides a systematic process for selecting

projects based on many criteria. These criteria can include factors such as meeting broad organizational needs; addressing problems, opportunities, or directive; the amount of time it will take to complete the project; the overall priority of the project; and projected financial performance of the project.

The first step in creating a weighted scoring model is to identify criteria important to project selection process. It often takes time to develop and reach agreement on these criteria. Holding facilitated brainstorming sessions or using groupware to exchange ideas can aid in developing these criteria. Some possible criteria for information technology projects include:

• supports key business objectives

• Has strong internal sponsor

• Has Strong customer support

• Uses realistic level of technology

• Can be implemented in one year or less

• Provides positive NPV

• Has l*ow* risk in meeting scope, time, and cost goals

Next, you assign a weight to each criterion. Once again, determining weights requires consultation and final agreement. These weights indicate how much requires each criterion or how important each criterion is.

5. **Implementation a Balanced Scorecard**

Drs. Robert Kaplan and David Norton developed another approach to help select and

manage projects that align with business strategy.\A **balanced scorecard** is a methodology that converts an organization's value drivers, such as customer service, innovation, operational efficiency, and financial performance, to a series of defined metrics. Organizations record and analyze these metrics to determine how well projects help them achieve strategic goals. Using a balanced scorecard involves several detailed steps.

**Project charters**

After top management decides on which projects to pursue, it is important to let the rest

of the organization know about these projects. Management needs to create and distribute documentation to authorize project initiation. This documentation can take many different forms, but one common form is a project charter. A **project charter** is a document that formally recognizes the existence of a project and provides direction on the project's objectives and management.

It authorizes the project manager to use organizational resources to complete the project. Ideally, the project manager will provide a major role in developing the project charter. Instead of project charters, some organizations initiate projects using a simple letter of agreement while others use much longer documents or formal contracts. Key project stakeholders should sign a project charter to acknowledge agreement on the need for and intent of the project. A project charter is a key output of the initiation process.

Inputs that are helpful in developing a project charter include the following:

• A contract: If you are working on a project under contract, the contract should include much of the information needed for creating a good project charter. Some people might use a contract 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.

• A 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.

• Enterprise environmental factors: These factors include the organization's structure, culture, infrastructure, human resources, personnel policies, marketplace conditions, stakeholder risk tolerances, industry risk information, and project management information systems.

• Organizational process assets information: Organizational process assets include formal and informal plans, policies, procedures, guidelines, information systems,

financial systems, management systems, lessons learned, and historical information that help people understand, follow, and improve business processes in a specific organization. How an organization manages its business processes, promotes learning, and shares knowledge can also provide important information when creating a project charter. Managers should review formal and informal enterprise plans, policies, procedures, guidelines, and management systems when developing a project charter.

Tools and techniques for developing a project charter include project selection methods, a project management methodology, a project management information system, and expert judgment.

The only output of the process to develop a project charter is a project charter.

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

• The project's title and date of authorization

• The project manager's name and contact information

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

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

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

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

• A roles and responsibilities matrix

• A sign-off section for signatures of key project stakeholders

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

**Preliminary Scope Statements**

A scope statement is a document used to develop and confirm a common understanding

of the project scope. It describes in detail the work to accomplish on the project and is an important tool for preventing scope creep-the tendency for project scope to keep getting bigger. It is helpful to create a *preliminary* or initial scope statement during project initiation so that the entire project team can start important discussions and work related to the project scope. A more detailed scope statement is prepared as part of project scope management. There are usually several versions of the scope statement, and each one becomes more detailed as the project progresses and more information becomes available.

Scope statements, like project charters, also vary by type of project. Complex projects have very long scope statements, whereas smaller projects have shorter scope statements. Project items often described in a preliminary scope statement include the project objectives, product or service requirements and characteristics, project boundaries, deliverables, product acceptance criteria, project assumptions and constraints, the organizational structure for the project, an initial list of defined risks, a summary of

schedule milestones, a rough order of magnitude cost estimate, configuration management requirements, and a description of approval requirements.

**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, since 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.

**Project Management Plan Contents**

Just as projects are unique, so are project management plan¥ small project involving a

few people over a couple of months might have a project management plan consisting of only a project charter, scope statement, and Gantt chart. A large project involving a hundred people over three years would have a much more detailed project management plan. It is important to tailor project management plans to fit the needs of specific projects. The project management plans should guide the work, so they should be only as detailed as needed for each project

There are, however, common elements to most project management plans. Parts of a project management plan include an introduction or overview of the project, a description of how the project is organized, the management and technical processes used on the project, and sections describing the work to be performed, the schedule, and the budget. The introduction or overview of the project should include, as a minimum, the following information:

• The project name

• A brief description of the project and the need it addresses.

• The sponsor's name

• The names of the project manager and key team members

• Deliverables of the project

• A list of important reference materials

• A list of definitions and acronyms, if appropriate

The description of how the project is organized should include the following information:

• Organizational charts

• Project

• Other organizational or process-related information

The section of the project management plan describing management and technical approaches should include the following information:

• Management objectives

• Project controls

• Risk management

• Project staffing.

• Technical processes

The next section of the project management plan should describe the work to perform and reference the scope management plan. It should summarize the following:

• Major work packages

• Key deliverables

• Other work-related information

The project schedule information section should include the following:

• Summary schedule

• Detailed schedule

• Other schedule-related information

'The budget section of the project management plan should include the following:

• Summary budget

• Detailed budget

• Other budget-related information

**Project Execution**

Directing and managing project execution involves managing and performing the work

described in the project management plan. The majority of time on a project is usually spent on execution, as is most of the project's budget. The application area of the project directly affects project execution because the products of the project are produced during project 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 human resource management and project communications management are crucial to a project's success. If the project involves a significant amount of risk or outside resources, the project manager also needs to be well versed in project risk management and project procurement management. Many unique situations occur during project execution, so project managers must be flexible and creative in dealing with them.

**Project Execution Tools and Techniques**

Directing and managing project execution requires specialized tools and techniques,

some of which are unique to project management. Project managers can use specific tools and techniques to perform activities that are part of execution processes. These include:

• **Project management methodology:** As mentioned earlier, many experienced project managers believe the most effective way to improve project management is to follow a methodology that describes not only what to do in managing a project, but how to do?

• **Project management information systems:** There are hundreds of project management software products available on the market today. Many large organizations are moving toward powerful enterprise project management systems that are accessible via the Internet. Project managers or other team members can create Gantt charts that include links to other planning documents.

**Monitoring and Controlling Project Work**

On large projects, many project managers say that 90 percent of the job is communicating

and managing changes. Changes are inevitable on most projects, so it's important to develop and follow a process to monitor and control changes.

Monitoring project work includes collecting, measuring, and disseminating performance information. It also involves assessing measurements and analyzing trends to determine what process improvements can be made. The project team should continuously monitor project performance to assess the overall health of the project and identify areas that require special attention.

The project management plan, work performance information, performance reports, and change requests are all important inputs for monitoring and controlling project work. Key tools and techniques for performing this process include using a project management methodology and a project management information system, as described for project execution.

Two important outputs of monitoring and controlling project work include recommended corrective and preventive actions.

**Integrated Change Control**

**Integrated change control** involves identifying, evaluating, and managing changes

throughout the project life cycle. The three main objectives of integrated change control are:

1. Influencing the factors that create changes to ensure that changes are beneficial: To ensure that changes are beneficial and that a project is successful, project managers and their teams must make trade-offs among key project dimensions, such as scope, time, cost, and quality.

2. Determining that a change has occurred: To determine that a change has occurred, the project manager must know the status of key project areas at all times. In addition, the project manager must communicate significant changes to top management and key stakeholders. Top management and other key stakeholders do not like surprises, especially ones that mean the project might produce less, take longer to complete, cost more than planned, or be of lower quality than desired.

3. Managing actual changes as they occur: Managing change is a key role of project managers and their teams. It is important that project managers exercise discipline in managing the project to help minimize the number of changes that occur.

Important inputs to the integrated change control process include the project management plan, work performance information (usually in the form of performance reports), requested changes, recommended preventive and corrective actions, recommended defect repair, and deliverables. Important outputs include approved and rejected change requests, approved corrective and preventive actions, approved and validated defect repair, deliverables and updates to the project management plan and project scope statement.

**Closing Projects**

The last process in project integration management is closing the project. In order to

close a project, you must finalize all activities and transfer the completed or cancelled work to the appropriate people. The main outputs of closing projects are:

• Administrative closure procedures: It is important for project teams and other stakeholders to develop and follow a step-by-step process for closing projects. In particular, administrative closure procedures should define the approval process for all project deliverables.

• Contract closure procedures: Many projects involve contracts, which are legally binding agreements. Contract closure procedures describe the methodology for making sure the contract has been completed, including delivery of goods and services and payment for them.

• Final products, services, or results: Project sponsors are usually most interested in making sure they receive delivery of the final products, services, or results they expected when they authorized the project.

• Organizational process asset updates: The project team should provide a list of project documentation, project closure documents, and historical information produced by the project in a useful format. This information is considered a process asset.

**Discussion Questions**

1. Describe project integration management.

2. How does project integration management relate to the project life cycle, stakeholders, and the other project management knowledge areas?

3. Briefly describe the strategic planning process.

4. Which project selection method(s) do you think organizations use most often for justifying information technology projects?

5. Summarize key work involved in each of the seven processes for project integration management.

6. Describe a well-planned and executed project with which you are familiar. Describe a disastrous project. What were some of the main differences between these projects?

7. Discuss the importance of following a well-integrated change control process on information technology projects. What do you think of the suggestions made in this chapter? Think of three additional suggestions for integrated change control on information technology projects.

**5 PROJECT SCOPE MANAGEMENT**

**Week 5 Topics**

- What is project scope management?

- Scope planning and scope management plan

- Scope definition and project scope statement

- Creating the work breakdown structure

- scope verification

- scope control

**Objectives:**

After reading this chapter, you will be able to:

1. Understand the elements that make good project scope management important.

2. Explain the scope planning process and describe the contents of a scope management plan.

3. Explain the scope definition process and a work breakdown structure.

4. Explain the importance of scope verification and scope control.

**Introduction**

The successful completion of a project depends on how well the scope of the project has

been defined and understood by both project manager and stakeholders. This can be accomplished using project scope management which is the subject of the chapter.

**Definition of Project Scope Management**

One of the most important and most difficult aspects of project management, therefore, 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.

Deliverable describes a product produced as part of a project. Deliverables can be product-related, such as a piece of hardware or software, or process-related, such as a planning document or meeting minutes. Project stakeholders must agree on what the products of the project are and, to some extent, how they should produce them to define all of the deliverables.

Project scope management includes the processes involved in defining and controlling what is or is not included I a project. It ensures that the project team and stakeholders have the same understanding of what products the project will produce and what processes the project team will use to produce them. There are five main processes involved in project scope management.

1. Scope planning involves deciding how the scope will be defined, verified, and controlled and how the WBS will be created. The project team creates a scope management plan as the main output of the project scope planning process.

2. Scope definition involves reviewing the project charter and preliminary scope statement created during the initiation process and adding more information during the planning process as requirements are developed and change requests are approved. The main outputs of scope definition are the project scope statement, requested changes to the project, and updates to the project scope management plan.

3. Creating the WBS involves subdividing the major project deliverables into smaller, more manageable components. The main outputs include a work breakdown

structure (WBS), a WBS dictionary, a scope baseline, requested changes to the project scope management plan.

4. Scope verification involves formalizing acceptance of the project scope. Key project stakeholders, such as the customer and sponsor for the project, inspect and then formally accept the deliverables of the project during this process. If the deliverables are not acceptable, the customer or sponsor usually requests changes, which result in recommendations for taking corrective actions. The main outputs of this process, therefore, are accepted deliverables, requested changes, and recommended corrective actions.

5. Scope control involves controlling changes to project scope, which is a challenge on many information technology projects. Scope control includes identifying, evaluating, and implementing changes to project scope as the project progresses. Scope changes often influence the team’s ability to meet project time and cost goals, so project managers must carefully weigh the costs and benefits of scope changes. The main outputs of this process are requested changes, recommended corrective actions, and updates to the project scope statement, WBS and WBS dictionary, scope baseline, project management plan and organizational process assets.

**Scope Planning and the Scope Management Plan**

The first step in project scope management is scope planning. The project's size,

complexity, importance, and other factors will affect how much effort is spent on scope planning. For example, a team working on a project to upgrade the entire corporate accounting system for a multibillion dollar company with more than 50 geographic locations should spend a fair amount of time on scope planning. A project to upgrade the hardware and software for a small accounting firm with only five employees, on the other hand, would need a much smaller scope planning effort. In any case, it is important for a project team to decide how they will define the scope, develop the detailed scope statement, create the work breakdown structure, verify the scope, and control the scope

for every project they undertake.

The main output of scope planning is a scope management plan. The scope management plan is a document that includes descriptions of how the team will prepare the project scope statement, create the WBS, verify completion of the project deliverables, and control requests for changes to the project scope.

Key inputs of the scope management plan include the project charter, preliminary scope statement, and project management plan.

The main tools and techniques available for scope planning include templates, forms, and standards, as well as expert judgment. For example, if a project involves developing a database, project team members can decide to use common systems analysis and design standards, such as creating entity relationship diagrams, use cases, data flow diagrams, and so on to help document the scope.

Many software tools include online templates and forms for creating these and similar items. Expert judgment should also be used to help decide the best way to manage scope for particular projects. For example, organizations often hire experts from outside companies to evaluate and recommend off-the-shelf software and then assist in managing the purchase and installation of the new software.

**Scope Definition and the Project Scope Statement**

The next step in project scope management is to define further the work required for the

project. 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 aides in communicating clear work responsibilities. The main tools and techniques used in scope definition include analyzing products, identifying alternative approaches to doing the work, understanding and analyzing stakeholder needs, and using expert judgment. The main output of scope definition is the project scope statement.

The project team develops a preliminary scope statement in initiating a project as part of the project integration management knowledge area. This document, as well as the project charter, organizational process assets, and approved change requests provide a basis for creating the **project** scope statement. The preliminary project scope statement should provide basic scope information, and the project scope statement should continue to clarify and provide information that is more specific.

Although contents vary, project scope statements should include, at a minimum, a description of the project, including its overall objectives and justification, detailed descriptions of all project deliverables, and the characteristics and requirements of products and services produced as part of the project. It is also helpful to document project success criteria in the project scope statement, as well as provide other scope- related information, such as the project boundaries, product acceptance criteria, project constraints and assumptions, project organization, defined risks, schedule milestones, order of magnitude cost estimate, configuration management requirements, and approval requirements

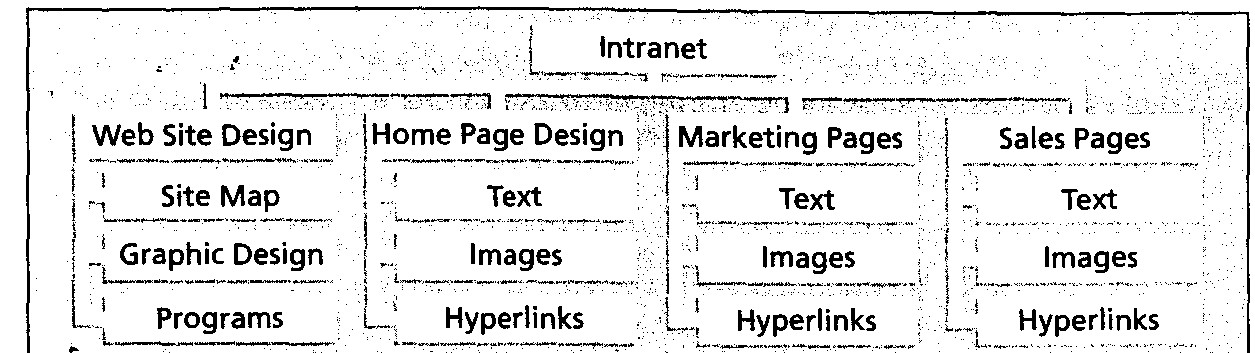
**Creating the Breakdown Structure**

After completing scope planning and definition processes, the next step in project scope

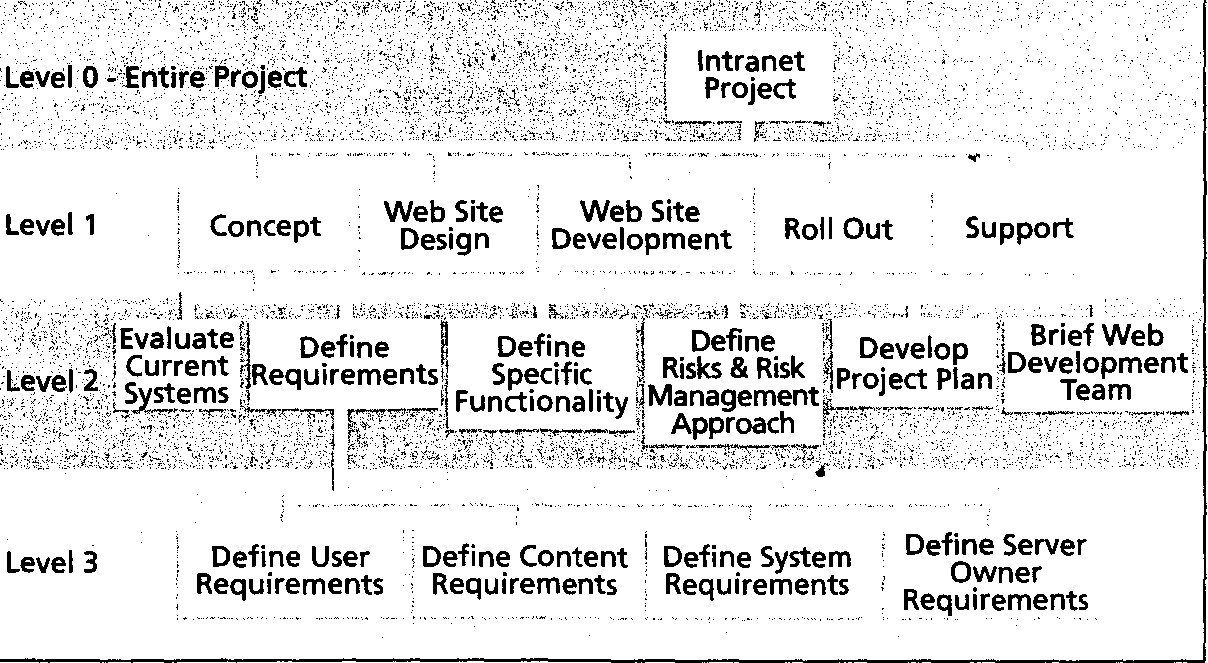
management is to create a work breakdown structure. A **work breakdown structure (WBS)** is a deliverable-oriented grouping of the work involved in a project that defines the total scope of the project. Because most projects involve many people and many different deliverables, it is important to organize 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. Since 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 statement and project management plan are the primary input for creating a WBS. The main tools and techniques include using WBS templates, as described below, and using **decomposition** or subdividing project deliverables into smaller pieces. The output of the process to create the WBS is the WBs itself, the WBS dictionary, a Scope baseline, and updates to the project scope statement and scope management plan.

What does a WBS look like? A WBS is often depicted as a task-oriented family tree of activities, similar to an organizational chart. A project team often organizes the WBS around project products, project phases, or using the project management process groups. Many people like to create a WBS in chart form first to help them visualize the whole project and all of its main parts. Figure below shows a WBS for an intranet project.

Notice that product areas provide the basis for its organization. In this case, there are main boxes or groupings on the WBS for developing the



In contrast, a WBS for the same intranet project can be organized around project phases, as shown below:



A WBS can also be shown in tabular form as an indented list of tasks that shows the same groupings of the work.

To create a good WBS, you must understand both the project and its scope and incorporate the needs and knowledge of the stakeholders. The project manager and the project team must decide as a group how to organize the work and how many levels to include in the WBS. Many project managers have found that it is better to focus on getting the top levels done well before getting too bogged down in more detail.

Many people confuse tasks on a WBS with specifications. Tasks on a WBS represent work that needs to be done to complete the project.

Another concern when creating a WBS is how to organize it so that it provides the basis for the project schedule. You should focus on what work needs to be done and how it will

be done, not when it will be done. In other words, the tasks do not have to be developed as a sequential list of steps. If you do want some time-based flow for the work, you can create a WBS using the project management process groups of initiating, planning, executing, controlling, and closing as level 1 in the WBS. By doing this, not only does

the project team follow good project management practice, but the WBS tasks can also be mapped more easily against time.

It is also very important to involve the entire project team and the customer in creating and reviewing the WBS. *People who will do the work should help to plan the work* by creating the WBS. Having group meetings to develop a WBS helps everyone understand *what* work must be done for the entire-project and *how* it should be done, given the people involved. It also helps to identify where coordination between different work packages will be required.

**Approaches you can Use to Develop a Work Breakdown Structure**

There are several approaches you can use to develop a work breakdown structure.

These approaches include:

• Using guidelines

• The analogy approach

• The top-down approach

• The bottom-up approach

• The mind-mapping approach

**a. Using Guidelines**

If guidelines for developing a WBS exist, it is very important to follow them. Some

organizations prescribe the form and content for WBSs for particular projects. Many organizations provide guidelines and templates for developing WBSs, as well as

examples of WBSs from past projects. At the request of many of its members, the Project Management Institute recently developed a WBS Practice Standard to provide guidance for developing and applying the WBS to project management.

***b. The Analogy Approach***

Another approach for constructing a WBS is the analogy approach. In the analogy

approach, you use a similar project's WBS as a starting point. Some organizations keep a repository of WBSs and other project documentation on file to assist people working on projects. Project 2003 and many other software tools include sample files to assist users in creating a WBS and Gantt chart. Viewing examples of other similar projects' WBSs allows you to understand different ways to create a WBS.

**c. The Top-down and Bottom-up Approaches**

Two other approaches for creating WBSs are the top-down and bottom-up approaches.

Most project managers consider the top-down approach of WBS construction to be conventional. To use the **top-down approach,** start with the largest items of the project and break them into their subordinate items. This process involves refining the work into greater and greater levels of detail.

In the **bottom-up approach,** team members first identify as many specific tasks related to the project as possible. They then aggregate the specific tasks and organize them into summary activities, or higher levels in the WBS. For example, a group of people might be responsible for creating a WBS to create an e-commerce application. Instead of looking for guidelines on how to create a WBS or viewing similar projects' WBSs, they could begin by listing detailed tasks they think they would need to do in order to create the application.

After listing detailed tasks, they would group the tasks into categories. Then, they would group these categories into higher-level categories. The bottom-up approach can be very time consuming, but it can also be a very effective way to create a WBS. Project managers often use the bottom-up approach for projects that represent entirely new systems or approaches to doing a job, or to help create buy-in and synergy with a project team.

**d. Mind Mapping**

Some project managers like to use mind mapping to help develop WBSs. **Mind mapping**

is a technique that uses branches radiating out from a core idea to structure thoughts and ideas. Instead of writing tasks down in a list or - immediately trying to create a structure for tasks, mind mapping allows people to write and even draw pictures of ideas in a nonlinear format. This more visual, less structured approach to defining and then grouping tasks can unlock creativity among individuals and increase participation and morale among teams.

**The WBS Dictionary and Scope Baseline**

The task should be described in more detail so everyone has the same understanding of

what it involves.

What if someone else has to perform the task? What would you tell him/her to do? What will it cost to complete the task? Information that is more detailed is needed to answer these and other questions.

A **WBS dictionary** is a document that describes detailed information about each WBS item. The format of the WBS dictionary can vary based on project needs. It might be appropriate to have just a short paragraph describing each work package. For a more complex project, an entire page or more might be needed for the work package descriptions. Some projects might require that each WBS item describe the responsible organization, resource requirements, estimated costs, and other information. The project manager should work with his/her team and sponsor to determine the level of detail needed in the WBS dictionary.

The approved project scope statement and its associated WBS and WBS dictionary form the **scope baseline.** Performance in meeting project scope goals is based on this scope baseline.

**Guidelines for creating a WBS and WBS Dictionary**

As stated previously, creating a good WBS is no easy task and usually requires several

iterations. Often, it is best to use a combination of approaches to create a project WBS. There are some basic principles, however, that apply to creating any good WBS and its WBS dictionary.

• A unit of work should appear at only one place in the WBS.

• The work content of a WBS item is the sum of the WBS items below it.

• A WBS item is the responsibility of only one individual, even though many people may be working on it.

• The WBS must be consistent with the way in which work is actually going to be performed; it should serve the project team first, and other purposes only if practical.

• Project team members should be involved in developing the WBS to ensure consistency and buy-in.

• Each WBS item must be documented in a WBS dictionary to ensure accurate understanding of the scope of work included and not included in that item.

• The WBS must be a flexible tool to accommodate inevitable changes while properly maintaining control of the work content in the project according to the scope statement.

**Scope Verification**

It is difficult to create a good project scope statement and WBS for a project. It is even

more difficult, especially on information technology projects, to verify the project scope and minimize scope changes. Some project teams know from the start that the scope is very unclear and that they must work closely with the project customer to design and produce various deliverables. In this case, the project team must develop a process for scope verification that meets unique project needs. Careful procedures must be developed to ensure the customer is getting what they want and the project team has enough time

and money to produce the desired products and services.

Even when the project scope is fairly well defined, many information technology projects suffer from **scope creep**-the tendency for project scope to keep getting bigger and bigger. There are many horror stories about information technology projects failing due to scope problems such as scope creep. For this reason, it is very important to verify the project scope and develop a process for controlling scope changes.

**Scope verification** involves formal acceptance of the completed project scope by the stakeholders. This acceptance is often achieved by a customer inspection and then sign- off on key deliverables. To receive formal acceptance of the project scope, the project team must develop clear documentation of the project's products and procedures to evaluate if they were completed correctly and satisfactorily. To minimize scope changes, it is crucial to do a good job of verifying project scope.

The project scope statement, WBS dictionary, project scope management plan, and deliverables are the main input for scope verification.

The main tool for performing scope verification is inspection. The customer, sponsor, or user inspects the work after it is delivered. The main outputs of scope verification are accepted deliverables, requested changes, and recommended corrective actions.

**Scope control**

Scope **control** involves controlling changes to the project scope. Users often are not

exactly sure how they want screens to look or what functionality they will really 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; assure changes are processed according to procedures developed as part of integrated change control and manage changes when they occur. You cannot do a good job of scope control if you do not first do a good job of scope definition and verification. How can you

prevent scope creep when you have not agreed on the work to be performed and your sponsor hasn't verified that the proposed work was acceptable? You also need to develop a process for soliciting and monitoring changes to project scope. Stakeholders should be encouraged to suggest changes that will benefit the overall project and discouraged from suggesting unnecessary changes.

**Suggestions for Improving User Input**

Lack of user input leads to problems with managing scope creep and controlling change.

How can you manage this important issue? Following are suggestions for improving user input:

• Develop a good project selection process for information technology projects. Insist that all projects have a sponsor from the user organization. The sponsor should not be someone in the information technology department, nor should the sponsor be the project manager.

• Have users on the project team. Some organizations require project managers to come from the business area of the project instead of the information technology group. Some organizations assign co-project managers to information technology projects, one from information technology and one from the main business group.

• Have regular meetings with defined agendas. Meeting regularly sounds obvious, but many information technology projects fail because the project team members do not have regular interaction with users.

• Deliver something to project users and sponsors on a regular basis. If it is some sort of hardware or software, make sure it works first.

• Do not promise to deliver what cannot be delivered in a particular timeframe. Make sure the project schedule allows enough time to produce the deliverables.

• Co-locate users with the developers. People often get to know each other better by being in close proximity. If the users cannot be physically moved to be near developers during the entire project, they could set aside certain days for co-location.

**Suggestions for reducing incomplete and changing requirements**

Some requirement changes are expected on information technology projects, but many

projects have too many changes to their requirements, especially during later stages of the project life cycle when it is more difficult to implement them. The following are suggestions for improving the requirements process:

a. Develop and follow a requirements management process that includes procedures for initial requirements determination.

b. Employ techniques such as prototyping, use case modeling, and Joint Application Design to understand user requirements thoroughly. Prototyping involves developing a working replica of the system or some aspect of the system. Use case modeling is a process for identifying and modeling business events, who initiated them, and how

the system should respond to them. Joint Application Design (JAD) uses highly organized and intensive workshops to bring together project stakeholders-the sponsor,

users, business analysts, programmers, and so on-to jointly define and design information systems. These techniques also help users become more active in defining system requirements.

c. Put all requirements in writing and keep them current and readily available. Several tools are available to automate this function.

d. Create a requirements management database for documenting and controlling requirements. Computer Aided Software Engineering (CASE) tools or other technologies can assist in maintaining a repository for project data.

e. Provide adequate testing to verify that the project's products perform as expected.

Conduct testing throughout the project life cycle.

f. Use a process for reviewing requested requirements changes from a systems perspective. For example, ensure that project scope changes include associated cost and schedule changes. Require approval by appropriate stakeholders.

g. Emphasize completion dates.

h. Allocate resources specifically for handling change requests. For

**Discussion Questions**

1. What is involved in project scope management?

2. Why is good project scope management so important on information technology projects?

3. Discuss the process of further defining project scope, going from information in a project charter to a preliminary scope statement, project scope statement, WBS, and WBS dictionary.

4. Describe different ways to develop a WBS and explain why it is often so difficult to do.

5. Describe a project that suffered from scope creep. Could it have been avoided? How?

Can scope creep be a good thing? When?

6. Why do you need a good WBS to use project management software?

7. What other types of software can you use to assist in project scope management?

**6. PROJECT TIME MANAGEMENT**

**Week 6 Topics**

- Activity definition

- Activity sequencing

- Activity resource estimating

- Activity duration estimating

- Schedule development

- Schedule control

**Objectives:**

After reading this chapter; you will be able to:

1. Understand the importance of project schedules and good project time management

2. Define activities as the basis for developing project schedules

3. Describe how project managers use network diagrams and dependencies to assist in activity sequencing

4. Understand the relationship between estimating resources and project schedules

5. Explain how various tools and techniques help project managers perform activity duration estimating

6. 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

7. Discuss how reality checks and people issues are involved in controlling and managing changes to the project schedule

8. Describe how project management software can assist in project time management and review words of caution before using this software

**Introduction**

As much as time is of essence on most projects, most projects suffer due to scheduling

problems. This chapter outlines time management for successful project completion.

**The importance of Project Schedules**

Many information technology projects are failures in terms of meeting scope, time, and

cost projections. Managers often cite delivering projects on time as one of their biggest challenges.

Managers also cite schedule issues as causing the most conflict on projects throughout a project's timeline.

The overall, schedule issues cause the most conflict over the life of a project. During project formation, or when a project is beginning, priorities and procedures cause more conflict than schedules. During the early phases of a project, only priorities cause more conflict than schedules. During the middle and end phases, schedule issues are the predominant source of conflict.

Perhaps part of the reason schedule problems are so common is that time is easily and simply measured. You can debate scope and cost overruns and make actual numbers appear closer to estimates, but once a project schedule is set, anyone can quickly estimate schedule performance by subtracting the original time estimate from how long it really took to complete the project.

Individual work styles and cultural differences may also cause schedule conflicts. Different cultures and even entire countries have different attitudes about schedules. For example, some countries close businesses for several hours every afternoon to have siestas. Others countries may have different religious or secular holidays at certain times of the year when not much work will be done. 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 these possibilities for schedule conflicts, it's important to use good project time management so that project managers can help improve performance in this area. 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 six main processes involved in project time management:

• **Activity definition** involves identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables. An activity or task is an element of work normally found on the work breakdown structure (WBS) that has an expected duration, a cost, and resource requirements. The main outputs of this process are an activity list, activity attributes, milestone list, and requested changes.

• Activity sequencing involves identifying and documenting the relationships between project activities. The main outputs of this process include a project schedule network diagram, requested changes, and updates to the activity list and attributes.

• Activity resource estimating involves estimating how many resources-people, equipment, and materials-a project team should use to perform project activities. The main outputs of this process are activity resource requirements, a resource breakdown structure, requested changes, and updates to activity attributes and resource calendars.

• Activity duration estimating involves estimating the number of work periods that are needed to complete individual activities. Outputs include activity duration estimates and updates to activity attributes.

• Schedule1development involves analyzing activity sequences, activity resource estimates, and activity duration estimates to create the project schedule. Outputs include a project schedule, schedule model data, a schedule baseline, requested changes, and updates to resources requirements, activity attributes, the project calendar, and the project management plan.

• Schedule control involves controlling and managing changes to the project schedule.

Outputs include performance measurements, requested changes, recommended corrective actions, and updates to the schedule model data, the schedule baseline, organizational process assets, the activity list and attributes, and the project management plan.

**Activity Definition**

Project schedules grow out of the basic documents that initiate a project. The project

charter often mentions planned project start and end dates, which serve as the starting points for a more detailed schedule. The project manager starts with the project charter and develops a project scope statement and WBS. The project charter should also include some estimate of how much money will be allocated to the project.

Using this information with the scope statement, WBS, WBS dictionary, project management plan, and information on organizational process assets, the project manager and project team begin developing a detailed list of activities and their attributes, a milestone list, and requested changes, if applicable.

The **activity** list is a tabulation of activities to be included on a project schedule.

The list should include the activity name, an activity identifier or number, and a brief description of the activity. The **activity attributes** provide more schedule-related information about each activity, such as predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity. The activity list and activity attributes should be in agreement with the WBS and WBS dictionary. Many project teams use an automated system to keep track of all of this activity-related information.

A **milestone** on a project 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. Milestones are also useful tools for setting schedule goals and monitoring Progress.

Activity information is a required input to the other time management processes. You cannot determine activity sequencing, resources, or durations, develop the schedule, or control the schedule until you have a good understanding of project activities.

The goal of the activity definition process is to ensure that the project team has complete understanding of all the work they must do as part of the project scope so they can start scheduling the work.

The WBS is often dissected further during the activity definition process as the project team members further define the activities required for performing the work. Activity definition also results in supporting detail to document important product information as well as assumptions and constraints related to specific activities.

**Activity Sequencing**

After defining project activities, the next step in project time management is activity

sequencing. Activity sequencing involves reviewing the activity list and attributes, project scope statement, milestone list, and approved change requests to determine the relationships between activities. It also involves evaluating the reasons for dependencies and the different types of dependencies.

**Dependency**

A **dependency or relationship** relates to the sequencing of project activities or tasks. For

example, does a certain activity have to be finished before another one can start? Can the project team do several activities in parallel? Can some overlap? Determining these relationships or dependencies between activities has a significant impact on developing and managing a project schedule.

There are three basic reasons for creating dependencies among project activities:

• **Mandatory dependencies** are inherent in the nature of the work being performed on a project. They are sometimes referred to as hard logic. For example, you cannot test code until after the code is written.

• **Discretionary dependencies** are defined by the project team. For example, a project team might follow good practice and not start the detailed design of a new

information system until the users sign off on all of the analysis work. Discretionary dependencies are 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. The installation of a new operating system and other software may depend on delivery of new hardware from an external supplier.

Even though the delivery of the new hardware may not be in the scope of the project, you should add an external dependency to it because late delivery will affect the project schedule.

**Network diagrams**

Network diagrams are the preferred technique for showing activity sequencing.

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

**Activity Resource Estimating**

Before you can estimate the duration for each activity, you must have a good idea of the

quantity and type of resources (people, equipment, and materials) that will be assigned to each activity. The nature of the project and the organization will affect resource estimating. Expert judgment, the availability of alternatives, and estimating data and software (discussed in more detail in Project Cost Management) are tools available to assist in resource estimating. It is important that the people who help determine what resources are necessary include people who have experience and expertise in similar projects and with the organization performing the project.

Important questions to answer in activity resource estimating include:

• How difficult will it be to do specific activities on this project?

• Is there anything unique in the project's scope statement that will affect resources?

• What is the organization's history in doing similar activities? Has the organization done similar tasks before? What level of personnel did the work?

• Does the organization have people, equipment, and materials that are capable and available for performing the work? Are there any organizational policies that might affect the availability of resources?

• Does the organization need to acquire more resources to accomplish the work? Would it make sense to outsource some of the work? Will outsourcing increase or decrease the amount of resources needed and when they'll be available?

A project's activity list, activity attributes, project management plan, enterprise environmental factors, organizational process assets (such as policies regarding staffing and outsourcing), and resource availability information are all important input to answering these questions.

The main outputs of the resource estimating process include a list of activity resource requirements, a resource breakdown structure, requested changes, and updates to the activity attributes and resource calendars, if needed.

**Activity Duration Estimating**

After working with key stakeholders to define activities, determine their dependencies,

and estimate their resources, the next process in project time management is to estimate the duration of activities. It is important to note that **duration** includes the actual amount of time worked on an activity plus elapsed time.

There are several inputs to activity duration estimating. Enterprise environmental factors, organizational process assets, the project scope statement, activity list, activity attributes, activity resource requirements, resource calendars, and the project management plan all include information that affect duration estimates.

**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. There are often several iterations of all the project time management processes before a project schedule is finalized. The ultimate goal of schedule development is to create a realistic project schedule that provides a basis for monitoring project progress for the time dimension of the project. The main outputs of this process are the project schedule, schedule model data, a schedule baseline, requested changes, and updates to resource requirements, activity attributes, the project calendar, and the project management plan. 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.

Several tools and techniques assist in the schedule development process:

• 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.

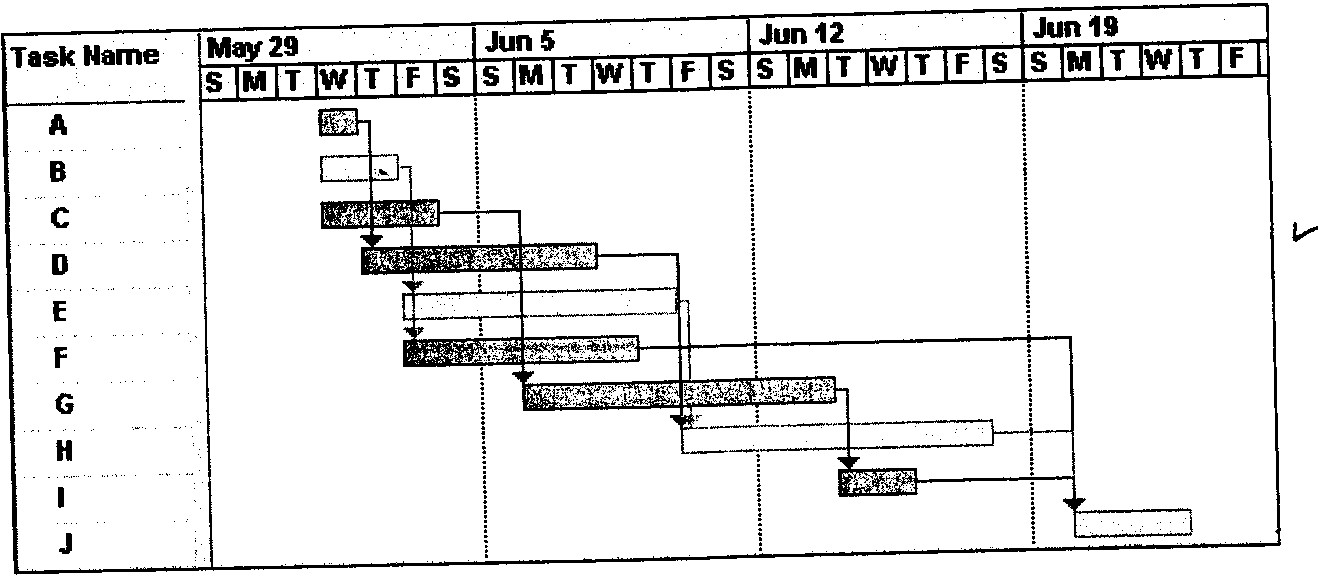
• Critical chain scheduling is a technique that accounts for resource constraints and uses project and feeding buffers.

• PERT analysis is a means for evaluating schedule risk on projects.

**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 a calendar format. Gantt charts are sometimes referred to as bar charts since the activities' start and end dates are shown as horizontal bars.



**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 will help 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. There are normally several tasks done in parallel on projects, and most projects have multiple paths through a network diagram. The longest path or path containing the critical tasks is what is driving the completion date for the project. You are not finished with the project until you have finished *all* the tasks.

**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. The **Theory of Constraints (TOC)** is a management philosophy developed by Eliyahu M. Goldratt and introduced in his book *The Goal.* The Theory of Constraints is based on the fact that, like a chain with its weakest link, any complex system at any point in time often has only one aspect or constraint that limits its ability to achieve more of its goal. For the system to attain any significant improvements, that constraint must be identified, and the whole system must be managed with it in mind. **Critical chain scheduling** is a method of

scheduling that considers limited resources when creating a project schedule and includes buffers to protect the project completion date.

**Program Evaluation and Review Technique (PERT)**

Another project time management technique is the Program Evaluation and Review

Technique (PERT)-a network analysis technique used to estimate project duration when there is a high degree of uncertainty about the individual activity duration estimates. PERT applies the critical path method to a weighted average duration estimate.

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. In other words, PERT uses a three-point estimate. Like the critical path method, PERT is based on a network diagram, normally the precedence diagramming method.

To use PERT, you calculate a weighted average for the duration estimate of each project activity using the following formula:

PERT weighted average = optimistic time + 4 x most likely time + pessimistic time

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By using the PERT weighted average for each activity duration estimate, the total project duration estimate accounts for the risk or uncertainty in the individual activity estimates.

**Schedule Control**

The final process in project time management is schedule control. Like scope control,

schedule control is a portion of the integrated change control process under project integration management. The goal of schedule control is to know the status of the schedule, influence the factors that cause schedule changes, determine that the schedule has changed, and manage changes when they occur.

The main inputs to schedule control are the schedule baseline, performance reports, approved change requests, and the schedule management plan. Tools and techniques include:

• Progress reports

• A schedule change control system, operated as part of the integrated change control system described in Project Integration Management

• Project management software, such as Project 2003 or similar software

• Schedule comparison charts, such as the tracking Gantt chart

• Variance analysis, such as analyzing float or slack

• Performance management, such as earned value, described in Project Cost

Management

The main outputs of schedule control include performance measurements, requested changes, recommended corrective actions, and updates to the schedule baseline, schedule model data, activity list, activity attributes, project management plan, and organizational process assets, such as lessons-learned reports related to schedule control.

**Discussion Questions**

1. Why do you think schedule issues often cause the most conflicts on projects?

2. Why is activity definition the first process involved in project time management?

3. Why is it important to determine activity sequencing on projects?

4. Discuss diagrams you have seen that are similar to network diagrams. Describe their similarities and differences.

5. How does activity resource estimating affect activity duration estimating?

6. Explain the difference between activity duration estimating and estimating the effort required to perform an activity.

7. Explain the following schedule development tools and concepts: Gantt charts, critical path method, PERT, and critical chain scheduling.

8. How can you minimize or control changes to project schedules?

9. List some of the reports you can generate with Project 2003 to assist in project time management.

10. Why is it difficult to use project management software well?