DISH
Digital Innovation and Skills Hub

Study Unit 10

Information Technology Project Management

Information Technology Project Management

- Introduction to IT Project Management
- Scope Management
- Project Time Management
- Project Cost Management
- Agile Project Management

Study Unit Duration

This Study Unit requires a 2 hours of formal study time.

You may spend an additional 2-3 hours for revision

Preamble

This study unit introduces projects and project management, explains how projects fit into programs and portfolio management, discusses the role of the project manager, and provides important background information on this growing profession. Although project management applies to many different industries and types of projects, this text focuses on applying project management to IT projects.

Learning Outcomes of Study Unit 10

Upon completion of this study unit, you should be able to:

10.1 Define Project, Project Management and explain the growing need for IT project management

10.2 Describe the scope and benefits of good project management

10.3 Define project time management, estimate duration of activities and develop PERT and GAUNT Charts, control schedule

10.4 Explain the significance of project cost management (PCM), and how project management software can assist in PCM

10.5 Explain agile project management, Agile Manifesto and enumerate the advantages of agile project management over traditional methods.

Introduction

This Study Unit covers basic introduction to information technology project management, Project Scope Management, Project Time Management, Project Cost Management and Agile Project Management.

The complexity and importance of IT projects, which involve using hardware, software, and networks to create a product, service, or result, have evolved dramatically. Today's companies, governments, and nonprofit organizations are recognizing that to be successful, they need to use modern project management techniques, especially for IT projects. Individuals are realizing that to remain competitive in the workplace, they must develop skills to become good project team members and project managers. They also realize that many of the concepts of project management will help them in their everyday lives as they work with people and technology on a day-to-day basis. Many organizations assert that using project management techniques provides advantages, such as:

- Better control of financial, physical, and human resources
- Improved customer relations
- Shorter development times
- Lower costs and improved productivity
- Higher quality and increased reliability
- Higher profit margins
- Better internal coordination
- Positive impact on meeting strategic goals
- Higher worker morale

10.1   Project

A project is a temporary discrete endeavor undertaken to create a unique product, service, or result. It is time-constrained, and often constrained by funding. It ends when the objectives have been reached or the project has been terminated. It is essential to understand projects so that we can understand their management. Projects can be large or small starting from single person to thousands of people. It may be started and finished in one day or might take years for finish. The following are examples of projects. Try to list other projects based on your understanding and learning from these examples:

- A consultant building network infrastructure of a company

- A team of students creates a smartphone application and sells it online.

- A company develops a driver-less car.

- A college upgrades its technology infrastructure to provide wireless Internet access across the whole campus as well as online access to all academic and student service information.

- A company develops a new system to increase sales force productivity and customer relationship management that will work on various laptops, smartphones, and tablets.

- A television network implements a system to allow viewers to vote for contestants and provide other feedback on programs via social media sites.

- A government group develops a system to track child immunizations.

- A large group of volunteers from organizations throughout the world develops standards for environmentally friendly or green IT.

- A global bank acquires other financial institutions and needs to consolidate systems and procedures.

- Government regulations require monitoring of pollutants in the air and water.

- A multinational firm decides to consolidate its information systems into an integrated enterprise resource management approach.

10.1.1 Project Attributes

The following attributes help define a project further.

i. Unique purpose

project has a unique purpose with a well-defined objective. It results in a unique product, service, or result.

ii. Temporary

A project has a definite beginning and end.

iii. Progressive elaboration

Projects are often defined broadly when they begin, and as time passes, the specific details of the project become clearer. Project should be developed in increments and project team should develop initial plans and then update them with more detail based on new information.

iv. Requires resources

A project requires often from various areas. Resources include people, hardware, software, and other assets. Many projects cross departmental or other boundaries to achieve their unique purposes.

v. Primary customer or sponsor

Most projects have many interested parties or stakeholders, but for a project to succeed someone must take the primary role of sponsorship. The project sponsor usually provides the direction and funding for the project.

vi. Uncertainty

it is sometimes difficult to certainly define project objectives, estimate how long it will take to complete, or determine how much it will cost. External factors also cause

uncertainty. This uncertainty is one of the main reasons project management is so challenging, especially on projects involving new technologies.

10.1.2 Project Constraints

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

Scope: What work will be done as part of the project? What unique product, service, or result does the customer or sponsor expect from the project? How will the scope be verified?

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

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

Managing the triple constraint involves making trade-offs between scope, time, and cost goals for a project. For example, you might need to increase the budget for a project to meet scope and time goals. Alternatively, you might have to reduce the scope of a project to meet time and cost goals. Although the triple constraint describes how the basic elements of a project interrelate, other elements can also play significant roles. Quality is often a key factor in projects, as is customer or sponsor satisfaction. Some people, in fact, refer to the quadruple constraint of project management, which includes quality as well as scope, time, and cost.

10.1.3 Project Management

Project management is "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements." Project managers must strive not only to meet specific scope, time, cost, and quality goals of projects, they must also facilitate the entire process to meet the needs and expectations of people involved in project activities or affected by them. Project managers play an important role in making projects, and therefore organizations, successful. Project managers work with the project sponsors, the project team, and other stakeholders to meet project goals. They also work with sponsors to define success for particular projects. Good project managers do not assume that their definition of success is the same as the sponsors'. They take the time to understand their sponsors' expectations and then track project performance based on important success criteria. An effective project manager is crucial to a project's success. Project managers work with the project sponsors, team, and the other people involved to achieve project goals.

Key elements of this framework include the project stakeholders, project management knowledge areas, project management tools and techniques, and the contribution of successful projects to the enterprise.

Project management is the process by which a project is planned, controlled, and measured in order to deliver the project work products.
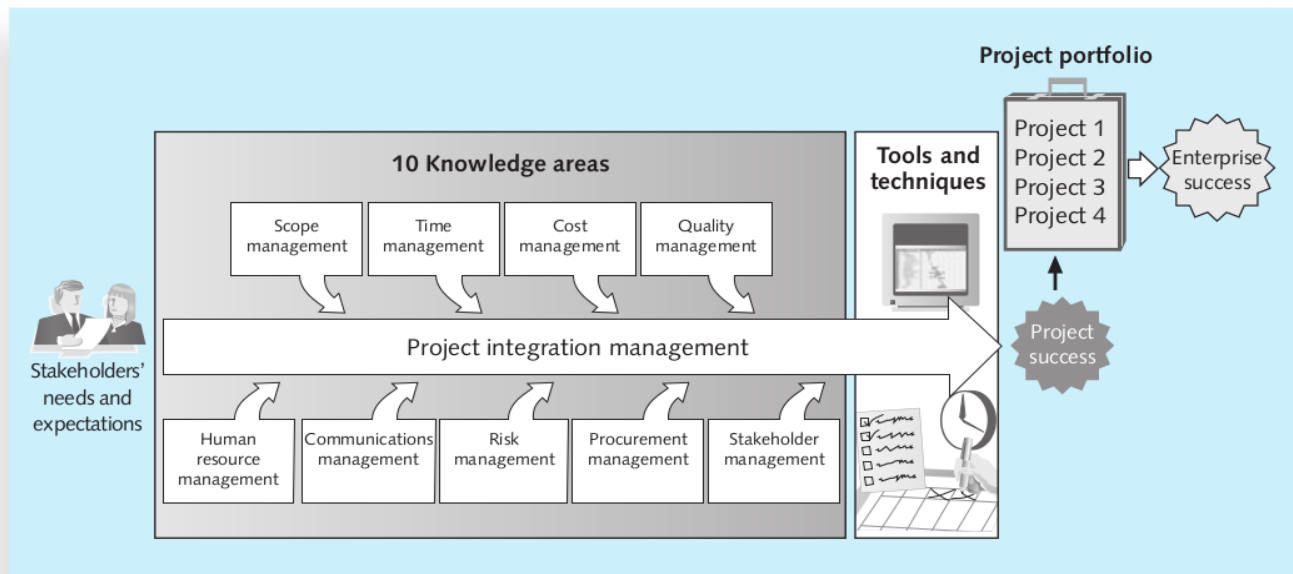
Figure 10.2   Project Management Framework

Why is project management important?

Statistics constantly point to the challenges in the successful delivery of IT projects

- Over 74% of projects are not delivered on time, on budget, or to expected quality.

- The most common reasons for these problems are:

    – Ill-defined or changing requirements

    – Unrealistic expectations or inaccurate estimates

    – Poor project planning or management

10.1.4 Project Stakeholders

Stakeholders are the people involved in or affected by project activities, and include the project sponsor, project team, support staff, customers, users, suppliers, and even opponents of the project. These stakeholders often have very different needs and expectations.

A familiar example of a project is building a new house. There are several stakeholders in a home construction project.

10.1.5 Project Management Knowledge Areas

Project management knowledge areas describe the key competencies that project managers must develop. The center of Figure 1-2 shows the 10 knowledge areas of project management.

1. Project scope management involves defining and managing all the work required to complete the project successfully.

2. Project time management includes estimating how long it will take to complete the work, developing an acceptable project schedule, and ensuring timely completion of the project.

3. Project cost management consists of preparing and managing the budget for the project.

4. Project quality management ensures that the project will satisfy the stated or implied needs for which it was undertaken.

5. Project human resource management is concerned with making effective use of the people involved with the project.

6. Project communications management involves generating, collecting, disseminating, and storing project information.

7. Project risk management includes identifying, analyzing, and responding to risks related to the project.

8. Project procurement management involves acquiring or procuring goods and services for a project from outside the performing organization.

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

10. Project integration management is an overarching function that affects and is affected by all of the other knowledge areas.

Project managers must have knowledge and skills in all 10 of these areas. This text includes an entire chapter on each of these knowledge areas because all of them are crucial to project success.

10.1.6 Project Management Tools and Techniques

Project management tools and techniques assist project managers and their teams in carrying out work in all 10 knowledge areas. Thomas Carlyle, a famous historian and author, stated, "Man is a tool-using animal. Without tools he is nothing, with tools he is all." As the world continues to become more complex, it is even more important for people to develop and use tools, especially for managing important projects. For example, some popular time-management tools and techniques include Gantt charts, project network diagrams, and critical path analysis. It is crucial for project managers and their team members to determine which tools will be most useful for their particular projects.

10.1.7 Project Success

How do you define the success or failure of a project? The list that follows outlines a few common criteria for measuring the success of a project

i. The project met scope, time, and cost goals

ii. The project satisfied the customer/sponsor

iii. The results of the project met its main objective, such as making or saving a certain amount of money, providing a good return on investment, or simply making the sponsors happy.

Why do some IT projects succeed and others fail? Table 1 below summarizes the results of CHAOS study. The factors that contribute most to the success of IT projects are listed in order of importance.

Table 10.1 What helps projects succeed

1. Executive support
2. User involvement
3. Clear business objectives
4. Emotional maturity
5. Optimizing scope
6. Agile process
7. Project management expertise
8. Skilled resources
9. Execution
10. Tools and infrastructure

Source: The Standish Group, "CHAOS Manifesto 2013: Think Big, Act Small" (2013).

10.1.8 Program and Project Portfolio Management

As mentioned earlier, about one-quarter of the world's gross domestic product is spent on projects. Projects make up a significant portion of work in most business organizations or enterprises, and managing those projects successfully is crucial to enterprise success. Two important concepts that help projects meet enterprise goals are the use of programs and project portfolio management.

Programs

A program is "a group of related projects, subprograms, and program activities managed in a coordinated way to obtain benefits and control not available from managing them individually." 20 As you can imagine, it is often more economical to group projects together to help streamline management, staffing, purchasing, and other work. The following are examples of common programs in the IT field.

Infrastructure: An IT department often has a program for IT infrastructure projects. This program could encompass several projects, such as providing more wireless Internet access, upgrading hardware and software, enhancing computer security, and developing and maintaining corporate standards for IT.

Applications development: This program could include several projects, such as updating an enterprise resource planning (ERP) system, purchasing a new off-the-shelf billing system, or developing a new capability for a customer relationship management system.

User support: In addition to the many operational tasks related to user support, many IT departments have several projects to support users. For example, a project might provide a better e-mail system or develop technical training for users.

A program manager provides leadership and direction for the project managers heading the projects within a program. Program managers also coordinate the efforts of project teams, functional groups, suppliers, and operations staff supporting the projects to ensure that products and processes are implemented to maximize benefits.

Project Portfolio Management

In many organizations, project managers also support an emerging business strategy of project portfolio management or portfolio management, as called in this text, in which organizations group and manage projects and programs as a portfolio of investments that contribute to the entire enterprise's success. Portfolio managers help their organizations make wise investment decisions by helping to select and analyze projects from a strategic perspective. Portfolio managers may or may not have previous experience as project or program managers. It is most important that they

have strong financial and analytical skills and understand how projects and programs can contribute to meeting strategic goals.

Figure 10.3 Project Portfolio Management

Portfolio management addresses questions like "Are we working on the right projects?", "Are we investing in the right areas?", and "Do we have the right resources to be competitive?" Pacific Edge Software's product manager, Eric Burke, defines project portfolio management as "the continuous process of selecting and managing the optimum set of project initiatives that deliver maximum business value."

10.1.9 The Role of the Project Manager

You have already read that project managers must work closely with the other stakeholders on a project, especially the sponsor and project team. They are also more effective if they are familiar with the 10 project management knowledge areas and the various tools and techniques related to project management. Experienced project managers help projects succeed. But what do project

managers do, exactly? What skills do they really need to do a good job? The next section provides brief answers to these questions, and the rest of this book gives more insight into the role of the project manager. Even if you never become a project manager, you will probably be part of a project team, and it is important for team members to help their project managers.

The job description for a project manager can vary by industry and by organization, but most project managers perform similar tasks regardless of these differences. In fact, project management is a skill needed in every major IT field, from database administrator to network specialist to technical writer. Because demand for project managers is high, some organizations have hired new college graduates to fill positions normally held by experienced professionals. For example, Boom Lab, a consulting company, is growing quickly by finding, training, and placing talented people as project coordinators. As new project coordinators gain experience and credentials, they often continue their careers by managing larger projects, becoming program managers, or transitioning into other management positions.

Suggested Skills for Project Managers

Project managers need to have a wide variety of skills and be able to decide which skills are more important in different situations. A Guide to the Project Management Body of Knowledge the PMBOK ® Guide recommends that the project management team understand and use expertise in the following areas:

- The Project Management Body of Knowledge

- Application area knowledge, standards, and regulations

- Project environment knowledge

- General management knowledge and skills

- Soft skills or human relations skills

There are three dimensions of project management competency: project management knowledge (knowing about project management), performance competency (being able to apply project management knowledge), and personal competency (attitudes and personality characteristics)

[PMBOK ® Guide 5th edition]. These skills include understanding change and understanding how organizations work within their social, political, and physical environments. Project managers must be comfortable leading and handling change, because most projects introduce changes in organizations and involve changes within the projects themselves. Project managers need to understand the organization in which they work and how that organization develops products and provides services. Project manager can delegate detailed responsibility for some of these areas to a team member, support staff, or even a supplier.

Project manager can delegate detailed responsibility for some of these areas to a team member, support staff, or even a supplier. Even so, the project manager must be intelligent and experienced enough to know which of these areas are most important and who is qualified to do the work. The project manager must make all key project decisions and take responsibility for them. Achieving high performance on projects requires soft skills, otherwise called human relations skills. Some of these soft skills include effective communication, influencing the organization to get things done, leadership, motivation, negotiation, conflict management, and problem solving.

Project managers must be flexible, creative, and sometimes patient in working toward project goals; they must also be persistent in making project needs known. IT project managers, must be able to make effective use of technology as it relates to the specific project. Making effective use of technology often includes special product knowledge or experience with a particular industry. They must make many decisions and deal with people in a wide variety of disciplines. Project managers do not normally have to be experts on any specific technology, but they have to know enough to build a strong team and ask the right questions to keep things on track. IT project managers must be willing to develop more than their technical skills to be productive team members and successful project managers. Everyone, no matter how technical they are, should develop business and soft skills.

Importance of People Skills and Leadership Skills

All project managers, especially those working on technical projects, need to demonstrate leadership and management skills. Leadership and management are terms often used

interchangeably, although there are differences. Generally, a leader focuses on long-term goals and big-picture objectives while inspiring people to reach those goals. A manager often deals with the day-to-day details of meeting specific goals. Some people say: "Managers do things right, and leaders do the right things." "Leaders determine the vision, and managers achieve the vision." "You lead people and manage things." However, project managers often take on the role of both leader and manager.

Good project managers know that people make or break projects, so they must set a good example to lead their team to success. They are aware of the greater needs of their stakeholders and organizations, so they are visionary in guiding their current projects and in suggesting future ones. Companies that excel in project management grow project "leaders," emphasizing development of business and communication skills. Yet, good project managers must also focus on getting the job done by paying attention to the details and daily operations of each task. Instead of thinking of leaders and managers as specific people, it is better to think of people as having leadership skills, such as being visionary and inspiring, and management skills, such as being organized and effective. Therefore, the best project managers have leadership and management characteristics; they are visionary yet focused on the bottom line. Above all else, good project managers focus on achieving positive results

10.1.10 The Project Management Profession

The Project Management Institute (PMI), an international professional society for project managers founded in 1969, has continued to attract and retain members, reporting more than 600,000 members worldwide by late 2021. Because so many people work on projects in different industries across the globe, PMI has created communities of practice that enable members to share ideas about project management in their particular application areas, such as information systems. PMI also has communities for aerospace/defense, financial services, government, healthcare, and agile techniques, to name a few. Note that there are other project management professional societies, such as the International Project Management Association (IPMA) and the Association for Project Management (APM).

10.1.11   Project Management Certification

Professional certification is an important factor in recognizing and ensuring quality in a profession. PMI provides certification as a Project Management Professional (PMP) - someone who has documented sufficient project experience and education, agreed to follow the PMI code of professional conduct, and demonstrated knowledge of project management by passing a comprehensive examination. Note that you do not need work experience to qualify for CompTIA's Project+ certification or PMI's CAPM certification, so college graduates just entering the workforce can earn these certifications and become more marketable.

Several studies show that organizations supporting technical certification programs tend to operate in more complex IT environments and are more efficient than organizations that do not support certification. Likewise, organizations that support PMP certification see the value of investing in programs to improve their employees' knowledge in project management. Many employers today require specific certifications to ensure that their workers have current skills, and job seekers find that they often have an advantage when they earn and maintain marketable certifications.

As IT projects become more complex and global in nature, the need for people with demonstrated knowledge and skills in project management will continue. Just as passing the CPA exam is a standard for accountants, passing the PMP exam is becoming a standard for project managers. Some companies require that all project managers be PMP certified. Project management certification is also enabling professionals in the field to share a common base of knowledge. For example, any person with PMP certification can list, describe, and use the 10 project management knowledge areas. Sharing a common base of knowledge is important because it helps advance the theory and practice of project management. PMI also offers additional certifications, including agile techniques, scheduling, risk, and program management.

10.1.12   Ethics in Project Management

Ethics, loosely defined, is a set of principles that guides decision making based on personal values of what is considered right and wrong. Making ethical decisions is an important part of project managers' personal and professional lives because it generates trust and respect with other people.

Project managers often face ethical dilemmas. If project managers can make more money by taking bribes, should they? No! Ethics guide us in making these types of decisions. PMI approved a Code of Ethics and Professional Conduct that took effect in January 2007. This code applies not only to PMPs but to all PMI members who hold a PMI certification, apply for a PMI certification, or serve PMI in a volunteer capacity.

It is vital for project management practitioners to conduct their work in an ethical manner. Even if you are not affiliated with PMI, these guidelines can help you conduct your work in an ethical manner, which helps the profession earn the confidence of the public, employers, employees, and all project stakeholders. The PMI Code of Ethics and Professional Conduct includes short chapters addressing vision and applicability, responsibility, respect, fairness, and honesty. A few excerpts from this document include the following:

"As practitioners in the global project management community: We make decisions and take actions based on the best interests of society, public safety, and the environment. We:

- Accept only those assignments that are consistent with our background, experience, skills, and qualifications. fulfill the commitments that we undertake.

- Inform ourselves about the norms and customs of others and avoid engaging in behaviors they might consider disrespectful.

- Listen to others' points of view, seeking to understand them.

- Approach directly those persons with whom we have a conflict or disagreement.

- Demonstrate transparency in our decision-making process.

- Constantly reexamine our impartiality and objectivity, taking corrective action as appropriate.

- Proactively and fully disclose any real or potential conflicts of interest to appropriate stakeholders.

- Earnestly seek to understand the truth.

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- Are truthful in our communications and in our conduct.

10.1.13 Project Management Software

There are several smartphone and tablet apps for project management. There are enough options that deciding which project management software to use has become a project in itself. This section summarizes the basic types of project management software available and provides references for finding more information.

Many people still use basic productivity software such as Microsoft Word and Excel t perform many project management functions, including determining project scope, time, and cost, assigning resources, and preparing project documentation. People often use productivity software instead of specialized project management software because they already have it and know how to use it. However, hundreds of project management software tools provide specific functionality for managing projects and performing portfolio management. Hence, selecting and using the right software can enhance productivity and you should look and use a product that improves your efficiency and effectiveness.

In summary, there are many reasons to study project management, particularly as it relates to IT projects. The number of IT projects continues to grow in almost every industry the complexity of these projects continues to increase, and the profession of project management continues to expand and mature. As more people study and work in this important field, the success rate of IT projects should continue to improve.

Question
Define IT project management and discuss key competencies an IT project needs to have for a successful completion of a project

Tutor Marked Assignment
What is the difference between a project and a portfolio and discuss how each is managed and lead. Identify a project and describe it in terms of its scope, time and cost goals. Also discuss its quality, resources, risk and how it is mitigated. Farther what went right and wrong and explain the role of the project manager and how you would have done things differently from IT project management perspective.

10.1.14 Assessment Quiz

1. All but one of the following are part of the triple constraints of project management

    A. meeting cost goals

    B. meeting risk goals

    C. meeting time goals

    D. meeting scope goals

2. A temporary endeavor undertaken to create a unique, service, or result refers to a

    A. program

B. process

C. portfolio

D. **project**

3. _____ is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements.

   A. **Project Management**

   B. Program Management

   C. Portfolio Management

   D. Requirements Management

4. Several application development projects done for the same functional group might best be managed as part of a _____.

   A. portfolio

   B. **program**

   C. investment

   D. project

5. A good project management results in all of the following except

   A. shorter development time

   B. higher workers' moral

   C. **lower cost of capital**

   D. higher profit margin

10.2 Project Scope Management

Defining scope is critically important and difficult aspect of project management. Project scope management encompasses optimized scope, user involvement, clear business objectives which are factors associated with project success.

Scope refers to all the work involved in creating the products (deliverable) of the project and the processes used to create them. Scope consists of boundaries and contours that shape a project.

Deliverables refers to what will be provided as a product of a development process which may 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 what the products of the project are and, to some extent, how they should be produced to define all of the deliverables.

Project scope management includes processes involved in defining and controlling what work is included a what is excluded in 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.

Table 10.2 Main Processes Involved in Project Scope Management

No	Main Process	Description	Output
1	**Planning scope**	defining and documenting the features and functions of the products as well as the processes used for creating them.	create a scope management plan and requirements management plan
2	**Collecting requirements**	defining and documenting the features and functions of the products as well as the processes used for creating them	requirements documentation and a requirements traceability matrix

3	**Defining scope**	reviewing the scope management plan, project charter, requirements documents, and organizational process	the project scope statement and updates to project documents
4	**Creating the WBS**	subdividing the major project deliverables into smaller, more manageable components	a scope baseline (which includes a WBS and a WBS dictionary) and updates to project documents
5	**Validating scope**	formalizing acceptance of the project deliverables after inspecting by Key project stakeholders, such as the customer and sponsor of the project	accepted deliverables, change requests, work performance information, and updates to project documents
6	**Controlling scope**	controlling changes to project scope throughout the life of the project. cope 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.	work performance information, change requests, and updates to the project management plan, project documents, and organizational process assets.

10.2.1 Planning Scope Management

This is the first step in project scope management which stresses on the importance of planning how the project scope will be managed during the project duration. The process involves reviewing the project management plan, project charter, enterprise environmental factors, and organizational process assets. After analysis of document and taking expert judgment into account, a **scope management plan** and the **requirements management plan** are developed.

Scope management plan

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Generally, includes the following information on how to prepare:

- Project scope statement

- Work Breakdown Structure(WBS)

- Ways of approving and maintaining WBS

- Ways to obtain formal acceptance of the completed project deliverables

- Control requests for changes to the project scope

Requirements management plan requires understanding of requirements. The 1990 IEEE Standard Glossary of Software Engineering Terminology defines a requirement as follows:

- A condition or capability needed by a user to solve a problem or achieve an objective.

- A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed document.

- A documented representation of a condition or capability as in the above two.

The PMBOK ® Guide, Fifth Edition, describes requirements as "conditions or capabilities that must be met by the project or present in the product, service, or result to satisfy an agreement or other formally imposed specification." It further explains that requirements "include the quantified and documented needs and expectations of the sponsor, customer, and other stakeholders. These requirements need to be elicited, analyzed, and recorded in enough detail to be included in the scope baseline and be measured once project execution begins."

Requirements management plan

Requirements management plan documents how project requirements will be analyzed, documented, and managed. A requirements management plan can include the following information:

- How to plan, track, and report requirements activities

- How to perform configuration management activities

- How to prioritize requirements

- How to use product metrics

- How to trace and capture attributes of requirements

10.2.2 Collecting Requirements

This step constitutes collection of requirements using difference ways such as interview, focus groups and facilitated workshops, questionnaires, surveys, observation, prototyping and document analysis which are common techniques for collecting requirements. On agile software development projects, the product owner creates the prioritized product backlog for each sprint, or generating ideas by comparing specific project practices or product characteristics to those of other projects or products inside or outside the performing organization, can also be used to collect requirements. A major consequence of not defining requirements well is rework, which

can consume up to half of project costs, especially for software development projects. Part of the difficulty is that people often do not have a good process for collecting and documenting project requirements. The project's size, complexity, importance, and other factors affect how much effort is spent on collecting requirements. It thus is important for a project team to decide how it will collect and manage requirements and is crucial to gather inputs from key stakeholders and align the scope with business strategy.

There are several ways to document the requirements. Project teams should first review the project charter because it includes high-level requirements for the project, and they should refer to the scope and requirements management plans. They should also review the stakeholder register and stakeholder management plan to ensure that all key stakeholders have a say in determining requirements. The format for documenting stakeholder requirements can range from a listing of all requirements on a single piece of paper to a room full of notebooks. People who have worked on complex projects, such as building a new airplane, know that the requirements documentation for a plane can weigh more than the plane itself! Requirements documents are often generated by

software and include text, images, diagrams, videos, and other media. Requirements are often broken down into different categories such as functional requirements, service requirements, performance requirements, quality requirements, and training requirements.

10.2.3 Defining Scope

The next step in project scope management is to provide a detailed definition of 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 aids in communicating clear work responsibilities. The main tools and techniques used in defining scope include expert judgment, product analysis, alternatives generation, and facilitated workshops. For example, a facilitator could have users, developers, and salespeople join a face-to-face meeting or virtual meeting to exchange ideas about developing a new product. The main outputs of scope definition are the project scope statement and project documents updates.

Key inputs for preparing the project scope statement include the project charter, scope management plan, requirements documentation, and organizational process assets such as policies and procedures related to scope statements, as well as project files and lessons learned from previous, similar projects. Although contents vary, project scope statements should include at least a product scope description, product user acceptance criteria, and detailed information on all project deliverables. It is also helpful to document other scope-related information, such as the project boundaries, constraints, and assumptions. The project scope statement should also reference supporting documents, such as product specifications that will affect what products are created or purchased, or corporate policies, which might affect how products or services are produced. Many IT projects require detailed functional and design specifications for developing software, which also should be referenced in the detailed scope statement. As time progresses, the scope of a project should become more clear and specific.

An up-to-date project scope statement is an important document for developing and confirming a common understanding of the project scope. It describes in detail the work to be accomplished on

the project and is an important tool for ensuring customer satisfaction and preventing scope creep, as described later in this chapter.

10.2.4 Creating The Work Breakdown Structure

After collecting requirements and defining scope, the next step in project scope management is to create a work breakdown structure. A work breakdown structure (WBS) is a deliverable-oriented grouping of the work involved in a project that defines its total scope. Because most projects involve many people and many different deliverables, it is important to organize and divide the work into logical parts based on how the work will be performed. The WBS is a foundation document in project management because it provides the basis for planning and managing project schedules, costs, resources, and changes. Because 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 complete WBS.

The project scope management plan, scope statement, requirements documentation, enterprise environmental factors, and organizational process assets are the primary inputs for creating a WBS. The main tool or technique is decomposition, subdividing project deliverables into smaller pieces. The outputs of the process of creating the WBS are the scope baseline and project documents updates. The scope baseline includes the approved project scope statement and its associated WBS and WBS dictionary. A WBS is often depicted as a task-oriented tree of activities, similar to an organizational chart. A project team often organizes the WBS around project products, project phases, or the project management process groups.

10.2.5 Scope Verification

Scope verification involves formal acceptance of the completed project scope by the stakeholder. 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. Scope creep is scope keep getting bigger and bigger beyond what is stipulated from the outset.

10.2.6 Scope Control

Scope control involves controlling changes to the project scope. Goals of scope control are to: Influence the factors that cause scope changes. Ensure changes are processed according to procedures developed as part of integrated change control. Manage changes when they occur. Variance is the difference between planned and actual performance.

 Many people like to create a WBS in chart form first to help them visualize the whole project.

Activity
Develop a work-break down structure of a project you have been apart, make assumptions if you haven't.

Group Work Assignment
List the advantages importance of scope management for project success.

10.2.8 Assessment Quiz

1. Which of the following is not one of the triple constraint of a project?

    A. Scope

    B. Time

    C. Cost

    D. Quality

2. _____ involves controlling changes to the project scope.

    A. Scope Verification

    B. Scope Control

    C. Requirement Collecting

    D. Scope Definition

3. Good scope definition is very important to project success because it helps improve,,, i

    A. the accuracy of time

    B. cost and resource estimates

    C. defines a baseline

    D. all of the above

4. _____ This is the first step in project scope management which stresses on the importance of planning how the project scope will be managed during the project duration.

A) **Planning Scope Management**

B) Collecting Requirements

C) Defining Scope

D) Creating Work Breakdown Structure

5. _____ is not a key inputs for preparing the project scope statement

A) the project charter

B) scope management plan

C) requirements documentation

D) **cost breakdown structure**

10.3 Project Time Management

Project time management refers to the management of the time spent, and progress made, on project tasks and activities. It deals with processes required to manage timely completion of the project. The process required is analyzed and developed for the completion of a project or deliverable. It requires the planning, scheduling, monitoring and controlling of all project activities.
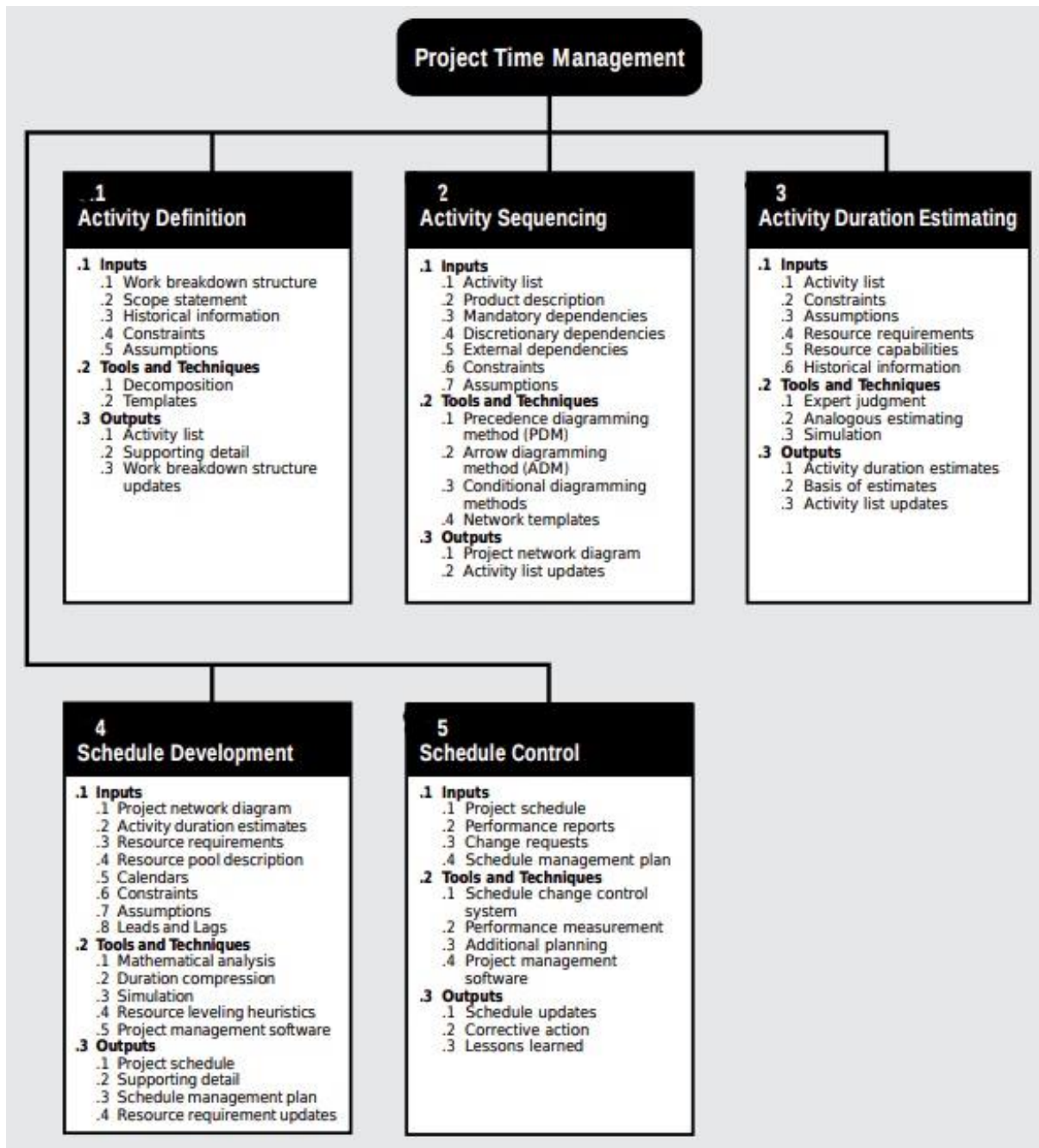
Figure 10.4 Project time management

Project time management consists of different components or steps in which each of these processes occur at least once in every project and in one or more project phases. Those steps include defining activities, sequencing activities, estimating activity resources, estimate activity

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duration, development of schedule and controlling schedule. Time management process happens mainly in the planning phase, although the project duration and the milestones are already decided in the initiation phase, but it is still the project manager's responsibility to plan the project activities and to meet the set project duration within the planned budget.

10.3.1 Defining Activities

Activity definition involves identifying and documenting the specific activities that must be performed in order to produce the deliverables and sub-deliverables identified in the work breakdown structure. The project deliverables are defined in enough details to determine resources and schedule estimates. The project team reviews the schedule management plan, scope baseline, enterprise environmental factors, and organizational process assets to begin defining activities. Tools and Techniques used in defining activities process include decomposition, rolling wave planning, templates and expert judgment. Outputs of this process include an activity list, activity attributes, a milestone list, and project management plan updates.

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. Activities or tasks are elements of work performed during the course of a project; they have expected duration, costs, and resource requirements.

Activity attributes provide 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.

Milestone is a significant event in a project which often takes several activities and a lot of work to complete a milestone. It is a marker to help in identifying necessary activities which is a useful tool for setting schedule goals and monitoring progress.

The goal of defining activities is to ensure that the project team completely understands all the work it must do as part of the project scope so that they can start scheduling the work. It may result in an **update on the project management plan**.

10.3.2 Activity Sequencing

The process of project time management that defines the order in which deliverables must be completed. defined activities are sequenced by determining their dependencies.

Inputs: include the schedule management plan, activity list and attributes, project scope statement, milestone list, and organizational process assets

Dependency

Defines the relationships that pertains to the sequencing of project activities or tasks. This dependency can be of three types which include:

a) **Mandatory dependencies** or hard logic are inherent in the nature of the work being performed on a project. e.g. you cannot eat food before it is prepared.

b) **Discretionary dependencies** are defined by the project team. They are sometimes referred to as soft logic and should be used with care because they may limit later scheduling options. 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.

External dependencies involve relationships between project and non-project activities. For example, the installation of a new operating system and other software may depend on delivery of new hardware from an external supplier. Even though delivery of the hardware may not be included in the scope of the project, you should add an external dependency to it because late delivery will affect the project schedule.

The project dependencies should be worked out in close collaboration with the project stakeholders in a similar fashion as activity definition.
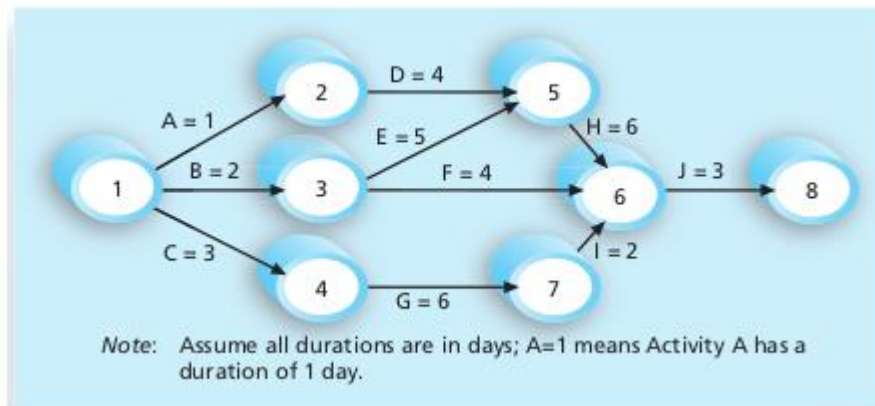
Network Diagrams

Activity sequence can be clearly shown using network diagrams. This diagrams is a schematic display of the logical relationships among project activities and their sequencing. They are also refer to as network diagrams as project schedule network diagrams or PERT charts.

In the network diagram displayed below the letters A through J represent activities with dependencies that are required to complete the project. These activities come from the WBS and activity definition process described earlier.

The arrows represent the activity sequencing or relationships between tasks. For example, Activity A must be done before Activity D, and Activity D must be done before Activity H. The format of this network diagram uses the activity-on-arrow (AOA) approach or the arrow diagramming method (ADM). This is a network diagramming technique in which activities are represented by arrows and connected at points called nodes to illustrate the sequence of activities.

Figure 10.5 Network diagramming technique

Note: Assume all durations are in days; A=1 means Activity A has a duration of 1 day.

A node is simply the starting and ending point of an activity. The first node signifies the start of a project, and the last node represents the end. Keep in mind that the network diagram represents activities that must be done to complete the project. It is not a race to get from the first node to the last node. Every activity on the network diagram must be completed in order to finish the project. Note also that not every item on the WBS needs to be shown on the network diagram; only activities with dependencies need to be shown. However, some people like to have start and end milestones and to list every activity. It is a matter of preference. For large projects with hundreds of activities, it might be simpler to include only activities with dependencies on a network diagram. Sometimes it is enough to put summary tasks on a network diagram or to break down the project into several smaller network diagrams

Estimate Activity Resources – Identifying and defining the types and quantities of resources and materials required to complete a deliverable.

Activity Duration Estimating– Identifying & estimating the timeline for completion of deliverable.

Schedule Development- the analysis of the order of activities, timelines, resources, and schedule barriers to develop a project schedule.

Schedule Control– Project management intervention to mitigate changes to the product schedule

10.4 Project Cost Management

Project cost management is one of the key constrains in project management that includes the processes required to ensure that a project team completes a project within an approved budget. Project managers must make sure their projects are well defined, have accurate time and cost estimates, and have a realistic budget that they were involved in approving. IT projects have a poor track record in meeting budget goals though. Many IT professionals, however, often react to cost overrun information with a smirk. They know that many of the original cost estimates for IT projects are low or based on unclear project requirements, so naturally there will be cost overruns. It is the project manager's job to satisfy project stakeholders while continuously striving to reduce and control costs. Not emphasizing the importance of realistic project cost estimates from the outset is only one part of the problem.

Many IT professionals think that preparing cost estimates is a job for accountants. On the contrary, preparing good cost estimates is a demanding, important skill that many professionals need to acquire. Another perceived reason for cost overruns is that many IT projects involve new technology or business processes. Any new technology or business process is untested and has inherent risks. Using good project cost management can change this false perception that costs grow and failures are to be expected, though cost management is not an easy task. There is a room for improvement in meeting cost goals through planning cost management, creating good estimates, and using earned value management (EVM) to assist in cost control.

There are four processes for project cost management:

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

2. **Estimating costs** involves developing an **approximation** or estimate of the costs of the resources needed to complete a project. The main outputs of the cost estimating process are activity cost estimates, basis of estimates, and project documents updates.

3. **Determining the budget** involves allocating the overall cost estimate to individual work items to establish a **baseline** for measuring performance. The main outputs of the cost budgeting process are a cost baseline, project funding requirements, and project documents updates.

4. **Controlling costs** involves controlling **changes** to the project budget. The main outputs of the cost control process are work performance information, cost forecasts, change requests, project management plan updates, project documents updates, and organizational process assets updates.

10.4.1 Basic Concepts

Cost is a resource sacrificed or foregone to achieve a specific objective, or something given up in exchange which are usually measured in monetary units.

Project Cost: total funds needed to complete the project and the expenditures made or estimated to be made, or monetary obligations incurred or estimated to be incurred to completed the project which are listed in a project baseline.

Project cost management includes the processes required to ensure that the project is completed within an approved budget.

10.4.2 Basic Principles of Cost Management

Most members of an executive board have a better understanding and are more interested in financial terms than IT terms, so IT project managers must speak their language. Thus IT project managers must understand cost management principles, concepts, and terms discussed below.

Profits are revenues minus expenses. To increase profits, a company can increase revenues, decrease expenses, or try to do both. Profit margin is the ratio of profits to revenues.

Profit margin is the ratio of profits to revenues. It is used to measure the potential benefits of a project.

Life cycle costing considers the total cost of ownership, or development plus support costs, for a project. It provides a big-picture view of the cost of a project throughout its life cycle.

Cash flow analysis determines the estimated annual costs and benefits for a project and the resulting annual cash flow.

Tangible costs or benefits are those costs or benefits that an organization can easily measure in dollars.

Intangible costs or benefits are costs or benefits that are difficult to measure in monetary terms.

Direct costs are costs that can be directly related to producing the products and services of the project.

Indirect costs are costs that are not directly related to the products or services of the project, but are indirectly related to performing the project.

Sunk cost is money that has been spent in the past; when deciding what projects to invest in or continue, you should not include sunk costs.

Learning curve theory states that when many items are produced repetitively, the unit cost of those items decreases in a regular pattern as more units are produced.

Reserves are dollars included in a cost estimate to mitigate cost risk by allowing for future situations that are difficult to predict.

Contingency reserves allow for future situations that may be partially planned for (sometimes called known unknowns) and are included in the project cost baseline.

Management reserves allow for future situations that are unpredictable (sometimes called unknown unknowns).

10.4.3 Planning Cost Management

It is the first step in project cost management that deals with how the costs will be managed throughout the life of the project. Project costs, like project schedules, grow out of the basic documents that initiate a project, like the project charter. The project manager and other stakeholders use expert judgment, analytical techniques, and meetings to produce the cost management plan.

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

Level of accuracy: Activity cost estimates normally have rounding guidelines, such as rounding to the nearest $100. There may also be guidelines for the amount of contingency funds to include, such as 10 or 20 percent.

Units of measure: Each unit used in cost measurements, such as labor hours or days, should be defined.

Organizational procedures links: Many organizations refer to the work breakdown structure (WBS) component used for project cost accounting as the control account (CA). Each control account is often assigned a unique code that is used in the organization's accounting system. Project teams must understand and use these codes properly.

Control thresholds: Similar to schedule variance, costs often have a specified amount of variation allowed before action needs to be taken, such as ±10 percent of the baseline cost.

Rules of performance measurement: If the project uses earned value management (EVM), as described later in this chapter, the cost management plan would define measurement rules, such as how often actual costs will be tracked and to what level of detail.

Reporting formats: This section would describe the format and frequency of cost reports required for the project.

Process descriptions: The cost management plan would also describe how to perform all of the cost management processes.

10.4.4 Cost Estimation

It's important to know the types of cost estimates, how to prepare cost estimates, and typical problems associated with IT cost estimates. Project managers must take cost estimates seriously if they want to complete projects within budget constraints. An important process in project time management is estimating activity resources, this information is required to develop a good cost estimate.

Type of Estimate

Rough order of Magnitude(ROM) – is done very early in the project life cycle(3-5 year before project completion). It provides a rough cost estimate for the purpose of decision making in project selection with an accuracy level of -50% to +100%.

Budgetary – is an estimate done in the early one to two year out. It puts dollars in the budget plan and is expected to be -10% to +25% accurate.

Definitive – id an estimate done later in the project in less than a year. It provides details for purchases by estimating actual costs and is expected to be -5%to +10%.

10.4.5 Cost Management Plan

A cost management plan is a document that describes how the organization will manage cost variances on the project. A large percentage of total project costs are often labor costs, so project managers must develop and track estimates for labor

Cost Estimation Tools and Techniques

Basic tools and techniques for cost estimates:

Analogous or top-down estimates: use the actual cost of a previous, similar project as the basis for estimating the cost of the current project.

Bottom-up estimates: involve estimating individual work items or activities and summing them to get a project total.

Parametric modeling uses project characteristics (parameters) in a mathematical model to estimate project costs.

Problems with IT Cost Estimate

- Estimates are done too quickly

- Lack of estimating experience

- Human beings are biased toward underestimation

- Management desires accuracy

Determining Budget

Cost budgeting involves allocating the project cost estimate to individual work items over time The WBS is a required input to the cost budgeting process since it defines the work items Important goal is to produce a cost baseline. A time-phased budget that project managers use to measure and monitor cost performance Controlling Cost. Project cost control includes:

- Monitoring cost performance

- Ensuring that only appropriate project changes are included in a revised cost baseline

- Informing project stakeholders of authorized changes to the project that will affect costs

Many organizations around the globe have problems with cost control

10.4.6 Earned Value Management(EVM)

EVM is a project performance measurement technique that integrates scope, time, and cost data Given a baseline (original plan plus approved changes), you can determine how well the project is meeting its goals.

You must enter actual information periodically to use EVM.

More and more organizations around the world are using EVM to help control project costs

The **planned value (PV)**, formerly called the budgeted cost of work scheduled (BCWS), also called the budget, is that portion of the approved total cost estimate planned to be spent on an activity during a given period

Actual cost (AC), formerly called actual cost of work performed (ACWP), is the total of direct and indirect costs incurred in accomplishing work on an activity during a given period

The **earned value (EV),** formerly called the budgeted cost of work performed (BCWP), is an estimate of the value of the physical work actually completed

EV is based on the original planned costs for the project or activity and the rate at which the team is completing work on the project or activity to date

Rate of performance (RP) is the ratio of actual work completed to the percentage of work planned to have been completed at any given time during the life of the project or activity

Rules of Thumb for Earned Value

- Negative numbers for cost and schedule variance indicate problems in those areas

- CPI and SPI less than 100% indicate problems

- Problems mean the project is costing more than planned (over budget) or taking longer than planned (behind schedule)

The CPI can be used to calculate the estimate at completion (EAC), an estimate of what it will cost to complete the project based on performance to date; the budget at completion (BAC) is the original total budget for the project. Project cost management is a traditionally weak area of IT projects, and project managers must work to improve their ability to deliver projects within approved budgets

10.5 Agile Project Management

After the release of the 2001 agile manifesto agile project management evolved and became a popular choice for many project managers, irrespective of the industry though it was originally

made for software development. Development of a quality product depends on the process used to complete the project. There is always a lot of pressure on software projects to become more productive and efficient. Software projects have been characterized by facing many issues and problems throughout their life cycles. To address this issues agile project management relies on incremental, iterative development cycles to complete less-predictable projects. It is ideal for exploratory projects in which requirements need to be discovered and new technology tested. Focuses on active collaboration between the project team and customer representatives. Agile stands to be one of the most popular approaches to project management because of its flexibility and evolutionary nature. Agile, in a nutshell, is an iterative and incremental approach to project management that helps teams keep up with the demands of the modern workplace. It consists of different methodologies and all of them are based on the concepts of flexibility, transparency, quality, and continuous improvement.

Agility: is the capability to efficiently and effectively adapt to an ever changing environment. Agility is a property of a system that is present to some varying extent, depending on how the system operates. It can be defined at different levels: personal, departmental or organizational. One can identify three drivers which will cause a system to become more agile: flow, learning and collaboration.

- Flow refers to the way work is processed by the system. If the processing of work occurs at a steady and sustainable rate, the system has a high level of flow. Such state of high flow is often accompanied by a feeling that work becomes easy and routine takes over. Some people refer to this state as "being in the zone".

- Learning refers to mechanisms in the system which allow the system to learn from past experiences, mistakes or other people, but also to uncover unknown unknowns (knowledge discovery).

- Collaboration refers to various ways how people in the system can work together to achieve a single goal.

10.5.1 The Agile Manifesto

The Agile Manifesto and the Twelve Principles of Agile Software were the consequences of industry frustration in the 1990s. The enormous time lag between business requirements (the applications and features customers were requesting) and the delivery of technology that answered those needs, led to the canceling of many projects. Business, requirements, and customer requisites changed during this lag time, and the final product did not meet the then current needs. The software development models of the day, led by the Waterfall model, were not meeting the demand for speed and did not take advantage of just how quickly software could be altered. In 2000, a group of seventeen "thought leaders," met in 2001 when the Agile Manifesto and Principles were formally written.

The Manifesto is comprised of four foundational values and 12 supporting principles which lead the Agile approach to software development. Each Agile methodology applies the four values in different ways, but all of them rely on them to guide the development and delivery of high-quality, working software.

Core Values

1. Individuals and interactions over processes and tools. While tools and processes are important, it is even more important to have competent people working together effectively.

2. Working software over comprehensive documentation. While good documentation is useful, the main point of development is to create software not documentation.

3. Customer collaboration over contract negotiation. While a contract is important, it is no substitute for working closely with customers to discover what they need.

4. Responding to change over following plan. While a project plan is important, it should not hinder to accommodate to changes.

Principles

The agile manifesto also identified twelve principles:

1. Customer satisfaction by early and continuous delivery of valuable software.

2. Welcome changing requirements, even in late development.

3. Deliver working software frequently (weeks rather than months).

4. Close, daily cooperation between business people and developers.

5. Projects are built around motivated individuals, who should be trusted.

6. Face-to-face conversation is the best form of communication (co-location).

7. Working software is the primary measure of progress.

8. Sustainable development, able to maintain a constant pace.

9. Continuous attention to technical excellence and good design.

10. Simplicity - the art of maximizing the amount of work not done - is essential.

11. Best architectures, requirements, and designs emerge from self-organizing teams.

12. Regularly, the team reflects on how to become more effective, and adjusts accordingly.

While the agile manifesto was written with software development in mind, many of its ideas can be transferred to projects in general, giving rise to idea of agile project management. Some core principles that return in agile project management are:

- Iterative, incremental and evolutionary development.

- Efficient and face-to-face communication.

- Very short feedback loops and adaptation cycles.

- Focus on quality.

10.5.2 Advantages of Agile PM

Agile project management give greater control over project as it focuses on delivering quality and value to customers while delivering within the given project constraints. It is useful in developing critical breakthrough technology or defining essential features allowing continuous integration,

verification, and validation of the evolving product. The frequent demonstration of progress to increase the likelihood that the end product will satisfy customer needs and ability of early detection of defects and problems make it a preferable choice for managers. The following are some of the main reasons and benefits of Agile and why it is adopted by top companies for managing their projects:

Quality product: Agile project management given wight to testing which leads to an improvement in the quality of product. The development it user centered which makes changes easily addressed. Since Agile is an iterative process, self-organizing teams keep on learning and growing with time and continue improving.

Customer satisfaction: customer is always involved in the decision making process which leads to greater customer retention. Starting from the planning phase customers are involved and they shape the development by actively giving feedback making sure that the final product is truly according to their requirements.

Shorter Time to Market: Another benefit of Agile Project Management is that the go-to-market time gets significantly reduced. This allows the product owner to successfully capitalize on the opportunity and in some cases, enjoy the first-mover advantage. It's only natural that when customers get to enjoy these benefits because of your performance, they'll come back to you for other projects.

Better Control: as a result of transparency, feedback integration, and quality-control features. stakeholders are involved in the process with daily progress reports through advanced reporting tools and techniques which ensures quality.

Predictability: There are also greater ways to identify and predict risks and plan to ensure that the project runs smoothly. Scrum methodology, for example, uses sprint backlogs and burn down charts to increase the visibility of the project which allows managers to predict performances and plan accordingly.

Reduced risks: Due to the fact that Agile works in small sprints that focus on continuous delivery, the risk of failure is reduced. There is always a small part that can be salvaged and used in the future even if a particular approach doesn't go as planned.

Increased flexibility: The constant and quick feedback from product owners and the ability to work on smaller bursts reduces costly mistakes and increases flexibility. Agile divides the project in short sprints that are both manageable and flexible enough to allow the team to implement changes on short notice.

Continuous improvement: Working on self-reflection and striving for continuous improvement is one of the 12 core principles of the Agile manifesto. An iterative approach is followed such that each sprint is better than the last one and previous mistakes will not be repeated. It fosters an open culture of idea exchange and collaboration which allows team members to learn from shared experiences and improve together.

Improved team moral: Teams are self-organized and self-managing with limited size that have increased autonomy and authority over their decisions. The project manager shields the team from interference from sponsors and management. The cross-functional nature of the teams also helps the members learn new project management skills and grow in their current roles. The team gets together frequently to discuss challenges and statuses letting them collaborate better.

Better Estimate: The metrics used by Agile teams in estimating time, cost, and measuring an overall project performance are more accurate and relevant than the ones used in traditional methodologies. Agile emphasizes on producing results and optimizing performance while the metrics in Waterfall methodology show how closely the project is tracking against the estimated cost and time. Agile produces important metrics like lead time, cycle time, and throughput that helps measure the team's performance, identify bottlenecks and make data-driven decisions to correct them.

In general, Agile framework is a powerful tool that helps managers, team members, and clients. From improving the quality of the product to helping in the professional development of the team

members, the benefits of Agile are numerous. It helps teams overcome pitfalls like excessive costs and scope creep.

10.5.3 Agile Project Management Methods

Agile is an umbrella term for a vast variety of methodologies and techniques, sharing the principles and values described above. Each of them has its own areas of use and distinctive features. The most popular frameworks are Scrum, Kanban, Hybrid, Lean, Bimodal, and XP. Before discussing these frameworks in more detail, let's look at their key features.

a) Scrum

Scrum framework as agile software development approach was developed by Ken Schwaber and Jeff Sutherland. In scrum the entire scope of work is broken down into short cycles – sprints. The sprints have a duration of one to four weeks which need to be strictly followed by team which will have a work plan for each sprint. Scrum mainly focusses on the collaboration and learning drivers of agility.

Roles: it defines three key roles namely a product owner, a team member and a scrum master. Scrum assumes that the work is done by a single self-organizing cross-functional team which contains a diverse set of skills required to perform the work. The role of a product owner emphasizes the need to continuously evaluate the needs of the customers.

Key events: a sprint, the sprint planning, the daily scrum, a sprint review and a sprint retrospective are the five key events in scrum. The sprint represents a single iteration which is timeboxed (fixed amount of time). If one considers the work assigned to a single sprint as 1 work-item, one could state that Scrum uses a work in progress(WIP)-limit of 1. Limiting the amount of work in progress makes it easier to identify inefficiency in a team's workflow.

Main artifacts: a product backlog, a sprint backlog and an increment are the three main artifacts in scrum. A product backlog contains a prioritized list of deliverables such as new features. A sprint backlog is a set of items that a cross-functional product team selects from its product backlog to work on during the upcoming sprint which is selected during sprint planning session. The

increment is the potentially releasable output of the sprint. Scrum assumes an incremental approach. Therefore, the increment refers to the work done in a specific sprint integrated with the work of all previous sprints. At the end of each sprint, the end deliverable has received an update which moves it closer to the end goal.

b) Kanban

The Kanban method goes back to a lean manufacturing method which was inspired by the Toyata Production System. Its key idea are to visualize work items to give participants a view of progress and to allow work to be pulled rather than be pushed. Over time, Kanban and Kanban boards in particular found their way to software development projects. It is used in all different kind of contexts outside software development thereafter. In Kanban there are no time boxed development cycles. The team can change the work plan at any time. It focuses on the visualization of work (by means of a Kanban board) by giving priority to the current work(WIP).

- Kanban limits work in progress (WIP). It does so by defining a commitment point and a delivery point in the process. The commitment point is where the team and the customer commit to the work being done, whereas the delivery point is where the customer commits to accept the output.

- Kanban advises to make work (and Kanban) policies explicit.

- Kanban focusses on managing the flow at a steady and sustainable rate.

- Kanban implements feedback loops.

- Kanban assumes collaborative improvements.

Kanban focuses mainly on the flow driver of agility. As a project method it is often combined with other method to give sufficient guidance for project management.

c) Hybrid

Blends the plan-driven principles and practices with agile(adaptive) principles and practices in the right proportion to fit a given situation. As agile and waterfall methods complement each other, agile software development is held under waterfall conditions i.e. flexible deadline, forecasted budget, and thorough risk assessment.

d) Bimodal

Follows two separate modes i.e traditional (mode 1) and agile (Mode 2). Two separate teams are working on projects with two different goals. For instance, Mode 1 team may do the maintenance of IT infrastructure while Mode 2 is developing an application to provide software solutions. In doing so cross team collaboration is very important.

e) Lean

Promotes fast software development with less effort, time and cost with development cycles being as short as possible. The product delivered early is being continuously improved. The team is independent and has a wider range of responsibilities than those of Scrum, Bimodal, and Hybrid. In lean developers can also formulate the product's concept.

f) Extreme Programming(XP)

It an agile software development framework that aims to produce higher quality software and higher quality of life for the development team. It introduces engineering practices aimed at helping developers write a clear code. Focus is on technical aspect of software development. Product development includes consistent stages: core writing, testing, analyzing, designing, and continuous integration of code. Face-to-face communication within the team and customer involvement in development is crucial. Originating from it there is an agile technique called pair programming in which two developers team together and work on one computer. They design, test and develop the system together.

10.5.4 Ways to Use Agile Methodology

Agile aims to create shorter development cycles and frequent product releases, unlike traditional waterfall project management. Because of the shorter time frames, teams can react to change in

customer's needs more effectively. That said, Agile Methodology can help users with the following:

Project planning: before teams can start any project, they need to understand the end goal, the value of the customer, and how they'll accomplish the project. Users can take advantage of the Agile project management framework to create a project scope. However, they need to keep in mind that Agile Methodology aims to address changes and addition to a project in a simpler manner. So the project scope they develop should seem changeable.

Product roadmap creation: a product roadmap here refers to the features that make up the end-product. A roadmap is an essential element of the planning stage of an Agile project since teams develop individual features during each sprint/iteration. At this point, a product owner will also design a product backlog. And when the plan sprints later, the team will pull tasks from the backlog.

Release planning: in Waterfall project management, the implementation of the date usually comes after the completion of the entire project. However, Agile project management uses shorter development cycles, which allows features to get released at the end of each cycle. Before beginning the project, project owners or teams can make a high-quality plan for feature releases after each sprint. They can always revisit and reassess the release of a particular feature.

Sprint planning: before a sprint can begin, business stakeholders have to first hold a sprint planning meeting. This helps them to determine what each team member should accomplish during that sprint and how they'll accomplish it. Sharing the load evenly between team members ensures that during the sprint, the task gets completed. Stakeholders can also visually document the workflow to identify and get rid of bottlenecks, improve team transparency, and share understanding within the Agile team.

Daily stand-ups: daily stand-up meetings help teams complete their project during each sprint and assess the implementation of necessary adjustments. These meetings usually last for only 15 minutes. Each team member has time to briefly explain what they've accomplished the previous day and what they'll be doing on that day.

Sprint review and retrospective: by the end of each spring cycle, a team should have a functioning feature or piece of software. If that's the case, project stakeholders will hold a sprint review meeting where the team will show them the final product. Also, in this meeting, both groups will discuss any product issues that might arise. In a sprint retrospective meeting, the key stakeholders will discuss how efficient the sprint was, what could have been implemented better, and what achievement occurred throughout the sprint.

The entire team needs to be present during the essential meetings, especially if they're new to Agile project management. This helps project stakeholders to gauge whether the team can tackle certain task during a sprint and to determine the sprint length for feature projects.

10.5.5 Agile Terms & Definitions

Agile Project Management:

Agile project management refers to the method of developing small portions of software in a frequent iteration cycle based on a changing environment.

Acceptance criteria: This phrase specifies a set of requirements the software needs to meet so it can satisfy the client's needs. Product owners usually write the statement from the viewpoint of the customer that explains how the user story should work. For the story to be accepted, it must pass the acceptance criteria.

Acceptance test: Acceptance test confirms whether or not a feature is functional. The result of the test is a pass or fail. Most often, the acceptance test is automated, meaning teams can perform them on all software versions. Acceptance criteria usually contain one or more acceptance tests.

Application Lifecycle Management (ALM): This refers to a continuous management process of a software application development from its initial planning stage to the retirement stage. It's used throughout the whole project and makes use of tools that help with requirement management, design, coding, testing, tracking, and release.

Backlog: Backlog is a list of product requirements that change continuously based on customer's needs. It's a completed list of all the required product features. Agile teams utilize a backlog to give precedence to certain features and understand which features need implementation.

Backlog grooming: Backlog grooming is when the rest of the team or a product owner refines the backlog on a daily basis to ensure that it contains the right items that are prioritized, and that the item at the top of the backlog is ready for release or delivery.

Burndown chart: Burndown charts track the amount of output a team has completed across a project based on hours, backlog items, or story points.

Business agility: This refers to the ability of a company or an organization to identify internal and external changes and respond to them accordingly to deliver value to its clients.

Cadence: It describes the flow of events according to the project. Cadence creates a pattern that the team can follow to understand what they're doing.

Continuous improvement: This is the process of boosting efficiency and quality by making slight changes incrementally. In the Kanban framework, continuous improvement means optimizing workflow and decreasing cycle time, therefore increasing productivity.

Collective ownership: Collective ownership means that every team member can change any code file, whether it's to repair a defect, improve a code's structure, or complete a development task.

Epic: Epic is a larger user story. In its state, it would be hard to complete in a single iteration.

Fail-fast: Fail-fast describes the process of beginning work on a project, getting immediate feedback, and then determining whether to continue working on the project or to take another approach.

Iteration: This is a fixed period in time, spanning 2 to 4 weeks, during which an Agile team builds a deliverable and shippable product. The product owner defines the iteration requirements at the beginning of the iteration, and the team agrees upon it.

Kanban: Kanban allows an Agile team to write down everything about the project on a board. This gives them a bigger understanding of the things going on, and helps them identify bottlenecks plaguing the project.

Poker planning: This is a game or a building exercise used to arrive at a group consensus for approximating workload.

Product owner: A product owner symbolizes the customer and communicates the customer's vision and the requirement to the Agile team. They jot down the acceptance criteria and maintain the backlog.

Scrum: Scrum is among the most popular Agile frameworks. It focuses on small independent teams working on short sprints (iterations).

Scrum Master: A Scrum Master is a team member who handles communication between Scrum team members and organizes daily planning meetings and retrospectives.

Stakeholder: This refers to someone who's not part of the Scrum team, but has some interest in the product created by the team.

Sprints: Sprints are short iterations, which usually takes between 1 to 3 weeks to complete.

Task: A task defines a unit of work that's broken down from a user story. Often it's completed by a single team member.

Task board: This is an online or physical visual representation of user stories as tasks. The board also displays the individuals assigned a specific task.

Technical debt: Throughout the project development process, Agile team members encounter several technical and emotional challenges in their personal lives. Because of this, the team sometimes uses a short-term, expedient approach to create the product without accounting for the long-term consequences.

Test-Driven Development (TDD): TDD is the practice of building and designing tests for functional working codes and then designing a code that will pass those tests. This helps the agile

team understand the full potential and purpose of the code and how it should work before it's developed.

Discuss different ways of using agile principles in a project you have been apart, make assumptions if you haven't.

Group Work Assessment

Discuss potential benefits of following agile project management in relation to the projects actively being done in your area. Also discuss each method in relation to the project and how it can be applied in the context.

10.5.6 Assessment

1. An agile project management methods in which there are no time boxed development cycles and that focuses on the visualization of work is called

    A) Scrum

    B) Lean

    C) XP

    D) Kanban

2. _____ refers to short iterations, which usually takes between 1 to 3 weeks to complete.

    A) Flows

    B) Sprints

C) Backlogs

D) Artifacts

3. Which of the following is **not** foundational value of the agile manifesto

A) Individuals and interactions over processes and tools

B) Working software over comprehensive documentation

C) Customer collaboration over contract negotiation

D) Following strict plans over responding to change

4. Agility is the capability to efficiently and effectively adapt to an ever changing environment.

A) **True**   B. False

5. Of the twelve principles of agile manifesto one is not correctly presented here:

A) Deliver working software frequently (weeks rather than months)

B) Projects are built around motivated individuals, who should be trusted

C) Speedy development is preferable than sustainable development

D) Working software is the primary measure of progress