**COM 412 PROJECT MANAGEMENT**

**Basic Concept 1: What is a Project?**

The most basic project management concept is knowing what a **project** is and when work is not a project. A project is well-defined task, which is a collection of several operations done in order to achieve a goal (for example, software development and delivery). It is also defined as a temporary effort to create value through a unique product, service or result. A project has the following features

* **Temporary:** a project has a definitive start and end date
* **Unique:** a project’s work is different from the ongoing work required to maintain the business and operations
* **Team, Budget, Schedule:** a project has an assigned team, budget, and schedule
* **Goal:** a project is done when the project goals are met

How Unique?

* Product characteristics are progressively elaborated.
* The product or service is different in some way from other product or services.

How Temporary?

* It has a definite beginning and end.
* It is not an ongoing effort such as in operations.
* It ceases when objective has been attained.
* The team is disbanded upon project completion.

**Software as a project**

Software is said to be an intangible product. Software development is a kind of all new stream in world business and there’s very little experience in building software products. Most software products are tailor made to fit client’s requirements. A Software Project is the complete procedure of software development from requirement gathering to testing and maintenance, carried out according to the execution methodologies, in a specified period of time to achieve intended software product.

**Project Manager**

A project manager is a person who undertakes the responsibility of executing a project. Project manager may never directly have involved in producing the end product but he controls and manages the activities involved in production.

A project manager closely monitors the development process, prepares and executes various plans, arranges necessary and adequate resources, maintains communication among all team members in order to address issues of cost, budget, resources, time, quality and customer satisfaction.

responsibilities that a project manager:

**Managing People**

* Act as project leader
* Liaison with stakeholders
* Managing human resources
* Setting up reporting hierarchy etc.

**Managing Project**

* Defining and setting up project scope
* Managing project management activities
* Monitoring progress and performance
* Risk analysis at every phase
* Take necessary step to avoid or come out of problems
* Act as project spokesperson

**Project Manager Responsibilities**

Project management is a complex and demanding field. Successful project managers must have leadership, technical, and organizational skills to lead the team towards the project goals. Every project is unique, but every project needs the project manager to:

• Help determine the project methodology to use for the project

• Ensure a project plan is developed

• Recruit project staff

• Support and train the project team

• Manage deliverables according to the project plan

• Aid in the establishment of a project schedule

• Support the assignment of tasks to project team members

• Communicate with stakeholders

**Basic Concept 2: What is Project Management?**

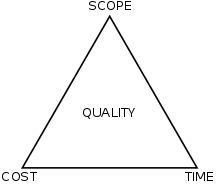
Project Management as "the application of knowledge, skills, tools and techniques to a broad range of activities in order to meet the requirements of a particular project."

**The project management triangle** is a model in project management that shows how the balance between three constraints—scope, time, and budget—affects the quality of the project. The triangle shows that affecting one constraint will mean adjusting one or both of the others in order to maintain the quality. It’s also called the triple constraint model or the iron triangle. Project managers must oversee all three of these constraints in order to complete a project successfully.

**Scope:** Scope refers to the deliverables and tasks that must be completed to achieve the project’s goals. The scope might change if stakeholders decide mid-project that they want to adjust a product, or add another product entirely.

**Cost:** Project cost is the total amount of money required to complete a project. This is also called the budget. Costs might include salaries for employees, and money for equipment, tools, office space, and other resources. Adding new members to a team or increasing the time it takes to complete a project can impact cost.

**Time:** Time is how long it takes to complete tasks in a project, and the project itself. This constraint is also called the schedule. An expanded scope can increase timelines. So can a decreased budget—for example, if a team member is removed from the team due to budget constraints, it can take longer to complete a project.

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**Why do we need Project Management?**

We need project management to manage projects effectively and drive them to success. Project Management starts with the decision to start a project upon weighing its need and viability. Once a project starts, it is crucial to watch the project progress at every step so as to ensure it delivers what all is required, in the stipulated time, within the allocated budget. Other drivers influencing the need of project management are −

* Exponential expansion of human knowledge
* Global demand for goods and services
* Global competition
* Team is required to meet the demand with quality and standard.
* Improved control over the project
* Improved performance
* Improved budget and quality

**Project Management Skills**

effective project management requires that the project management team acquire the following three dimensions of project management competencies −

* **Project Management Knowledge Competency** − This refers to what the project management team knows about project management.
* **Project Management Performance Competency** − This refers to what the project management team is able to do or accomplish while applying their project management knowledge.
* **Personal Competency** − This refers to how the project management team behaves when performing the project or activity.

**Interpersonal Skills Management**

The management of interpersonal relationships includes −

* **Effective communication** − The exchange of information
* **Influencing the organization** − The ability to "get things done"
* **Leadership** − Developing a vision and strategy, and motivating people to achieve that vision and strategy
* **Motivation** − Energizing people to achieve high levels of performance and to overcome barriers to change
* **Negotiation and conflict management** − Conferring with others to come to terms with them or to reach an agreement
* **Decision Making** − Ability to take decision independently.
* **Political and cultural awareness** − Important to handle various personal and professional issues.
* **Team Building** − Ability to create a productive team.

**Basic Concept 3: Project Management Phases**

**What is Project Life Cycle and its Main Characteristics?**

A project life cycle is the sequence of phases that a project goes through from its initiation to its closure. The number and sequence of the cycle are determined by the management and various other factors like needs of the organization involved in the project, the nature of the project, and its area of application. The phases have a definite start, end, and control point and are constrained by time. The project lifecycle can be defined and modified as per the needs and aspects of the organization. Even though every project has a definite start and end, the particular objectives, deliverables, and activities vary widely. The lifecycle provides the basic foundation of the actions that has to be performed in the project, irrespective of the specific work involved. Project life cycles can range from predictive or plan-driven approaches to adaptive or change-driven approaches. In a predictive life cycle, the specifics are defined at the start of the project, and any alterations to scope are carefully addressed. In an adaptive life cycle, the product is developed over multiple iterations, and detailed scope is defined for iteration only as the iteration begins.

**Characteristics of the Project Life Cycle**

Although projects are unique and highly unpredictable, their standard framework consists of same generic lifecycle structure, consisting of five phases. The project lifecycle includes the following:

1. **Initiation:** The start of a project, in which goals and objectives are defined through a business case and the practicality of the project is determined by a feasibility study.
2. **Planning:** During the project planning phase, the scope of the project is defined by a work breakdown structure (WBS) and the project methodology to manage the project is decided on. Costs, quality and resources are estimated, and a project schedule with milestones and task dependencies is identified. The main deliverable of this phase is your project plan.
3. **Execution:** The project deliverables are completed during this phase. Usually, this phase begins with a kick-off meeting and is followed by regular team meetings and status reports while the project is being worked on.
4. **Monitoring & Controlling:** This phase is performed in tandem with the project execution phase. Progress and performance metrics are measured to keep progress on the project aligned with the project plan.
5. **Closure and Review:** The project is completed when the stakeholder receives the final deliverable. Resources are released, contracts are signed off on and, ideally, there will be an evaluation of the successes and failures.

**The Initiation Phase:** The initiation phase aims to define and authorize the project. The project manager takes the given information and creates a Project Charter. The Project Charter authorizes the project and documents the primary requirements for the project. It includes information such as:

* Project’s purpose, vision, and mission
* Measurable objectives and success criteria
* Elaborated project description, conditions, and risks
* Name and authority of the project sponsor
* Concerned stakeholders

During the initiation phase, some of the project goals might be broad because not all of the project details have been determined. While it's okay to have broader goals, it's helpful to add specificity where possible. That's because clarifying project goals early on can help you avoid misalignment and gain a clearer understanding of the project's scope, budget, and timeline.

Remember, *project goals* are the desired outcomes of the project. Outlining clear and specific goals is an important step in creating an effective project charter and crucial to launching a successful project, so you'll need to be able to accurately identify whether or not a goal has been met. When your goals are clear, you'll be able to determine your project deliverables. *Project deliverables* are specific tasks or outcomes that contribute to the completion of a goal.

As a project manager, it's your role to ensure that the project goals are well-defined so that you and your team have a clear roadmap. This not only allows you to focus, but also eliminates wasted time and miscommunication going forward. You can create clearly-outlined goals with the help of the SMART method. The SMART method helps turn your project goals into SMART goals. Remember, this means your goals are specific, measurable, attainable, relevant, and time-bound.

These qualities can help you measure your success more accurately and allow you to make more precise adjustments along the way. Let's review some best practices for ensuring your project goals are also SMART goals.

To make a goal more specific, make sure that it provides answers to questions like "What am I aiming to accomplish?" and "What are the requirements and constraints of this goal?" Here's a tip I like to use to add specificity to goals. Look for words in your goals that might be subjective or based on an opinion, such as bigger, better, or faster. Once you've identified subjective words, connect with your stakeholders to agree on a definition of what it actually means to make something bigger or better or faster. What does bigger or better entail in practice? Faster by how much, specifically? The SMART method helps you make your goals more specific by making them measurable. For example, if your stakeholder wants to increase company profits, ask, "By how much?" Do they want to increase profits by five percent? By 30 percent? Adding numbers and figures to your goal makes it a lot easier to know when you've achieved it. If you're having trouble making a goal measurable, research how others in your industry quantify success. This is called *benchmarking*, which refers to evaluating success against the standard.

SMART goals are also attainable, which means that the goal is challenging but not impossible to reach. Ask yourself and the team, "Can it be done?" Do you have the time, resources, and people available to complete the goal on time and within budget? If not, you'll need to make some changes to your goals. And all project goals should be relevant. Ask yourself, "Does it make sense for us as a company or as a project team to pursue this goal?" One best practice for determining the relevance of your project goals is to notice how closely your project goals align with the wider goals of your company or organization.

The last part of the SMART framework is to make your goal time-bound. You'll want to add a deadline to your goal so that you know when it's supposed to be completed.

**The Planning Phase:** The purpose of this phase is to lay down a detailed strategy of how the project has to be performed and how to make it a success.

Project Planning consists of two parts:

* Strategic Planning
* Implementation Planning

In strategic planning, the overall approach to the project is developed. In implementation planning, the ways to apply those decisions are sought.

**The Execution Phase:** In this phase, the decisions and activities defined during the planning phase are implemented. During this phase, the project manager has to supervise the project and prevent any errors from taking place. This process is also termed as monitoring and controlling. After satisfaction from the customer, sponsor, and stakeholder’s end, he takes the process to the next step.

**The Monitoring and controlling Phase:** In the project life cycle, the project monitoring and control phase happens in tandem with the execution phase. What it involves depends on how a project is organized and defined. Project management monitoring and controlling means actively reviewing the status of your project as it proceeds, evaluating potential obstacles, and implementing necessary changes. During this phase, organizations need to juggle several responsibilities, including:

* Keeping to the schedule
* Staying within budget
* Avoiding scope creep
* Managing risk

**The Termination Phase:** This is the last phase of any project, and it marks the official closure of the project.

project management process groups. This general lifecycle structure is used when dealing with upper management or other people less familiar with the project. Some people might confuse it with the, but the latter contains activities specific to the project. The project lifecycle, on the other hand, is independent of the life cycle of the particular outcome of the project. However, it is beneficial to take the current life-cycle phase of the product into account. It can provide a common frame of reference for comparing different projects

The generic life cycle structure commonly exhibits the following characteristics:

* At the start, cost and staffing levels are low and reach a peak when the work is in progress. It again starts to drop rapidly as the project begins to halt.
* The typical cost and staffing curve does not apply to all projects. Considerable expenses are required to secure essential resources early in its life cycle.
* Risk and uncertainty are at their peak at the beginning of the project. These factors drop over the lifecycle of the project as decisions are reached, and deliverables are accepted.
* The ability to affect the final product of the project without impacting the cost drastically is highest at the start of the project and decreases as the project advances towards completion. It is clear from the figure 2 that the cost of making new changes and rectifying errors increases as the project approaches completion.

**Basic Concept 4: Project Requirement Analysis and Documentation**

Projects are successful when they deliver positive outcomes and satisfy stakeholders' expectations which can only be possible through gathering project requirements from sponsors and end-users. **Requirements analysis** involves defining, analyzing, validating, and aligning stakeholders' expectations for new projects while considering all possible conflicts. It’s a process of identifying, analyzing, and managing project requirements to determine what the project should accomplish and eliminate any ambiguities or conflicting requirements in your project plan. Any accepted requirements must be:

* Documented
* Actionable
* Measurable
* Testable
* Traceable
* Defined with sufficient details
* Related to overall business needs

Typically, you carry out the requirements analysis process before you begin project planning. Additionally, in project management, you conduct requirements analysis when:

* Calculating development costs
* Setting project priorities
* Creating a work breakdown structure
* Including project specialists in an ongoing project

There are three main stages in conducting a thorough requirements analysis:

* The first step is to gather the requirements by collecting business process documentation and conducting interviews with stakeholders.
* Next, analyze and validate the requirements, evaluating whether they're clear, complete, consistent, and unambiguous.
* Finally, record the requirements and monitor their implementation throughout the project.

**What are the benefits of a requirements analysis?**

The return on investment for a good quality requirements gathering and analysis almost always outweighs the cost. Giving due time and effort into the process means you can deliver a superior product with much fewer roadblocks taking up your time. Some of the benefits of a good requirements analysis include:

* Fewer defects in the finished product
* Faster delivery
* Reducing miscommunication and rework
* Fostering a more collaborative work environment for your team
* Discovering new opportunities for growth and innovation
* Higher customer satisfaction

**Basic Concept 5: Project Planning**

**What is project planning?**

The project planning phase of project management is where a project manager builds the project roadmap, including the project plan, project scope, project schedule, project constraints, work breakdown structure, and risk analysis. It doesn’t matter if the project is a new website or a new building, the project planning phase serves as a roadmap and acts as a control tool throughout the project. Project planning provides guidance by answering questions like:

* What product(s) or service(s) will we deliver?
* How much will the project cost?
* How can we meet the needs of our stakeholders?
* How will progress be measured?

**Purpose of project planning.**

Project planning communicates deliverables, timing and schedules, along with team roles and responsibilities. During the planning phase of a project, the project manager is forced to think through potential risks and hang-ups that could occur during the project.

These early considerations can prevent future issues from affecting the overall success of the project, or at times, cause a project to fail. Too little planning causes chaos and frustration and too much planning causes a lot of administrative tasks, not allowing enough time for creative work.

**What is a project plan?**

A project plan is a series of formal documents that define the execution and control stages of a project. The plan includes considerations for risk management, resource management and communications, while also addressing scope, cost and schedule baselines.

Project plans are coordinated by the project manager, with input from stakeholders and team members. Plan components cover the “what” and “how” of a project. Plans include details related to:

**What are the components of a project plan?**

The three major parts of a project plan are the scope, budget and timeline. They involve the following aspects:

* **Scope.** The scope determines what a project team will and will not do. It takes the team's vision, what stakeholders want and the customer's requirements and then determines what's possible. As part of defining the project scope, the project manager must set performance goals.
* **Budget.** Project managers look at what manpower and other resources will be required to meet the project goals to estimate the project's cost.
* **Timeline.** This reveals the length of time expected to complete each phase of the project and includes a schedule of milestones that will be met.

**What is included in a project plan?**

In project management, planning is a multifaceted process. A full project plan might include the following documents:

* Project charter.

This is a short, formal summary of your project’s aims, methods and stakeholders. Provides a general overview of the project. It describes the project’s reasons, goals, objectives, constraints, stakeholders, among other aspects.

A project charter is a formal document that clearly defines the project and outlines the necessary details to reach the project's goals. The project manager creates the charter during the initiation phase, which is the first phase of the project life cycle.

The project charter

* helps you organize vital project information,
* create a framework for the work that needs to be done, and
* communicate those details to the necessary people.

It's also useful as a reference throughout the project's life cycle, since it can help stakeholders realign on the project scope, goals, and costs.

The project charter contains key information about a project,

* like the summary,
* goals, and
* deliverables.

The goal of the summary is to provide an overview of the project and to outline the goals you hope to accomplish. Summaries should be brief—just a few sentences at most, and to the point. After the summary comes project goals and deliverables. A charter can include other sections as well, such as budget and cost and success metrics.

* Project schedule.

Schedules list what needs to be done and when, including details of any tools, bookings or people you might need to utilize at each stage. This is sometimes paired with a work breakdown structure (WBS). Depending on the nature of your project, you might list activities, costs and allocated hours beneath each deliverable.

* Cost management plan.

This is essentially a detailed budget. Using the project planning phase to identify procurements, suppliers and resources can help you to map your project’s price tag. A project manager might use this document to think about human resource costs and consider figures that might grow if elements of your project plan change.

* Statement of work (SoW).

A statement of work can help you keep an eye on scope, by listing a breakdown of the project’s aims and tasks. It’s often more detailed and less formal than a project charter. *A statement of work (SOW) defines the project’s scope, schedule, deliverables, milestones, and tasks.*

* Work Breakdown Structure

Breaks down the project scope into the project phases, subprojects, deliverables, and work packages that lead to your final deliverable.

* Risk management plan.

This allows you to identify the project’s main hazards for your organization and their potential impact. Analyzing the likelihood of each risk, high, medium or low, can give you sight of where to focus your efforts right from the project planning phase.

* Stakeholder management plan.

In project management, each department comes to the table with distinct priorities, so drafting a stakeholder management plan can help. This document can ensure you identify all stakeholders, assign roles and prioritize interests accordingly.

* Quality plan.

This aspect of the planning phase sets quality standards and acceptance criteria for deliverables.

**How to Create a Project Plan?**

Your project plan is essential to the success of any project. Without one, your project may be susceptible to common project management issues such as missed deadlines, scope creep and cost overrun. While writing a project plan is somewhat labor intensive up front, the effort will pay dividends throughout the project life cycle.

The basic outline of any project plan can be summarized in these six steps:

* Define your project’s stakeholders, scope, quality baseline, deliverables, milestones, success criteria and requirements. Create a project charter, work breakdown structure (WBS) and a statement of work (SOW).
* Identify risks and assign deliverables to your team members, who will perform the tasks required and monitor the risks associated with them.
* Organize your project team (customers, stakeholders, teams, ad hoc members, and so on), and define their roles and responsibilities.
* List the necessary project resources, such as personnel, equipment, salaries, and materials, then estimate their cost.
* Develop change management procedures and forms.
* Create a communication plan, schedule, budget and other guiding documents for the project.

**What Is Project Planning Software?**

Project planning software are highly flexible and adaptable program with features that are designed to assist in project planning process. Good project planning software can streamline the document drafting process in project management. It might allow you to combine these elements of analyze them side-by-side, for instance.

Advantages of using project planning software

* Organize, prioritize and assign tasks
* Plan and schedule milestones and task dependencies
* Monitor progress, costs and resources
* Collaborate with team
* Share project plans with team and stakeholders
* Generate reports on plans

Some project planning software tools include the following:

* **Asana** offers different project views to suit a team's preferences.
* **ClickUp** comes with several Agile-based features, including a custom automation builder that lets users create reusable task templates.
* **Freedcamp** lets users organize their projects using a Gantt chart or Kanban
* **Hive** has a template creation tool in the task management feature that speeds up task creation.
* **Scoro** is a combination of tools and includes customer relationship management
* **Trello** provides Kanban features, budget management, resource management and progress tracking features.
* **Wrike** integrates with tools like Jira, Slack and Dropbox.

**Project Planning Tools**

Project planning tools help everyone concerned keep track of project requirements and deadlines. Some of the most popular project planning tools include the following:

* Gantt Chart

Gantt charts are an industry standard that helps in tracking both time and interdependencies between tasks. Gantt charts are an essential tool to show different phases, jobs, and resources involved in project management

* Critical Path Method (CPM)

Critical Path Method (CPM) is a crucial tool for determining the progress of the project to ensure that the project is on schedule. CPM helps in determining the essential or critical path by finding out the longest stretch of dependent tasks

* PERT Chart

The Program Evaluation and Review Technique (PERT) helps in analyzing the tasks to complete the project and the time required to complete those tasks. PERT simplifies the planning and scheduling of large and complex projects

* Work Breakdown Structure (WBS)

Work Breakdown Structure (WBS) is a process of organizing the team's work into manageable sections. WBS is a hierarchical structure of the deliverables needed to complete the project

* Project Documentation

Project documentation is created during the project lifecycle, which involves project scope, its schedule, and the risk analysis. Project documents help in better understanding and risk analysis of the project

**Project Planning Terms**

Here is a list of general terms related to project planning.

* **Deliverable:** The results of a project, such as a product, service, report, etc.
* **Stakeholder:** Anyone with a vested interest in the project—project manager, project sponsor, team members, customers, etc.
* **Tasks:** Small jobs that lead to the final deliverable.
* **Milestone:** The end of one project phase, and the beginning of the next.
* **Resources**: Anything you need to complete the project, such as personnel, supplies, materials, tools, people and more.
* **Budget:** Estimate of total cost related to completing a project.
* **Tracking & Monitoring:** Collecting project data, and making sure it reflects the results you planned for.

**Project Planning stakeholders**

Prior to developing a project plan, the project manager should explain the purpose of the plan to key stakeholders. These are the organizations and individuals who are affected by the project and they need to understand what goes into planning their project – a key component of good stakeholder management.

Examples of stakeholders include:

* Project sponsors
* Business experts
* Project team
* End users

The project manager should host a project kick-off meeting for stakeholders. The meeting may be used to discuss the vision statement from the project sponsor, roles and responsibilities, team dynamics, decision-making, and other ground rules.

**Assign team roles and ongoing responsibilities.**

Over the course of a project, a project manager should continually analyze project quality, monitor risk, and communicate effectively. The plan may have been mapped out, but your project’s wheels start turning only when tasks are assigned. Define responsibilities clearly, either by individual, group or department, depending on project scale. Ensure systems are in place for each task and line of communication to flow smoothly from the last.

**Monitor project quality.**

The project manager is responsible for monitoring project quality to ensure the end result meets expectations. Project quality is proactive and it involves error prevention and risk management.

A quality plan aids in this ongoing responsibility by outlining standards, acceptance criteria, and project metrics. It is used to guide reviews and inspections during the project.

**Communicate effectively.**

Effective communication is central to the success of a project. Project communications can be guided with a communications plan. This document clarifies:

* Who receives which reports
* How issues will be handled
* Where project information is stored
* Who has access to it

**Project planning techniques.**

After the project management planning phase, you want your groundwork to set things out in a way that works for everyone. Some useful techniques could make this more likely, including:

* Meetings
* Workshops
* Surveys

**Chapter 6: How to Design Work Breakdown Structures**

A work breakdown structure (WBS) is a project management tool that takes a step-by-step approach to complete large projects with several moving pieces. By breaking down the project into smaller components, a WBS can integrate scope, cost and deliverables into a single tool. While most WBSes are deliverable-based, they can also be phase-based.

A **deliverable-based** WBS first breaks down the project into all the major areas of the project scope as control accounts and then divides those into project deliverables and work packages.

The **phase-based** WBS displays the final deliverable on top, with the WBS levels below showing the five phases of a project (initiation, planning, execution, control and closeout). Just as in the deliverable-based WBS, the project phases are divided into project deliverables and work packages.

**Some commonly used terms used with WBS project management include:**

* Acceptance Criteria: Standards to be met to achieve customer or other stakeholder requirements
* Budget: Expenses associated with the project, which can be broken down by deliverables or phases
* Deliverables: The product, service or results created at various stages of the project. For instance, in a website design project, a deliverable-based WBS would be structured around deliverables such as URL, layout and written content
* Milestones: Critical stages of the project identified in the WBS
* Phases: The various stages of a project. For instance, in a website design project, a phase-based WBS would be structured around things like discovery, design and launch, rather than specific deliverables
* WBS: Work breakdown structure

**WBS Elements**

A typical project work breakdown structure is made up of several key components such as:

* WBS Dictionary: A WBS dictionary is a document that defines the various WBS elements. It’s an important component of a WBS because it allows the project participants and stakeholders to understand the work breakdown structure terminology with more clarity.
* WBS Levels: The WBS levels are what determines the hierarchy of a WBS element. Most work breakdown structures have 3 levels that represent the project’s main deliverable, control accounts, project deliverables and work packages.
* Control Accounts: Control accounts are used to group work packages and measure their status. They’re used to control areas of your project scope. In our example, the execution project phase could be a control account because it has several deliverables and work packages associated with it.
* Project Deliverables: Project deliverables are the desired outcome of project tasks and work packages. In our WBS example, we can observe some examples of project deliverables such as the project budget or interior work. Both of them are the result of smaller tasks and work packages.
* Work Packages: As defined by the project management institute (PMI) in its project management body of knowledge book (PMBOK) a work package is the “lowest level of the WBS”. That’s because a work package is a group of related tasks that are small enough to be assigned to a team member or department. As a project manager, you can estimate costs and duration of these work packages, which makes them an essential WBS element.
* Tasks: Your tasks make up your work packages and therefore, your project scope. A WBS will help you define each task requirements, status, description, task owner, dependencies, and duration.

**Why a WBS Is Helpful for Project Management**

Work breakdown structure is a helpful project management tool for several reasons.

* First, it breaks down the project into bite-size components, making the project less overwhelming and more manageable.
* Second, it provides a roadmap for the different individuals and teams working on the project. Many projects involve different teams moving in tandem, all of which need to coordinate and integrate for project completion. By using a WBS, the various individuals and teams can focus on their specific tasks and deliverables while also seeing how their piece fits into the project as a whole.
* Finally, a WBS is an excellent tool for measuring project completion, identifying milestones and allocating budget resources. By using the 100% rule, project managers can be confident that the project is properly budgeted and that they won’t run into any roadblocks due to a “surprise” deliverable.

**How to Create and Use a WBS Effectively**

To use a work breakdown structure effectively, it is important to include all components of a project (remember that 100% rule described above) but without too much detail. Turns out, there can be too much of a good thing when it comes to the WBS.

To create a WBS:

1. Define the project. The first step in creating a work breakdown structure is to clearly establish the project. For some projects, this might be fairly straightforward. For other projects, it might require refining the actual scope of the project so that the WBS is scaled appropriately and doesn’t become unwieldy.

2. Set project boundaries. Once the project is defined and described, you can set boundaries on what is and isn’t included in the WBS.

3. Identify project deliverables. This will include high-level deliverables associated with the project, such as a Project Scope Statement or Mission Statement.

4. Define Level 1 elements. Remember the 100% rule while creating the Level 1 deliverables.

5. Break down each of the Level 1 elements. The process of breaking down Level 1 elements is called decomposition. It consists of breaking down a task into smaller and smaller pieces, applying the 100% rule at each level. At each subsequent level, ask yourself whether further decomposition would improve project management. Continue breaking down the elements until the answer to that question is “no.” When you’ve completed the decomposition process for each element in Level 1, the WBS is complete.

6. Identify team members. Identify an individual or team who is responsible for each element.

7. Create a Gantt chart to accompany the WBS. A Gantt chart shows activities over time so that you can visually see information related to the schedule of the project and its various activities.

**Basic Concept 7: PERT Chart**

A PERT chart is a visual project management tool used to map out and track the tasks and timelines. The name PERT is an acronym for Project (or Program) Evaluation and Review Technique.

PERT charts are similar to Gantt charts in that they offer a graphical view of a project’s tasks, schedule, and timelines. But there are several significant differences between these two types of project management diagrams:

1. Gantt charts are bar graphs; PERT charts are free-form

Gantt charts are drawn as bar graphs along a timeline, as shown below. They represent the tasks and phases of a project with horizontal bars, each drawn to a length representing its estimated timeframe.

A PERT chart, by contrast, can be drawn as a free-form diagram. Project managers create PERT charts by drawing boxes or circles (“nodes”) representing events or milestones and connecting them via arrows, representing the tasks that must be completed between each milestone and the amount of time the team will have to complete each task.

2. PERT charts illustrate dependencies; Gantt charts do not

One disadvantage of using a Gantt chart to track a project is that it does not indicate task dependencies. Each bar on the graph stands alone. This makes it difficult for project managers to know how much one missed deadline could affect other chart tasks.

PERT charts solve this challenge with the use of directional arrows. These directional (or “concurrent”) arrows indicate that a series of tasks must be completed in sequence because they have interdependencies. On the other hand, diverging arrows indicate functions that can be completed parallel or out of order because they do not have dependencies.

In the PERT chart example below, you can see the task represented in node 1 has a dependency because its arrow goes only to node 2. From node 2, however, the team may work on either or both of the tasks represented by the diverging arrows going to nodes 3 and 4. Therefore, these activities do not have dependencies.

**How to develop a PERT chart?**

Since your project almost certainly will benefit from the use of one of these diagrams, I’ve laid out six steps for successfully creating a PERT chart.

**Step 1: List out your project milestones and tasks**

Milestones, or deliverables, are kind of like the checkpoints in a racing video game, and every turn, pass, or straightaway you drive are the tasks you perform to complete those checkpoints.

In order to create a PERT chart, you have to know all of the major milestones your team will have to accomplish and the tasks that’ll make that happen. List out these milestones and their individual tasks.

**Step 2: Identify the sequence of those tasks**

You’ve listed all of your milestones and tasks necessary to complete your project, so now it’s time to put those tasks into the correct sequence for completion.

While establishing this sequence and order of tasks, be sure to point out any task dependencies.

**Step 3: Determine the time criteria for your tasks**

This is the most technical step of the PERT diagram creation process. If you’re already familiar with the critical path method, you’ll know there are three specific time criteria you have to figure out for each task:

**Earliest start date/time (ESD/EST**): This is the earliest possible time you can begin a task in your project. In order to determine the earliest start date or time, you have to understand all of your task dependencies inside and out.

**Earliest finish date/time (EFD/EFT):** This is the earliest possible time you hope to finish a particular task. This is determined by adding up all of the previous dependent step times including the duration of this particular step you are attempting to measure.

**Time to complete:** This is the duration of time you plan on spending to complete each individual task.

**Step 4: Draw up your PERT diagram**

You can create a PERT chart either by drawing one up yourself or by generating one using PERT software. The visual construction of a PERT chart isn’t tied just to the examples used above. PERT is more of a function, rather than a visual style of representing a project structure.

Create your PERT chart in whatever way makes the most sense to you, but just be sure to include all of the information you gathered in the previous steps in order to construct it.

**Step 5: Draw out your critical path**

Now that you’ve created your PERT chart with all of the relevant information, you can use this chart to identify the critical path of your project. Your critical path is the identification of the most important steps necessary that’ll help you determine the minimal duration of your project.

*Example workflow for grilling a steak designating the critical path as the path taking the most time.*

*This is a simplified steak-grilling example of a PERT chart, but it demonstrates all of the necessary ingredients (pun intended). Image source: Author*

*In this PERT chart, I’ve used the earliest start time (EST), earliest finish time (EFT), and the time to complete (TTC) to identify the shortest possible finish time and draw out this critical path in red.*

*If I were to follow this basic critical path, I would have everything I needed to prepare and cook a steak successfully.*

**Step 6: Update your PERT chart as needed**

Your PERT chart is a planning tool that is not set in stone. This diagram can be changed whenever circumstances are altered during the project execution phase.

Use your PERT chart as your initial roadmap for your project and transition over to a Gantt chart for the purposes of oversight and management.

**The best project management software for PERT charts**

1. SmartDraw Chart Creator

SmartDraw is a cloud-based chart generation software that’ll work on both your desktop, Mac or PC, as well as your mobile phone, IOS and Android. This tool already includes several PERT chart templates that you can use to create the perfect diagram for your project.

2. Lucidchart

Lucidchart is a desktop-based chart creation software that seems to function more like Microsoft Paint than anything else. Luckily this makes it a very easy app to pick up and run with. All you have to do is click and adjust the shapes in your chart, add your information, and off you go.

3. Creately

Last, but not least, we have Creately. This platform uses a simple drag-and-drop system for creating all kinds of organizational charts, including PERT diagrams. This tool combines many of the positive aspects of the last two options.

**Basic Concept 8: Project Execution and Quality management**

A **project execution plan** (PEP) is an action plan that explains how a project execution phase will be managed for any given project. It’s similar to a project plan but its scope is much narrower as it only includes what’s related to project execution, while project plans cover the entire project life cycle.

Execution planning can be broken down into key areas to ensure you’re not neglecting anything crucial. While each organization might approach its project execution plan differently, we’ve outlined seven key elements to include in your project execution plan.

Project Organization

The term “project organization” refers to the organizational structure of a project team and the different roles and responsibilities of everyone. It’s important that your project team members understand how this works so they know who they should report to and other important guidelines.

Project Scope

The scope of a project defines all activities that will be executed so that the stakeholders and project teams understand exactly what will be done before the project starts so there are no future misunderstandings. Defining your project scope is key for estimating costs and creating a project schedule, project budget and resource plan. Project scope is also a key project constraint to monitor during the project execution phase.

Project Schedule

Project schedules are one of the most important project management tools for many reasons. First, a project schedule marks due dates for project tasks, deliverables and milestones, allowing project managers to keep track of their team’s progress. In addition, it’s a tool that project managers use during project execution to make sure project resources such as people, equipment or raw materials are available whenever they’re needed.

Resource Plan

A resource plan is a document that lists all the resources that are needed for the execution of a project. This is done by estimating the resources for each task to provide a detailed description of your project resource needs.

Project Budget

Project budgets are a cost estimate that assigns a price to all the project resources and sets a spending limit for them. Project budgets are a baseline that helps project managers avoid overspending and control project execution costs.

Risk Management Plan

While every project execution can be impacted by many risks, that doesn’t mean you can’t attempt to control those risks. To do so, you’ll need to create a risk management plan, an important project management document that’s used to identify potential risks, describe risk mitigation strategies and allocate the necessary resources.

Communications Plan

One of the most important aspects of project execution is communication. In addition to your project execution plan, it’s important to create a communications plan. It determines how your team communicates on a regular basis, any meeting guidelines and reporting frequency and methods.

Project Execution Challenges

There are more problems than we’ve outlined as things may go wrong or stray from the project plan. That’s why monitoring and tracking during execution are so important. Here are some common issues to look out for.

Project Execution Gaps

Organizations that implement an executive strategy to turn strategic goals into business value will discover the “larger system” for success–the C-suite executives, middle management, project manager and project team. There are two pieces to closing the gap:

* Aligning the strategic plan goals and objectives with an implementation plan
* Executing in the program and project delivery of outcomes that meet those objectives

**Project quality management** is the process of continually measuring the quality of all activities and taking corrective action until the team achieves the desired quality. Quality management processes help to:

* Control the cost of a project
* Establish standards to aim for
* Determine steps to achieve standards
* Effective quality management of a project also lowers the risk of product failure or unsatisfied clients.

Project quality management plan.

Most project managers intend to create the best possible product or service. But even the most skilled, educated teams, with the most modern tools, may fail without the right project quality management plan in place.

**Quality assurance.**

Quality assurance provides evidence to stakeholders that all quality-related activities are being done as defined and promised. It ensures safeguards are in place to guarantee all expectations regarding quality outputs will be met.

Quality assurance is done to the products and services delivered by a project, as well as the processes and procedures used to manage the project. The team can do this through systems such as a process checklist or a project audit.

Quality assurance tests use a system of metrics to determine whether the quality management plan is proceeding acceptably. By using both qualitative and quantitative metrics, you can effectively measure project quality with customer satisfaction.

**Quality control**

Quality control involves operational techniques meant to ensure quality standards. This includes identifying, analyzing, and correcting problems. While quality assurance occurs before a problem is identified, quality control is reactionary. It occurs after a problem has been identified and suggests methods of improvement.

It measures specific project outputs and determines compliance with applicable standards. It also identifies project risk factors, their mitigation, and ways to prevent and eliminate unsatisfactory performance.

Quality control can also ensure the project is on budget and on schedule. You can monitor project outputs through peer reviews and testing. By catching any deliverables failing to meet the agreed standards throughout, you can simply adjust direction rather than having to entirely redo certain aspects.

Benefits of project quality management:

* Quality products. Ensuring you and the project team check the quality of the project means the product will go through multiple development processes. This will help to deliver a final product that meets customer expectations.
* Customer satisfaction. Tackling problems in real-time and communicating with the customer will ensure they’re up to date and aware of any issues. Incremental customer feedback can also help you to deliver a better final product.
* Increased productivity. With a project quality management system everyone knows deadlines and what is needed in advance. Having set deadlines, meetings, and reports can influence the project team to hit targets early to keep the project on track.
* Financial gains. Projects can run over budget if good quality management is absent. By having the three processes in place — planning, assurance, and control — you can tackle problems before they cut into your budget.

**Basic Concept 9: Project Risk Management**

**Project risk** is any potential issue that could negatively impact the successful completion of your projects. Risks could be due to internal or external factors. For instance, a key supplier going out of business and a key team member leaving your organization—both qualify as project risks.

**Project risk management** is the process of identifying, assessing, and responding to unexpected risks that might affect your project's goals and progress. project risk management is a process that aims to reduce project risks that have already occurred, are occurring, or are likely to occur in the future. It focuses on risk reduction by identifying the root causes of risks and minimizing their impact, if not completely eliminating them.

**Common types of project management risks**

the most common types of project risks are:

* **Individual project risks:** These are individual risk events that, if they occur, can affect the quality, cost, time, and/or scope of a project. Examples include not having enough resources for a job and having to deal with sick leaves or employee time-off during peak season.
* **Overall project risks:** These risks refer to the impact of uncertainty on the overall project. Overall project risk comprises an aggregate of individual risks plus all other sources of project uncertainty. Examples of such uncertainties include natural calamities, wars, and changes in government policies.
* **Variability risks:** These risks are associated with fluctuations or inaccuracies in demand, supply, quality, price, etc., that can impact the project outcome. Examples include varying raw material prices and changing the supplier of a crucial product component.
* **Ambiguity risks:** These risks stem from the lack of clarity in project requirements that can lead to misinterpretations or mistakes. Examples include inaccurate requirements gathering from clients and different interpretations of the project scope among team members.

**5 steps to manage project risks**

Risks are an inherent part of any project. While it’s impossible to eliminate all risks, it’s indeed possible to limit their impact by managing them. The following steps will help you competently reduce and control all potential project risks.

1. **Identify potential risks**

The first step is identifying all potential risks that could affect your project’s timeline or goals. It includes closely analyzing the overall project plan and determining any potential issues that could arise.

One way to ace this step is by scheduling brainstorming sessions with your project team and stakeholders. Once you identify the risks, put them into a risk register. This will help you track all the risks along with their details such as duration, impact, priority, and status.

2. **Analyze the identified risks**

Once you identify the risks, start analyzing them to understand how and to what extent they can impact your project. Focus on quantitative and qualitative risk analysis. Quantitative risk analysis assigns a numerical value to risk probability, while qualitative risk analysis is used to identify and assess risks that can’t be quantified. Both help identify risks that need your immediate attention.

When assessing risks, consider three key factors: *risk probability* (likelihood of a risk event occurring), *risk impact* (consequences of a risk event occurring), and *risk vulnerability* (extent to which a risk event can be controlled). These will help you understand the overall project risk level and plan mitigation measures accordingly.

3. **Create a response plan**

Now that you have a better understanding of potential project risks, it’s time to develop a response plan. The response plan should include how you’ll address each of the identified high-priority risks. The plan should also be achievable, practical, and tailored to fit your project’s specific needs.

Transfer, mitigation, avoidance, and acceptance are four different ways to respond to risks. Based on your risk tolerance, create a response plan to either transfer, mitigate, avoid, or accept potential project risks.

4. **Implement the response plan**

This require close coordination between team members and stakeholders. To execute the plan effectively, designate someone to be in charge of each step so there is continuity and no confusion. As the project progresses, keep a close eye on the risks and make changes to the response plan as needed.

5. **Monitor and evaluate risks**

Risk management is not a one-time activity; it’s an ongoing process that should be revisited regularly. And that’s why you should never stop monitoring and evaluating project risks. Continuous monitoring will allow you to track the progress of mitigation measures, ensure they are effective, and make necessary adjustments when required.

**Basic Concept 10: Project Cost management**

**Project cost management** is the process of estimating, budgeting and controlling costs throughout the project life cycle, with the objective of keeping expenditures within the approved budget.

For a project to be considered a success, it’s necessary that

* it delivers on the requirements and scope
* its execution quality is of a high standard
* it’s completed within schedule and
* it’s completed within budget.

By implementing efficient cost management practices, project managers can:

* Set clear expectations with stakeholders
* Control scope creep by leveraging transparencies established with the customer
* Track progress and respond with corrective action at a quick pace
* Maintain expected margin, increase ROI, and avoid losing money on the project
* Generate data to benchmark for future projects and track long-term cost trends

The Four Steps in Project Cost Management

While cost management is viewed as a continuous process, it helps to split the function into four steps: resource planning, estimation, budgeting and control.

1. Project Resource Planning

Resource planning is the process of identifying the resources required to execute a project and take it to completion. Examples of resources are people (such as employees and contractors) and equipment (such as infrastructure, large construction vehicles and other specialized equipment in limited supply).

2. Cost Estimation

Cost estimation is the process of quantifying the costs associated with all the resources required to execute the project. To perform cost calculations, we need the following information:

* Resource requirements (output from the previous step)
* Price of each resource (e.g., staffing cost per hour, vendor hiring costs, server procurement costs, material rates per unit, etc.)
* Duration that each resource is required
* List of assumptions
* Potential risks
* Past project costs and industry benchmarks, if any
* Insight into the company’s financial health and reporting structures

3. Cost Budgeting

Cost budgeting can be viewed as part of estimation or as its own separate process. Budgeting is the process of allocating costs to a certain chunk of the project, such as individual tasks or modules, for a specific time period. Budgets include contingency reserves allocated to manage unexpected costs.

Budgeting creates a cost baseline against which we can continue to measure and evaluate the project cost performance. If not for the budget, the total estimated cost would remain an abstract figure, and it would be difficult to measure midway. Evaluation of project performance gives an opportunity to assess how much budget needs to be released for future phases of the project.

4. Cost Control

Cost control is the process of measuring cost variances from the baseline and taking appropriate action, such as increasing the budget allocated or reducing the scope of work, to correct that gap. Cost control is a continuous process done throughout the project lifecycle. The emphasis here is as much on timely and clear reporting as measuring.

Along with the cost baseline, the cost management plan is an essential input for cost control. This plan contains details such as how project performance will be measured, what is the threshold for deviations, what actions will be done if the threshold is breached, and the list of people and roles who have the executive authority to make decisions.

Earned value management (EVM) is one of the most popular approaches to measuring cost performance. Let’s take an example.

At the end of a week, you measure the progress of task X and find that it’s 25% complete. Now, how do you assess if you are on track to meet the task budget?

First, a project manager calculates the planned value for this task (at the planning stage). Let’s say, Task X has a budget of $4000 and is expected to be 50% complete by the week.

Planned value (PV) of task X by the week = $4000 \* .5 = $2000

Earned value (EV) of task X by the week = $4000 \* .25 = $1000

Now, you also determine the actual cost (AC) of the work, which involves other variables such as equipment and material costs (say, $800).

Schedule variance = EV – PV = $1000 – $2000 = -$1000.

Cost variance = EV – AC = $1000 – $800 = $200.

The negative schedule variance indicates that the task is falling behind, but the positive cost variance indicates that it’s under budget.

While dealing with hundreds of tasks in huge projects, cost control can provide the level of transparency that decision makers require to respond quickly to the situation.

**The three-point estimating technique**

Estimating is a crucial aspect of project management. Project managers are expected to accurately estimate essential elements of the project, such as costs, scope, and time. There are many different estimation techniques that can be used, depending on what aspect of the project needs an estimate. Estimation techniques allow project managers to provide better forecasts to stakeholders and clients and more accurately budget the funds and resources they need for project success.

The *three-point estimating technique* can be used to help determine the most realistic time estimate for a task. It uses optimistic, pessimistic, and most likely calculations, meaning calculations are based on the “best case” (optimistic), “worst case” (pessimistic), and most probable scenarios.

Three-point estimation

In this technique, each task receives three estimates: optimistic, most likely, and pessimistic. Each of these three estimates is then associated with the corresponding amount of time that task is expected to take.

* **Optimistic**

Assumes the best case scenario that issues will not occur

* **Most Likely**

Assumes some issues might occur and based on how long the task usually takes under normal circumstances

* **Pessimistic**

Assumes the worst case scenario that issues will definitely occur

**The three-point estimating process**

For each task, add a duration estimate in each category: optimistic, most likely, and pessimistic. You can get these estimates by doing research on the task or by asking a task expert. As a best practice, add notes about the conditions that determine each estimate.

*Optimistic* = Vendor is well-qualified,

has all the materials, and shows up

on time; Staff shows up in time and

successfully completes training within scheduled amount of time;

All equipment works.

4 Hours

*Most Likely* = Vendor is qualified but might not have all the materials;

Vendor is new and needs extra time

to prepare; Extra training time has

to be scheduled for absentee staff;

Minor glitches with equipment;

Training has to be rescheduled.

6 Hours

*Pessimistic* = Original vendor quits;

New vendor has to be hired;

Staff no-shows or turnover right before the training; Equipment isn’t delivered

on time or doesn’t work; Training

can’t happen until new equipment arrives.

6 Days

***Determining a final estimate***

To determine your final estimate—the estimate you’re going to use in your project plan—examine the optimistic and pessimistic timing, then compare it with the most likely timing. Consider the conditions that are likely to exist while the task is being completed. Does it seem reasonable that the most likely time can be met? If your team has never completed this task before, or if dependencies for the task are unknown, then the final estimate should be closer to the pessimistic estimate. If your team is familiar with the task and you’re able to confirm the conditions for an optimistic estimate, then the final estimate can be closer to the optimistic estimate. Alternatively, simply use the most likely estimate, especially if the difference between the optimistic and pessimistic estimates is minimal (a few hours or no more than one or two days). A good practice is to build in a “buffer” that accounts for risks that are likely but still keeps the project progressing at an efficient rate.

Three-point estimation formulas

Some projects will require you to calculate specific numeric values for task time estimates. There are many online resources that provide more instruction for how to calculate estimates, but we’ve provided two popular formulas: The Triangular Distribution and the Beta (PERT) Distribution.

For each formula: E is Estimate (the final estimate you’ll assign to the task), o = optimistic estimate, p = pessimistic estimate, and m = most likely estimate.

E = estimate (the final estimate) o = optimistic estimate m = most likely estimate P = pessimistic

The Triangular Distribution

The weight of each estimate in this equation is identical, which means the most likely case does not affect the final estimate more than the optimistic or pessimistic estimates.

E= (o+m+p) /3 Example o = 4 hours m = 8 hours p = 16 hours E= (4 + 8 + 16) /3 E= 28 /3 E= 9.3 hours

The Beta (PERT) Distribution

The Beta (PERT) distribution is a weighted average. The most likely estimate receives a multiplier of four, while the overall divisor is increased to six.

This method takes into account that the most likely case is more likely to occur, so it’s given more weight. The added weight is reflected in the multiplier of four.

Placing more weight on the most likely estimate increases the accuracy of the estimate. In most cases, the Beta (PERT) Distribution has been proven to be more accurate than three-point estimating and is often used to calculate both cost and time estimates.

E= (o+4m+p) /6 Example E= (4 + 4(8) + 16) /6 E= 52 /6 E= 8.7 hours