

# Software Project Management

## UNIT -I:

**Introduction:** Project, Management, Software Project Management activities, Challenges in software projects, Stakeholders, Objectives & goals

**Project Planning:** Step-wise planning, Project Scope, Project Products & deliverables, Project activities, Effort estimation, Infrastructure

## Introduction

### 1.1 Project:

A project is a group of tasks that need to complete to reach a clear result. A project also defines as a set of inputs and outputs which are required to achieve a goal. Projects can vary from simple to difficult and can be operated by one person or a hundred.

Projects usually described and approved by a project manager or team executive. They go beyond their expectations and objects, and it's up to the team to handle logistics and complete the project on time. For good project development, some teams split the project into specific tasks so they can manage responsibility and utilize team strengths.

### 1.2 Management:

Management involves the following activities:

- ▶ Planning – deciding what is to be done
- ▶ Representing – liaising with clients, users, developers and other stakeholders
- ▶ Organizing – making arrangements
- ▶ Monitoring – checking on progress.
- ▶ Directing – giving instructions
- ▶ Innovating – coming up with solutions when problems emerge
- ▶ Staffing – selecting the right people for the job
- ▶ Controlling – taking action to remedy hold- ups

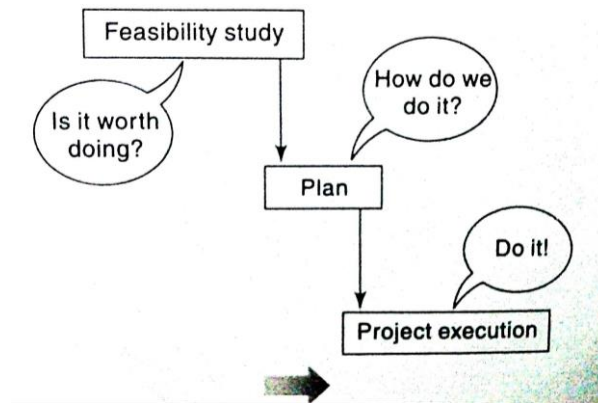
Report published by Standish Group in United states analyzed 13,522 projects concluded that

- ▶ Only a third of projects are successful.
- ▶ 82% of projects are late.
- ▶ 43% exceeded their budget.

History of development of software is not full of success stories because

- ▶ It sometimes does not meet the requirements
- ▶ It often costs more than budgeted
- ▶ It takes longer to complete than planned
- ▶ Its maintenance is difficult

### 1.2.1 Activities covered by Project Management:



#### 1. Feasibility study:

- ▶ Assess whether a project is worth starting. I.e. it has a valid business case.
- ▶ Information is gathered about the requirements of the proposed application.
- ▶ The developmental and operational costs and the value of the benefits of the new system will be estimated.

#### 2. Planning

- ▶ If the feasibility study indicates that the project appears viable, then Project Planning starts.
- ▶ We create an outline plan for the whole project and a detailed one for the first stage.
- ▶ We get detailed information after the earlier stages of the project, planning of the latter stages is left nearer to the start

#### 3. Project execution

- ▶ Execution of a project contains design and implementation sub phases.
- ▶ Design is making decisions about the form of products to be created that is external appearance of the software like user interface or internal architecture
- ▶ The plan details the activities to be completed to create these products.

It is a proper way of planning and leading software projects. It is a part of project management in which software projects are planned, implemented, monitored and controlled.

### 1.2.2 Need of Software Project Management:

Software is a non-physical product. Software development is a new stream in business and

there is very little experience in building software products. Most of the software products are made to fit client's requirements. The most important is that the basic technology changes and advances so frequently and rapidly that experience of one product may not be applied to the other one. Such type of business and environmental constraints increase risk in software development hence it is essential to manage software projects efficiently.

It is necessary for an organization to deliver quality product, keeping the cost within client's budget constrain and deliver the project as per scheduled. Hence in order, software project management is necessary to incorporate user requirements along with budget and time constraints.

### **Advantages of Software Project Management:**

- It helps in planning of software development.
- Implementation of software development is made easy.
- Monitoring and controlling are aspects of software project management.
- It overall manages to save time and cost for software development

### **1.3 Software Project Management Activities:**

Software Project Management consists of many activities that include planning of the project deciding the scope of product, estimation of cost in different terms, scheduling of tasks, etc.

The lists of activities are as follows:

1. Project planning and Tracking
2. Project Resource Management
3. Scope Management
4. Estimation Management
5. Project Risk Management
6. Scheduling Management
7. Project Communication Management
8. Configuration Management

### **Project Planning and Tracking**

Project planning is a feature of Project Management, which includes of various processes. The aim of these processes is to make sure that various **Project tasks are well coordinated** and **they meet the various project goals** including timely completion of the project.

Project Planning is a feature of Project Management that focuses a lot on **Project Integration**.

The project plan shows the current status of all project activities and is used to observe and control the project. The Project Planning tasks ensure that various elements of the Project are coordinated and therefore guide the project execution.

**Project Resource Management:** In software Development, all the elements are referred to as resources for the project. It can be a human resource, productive tools, and libraries.

Resource management includes:

- Create a project team and assign responsibilities to every team member
- Developing a resource plan is derived from the project plan.
- Adjustment of resources.

**Scope Management:** It describes the scope of the project. Scope management is important because it clearly defines what would do and what would not. Scope Management creates the project to contain **restricted and quantitative tasks**, which may merely be documented and successively avoids price and time overrun.

**Estimation Management:** This is not only about cost estimation because whenever we start to develop software, but we also figure out their size (**line of code**), **efforts**, **time** as well as cost.

- If we talk about the size, then Line of code depends upon user or software requirement.
- If we talk about effort, we should know about the size of the software, because based on the size we can quickly estimate how big team required producing the software.
- If we talk about time, when size and efforts are estimated, the time required to develop the software can easily determine.

And if we talk about cost, it includes all the elements such as:

- Size of software
- Quality
- Hardware
- Communication
- Training
- Additional Software and tools
- Skilled manpower

**Project Risk Management:** Risk management consists of all the activities like **identification, analyzing and preparing the plan for predictable and unpredictable risk** in the project.

Several points show the risks in the project:

- The Experienced team leaves the project, and the new team joins it.
- Changes in requirement.
- Change in technologies and the environment.
- Market competition.

**Scheduling Management:** Scheduling Management in software refers to all the activities to complete in the specified order and within time slotted to each activity. Project managers define multiple tasks and arrange them keeping various factors in mind.

For scheduling, it is compulsory -

- Find out multiple tasks and correlate them.
- Divide time into units.
- Assign the respective number of work-units for every job.
- Calculate the total time from start to finish.
- Break down the project into modules.

**Project Communication Management:** Communication is an essential factor in the success of the project. It is a bridge between client, organization, team members and as well as other stakeholders of the project such as hardware suppliers.

From the planning to closure, communication plays a vital role. In all the phases, communication must be clear and understood. Miscommunication can create a big blunder in the project.

**Project Configuration Management:** Configuration management is about to control the changes in software like requirements, design, and development of the product.

The Primary goal is to increase productivity with fewer errors.

Some reasons show the need for configuration management:

- Several people work on software that is continually updated.
- Help to build coordination among suppliers.
- Changes in requirement, budget, and schedule need to accommodate.
- Software should run on multiple systems.

Tasks perform in Configuration management:

- Identification
- Baseline
- Change Control
- Configuration Status Accounting
- Configuration Audits and Reviews

**1.4 Challenges in software projects:****1. Lack of clear goals and success criteria**

Clarity is one of the most important requirements for the successful completion of the project and the lack of it creates several project management issues. A study states that about 39% of projects fail due to the lack of project planning and a clearly defined goal.

It is also important for a project manager to come up with a way of quantifying project progress by setting up milestones and quality tests. In addition to helping your team progress, having a clear set of objectives will also help project managers defend their vision in front of the upper management and the customers.

**2. Lack of communication**

Effective communication in project management is extremely important for a successful project. You need to have timely and transparent methods of communication to ensure that all stakeholders are involved in the process. Deloitte states that 32 percent of professionals believe that communication is the biggest issue of project management.

Miscommunication is also dangerous for project teams because it affects their teamwork. It can cause conflicts among team members and can potentially delay the project.

**3. Budgeting issues**

Most managers consider financial issues as one of the biggest hurdles in effective project management. A study in 2017 revealed that 49.5 percent of manufacturing managers' report costs as the biggest project management challenge they face. By efficient cost management, a manager can avoid various common complications a project may face and strive for better and quicker results.

**4. Inadequate skills of team members**

A chain is as strong as its weakest link and in the case of project team's performance highly depends on their individual skill levels. As a project manager, you can create the most ideal environment but if the team does not possess the necessary skills to tackle the problem at hand, your project is bound to fail. This is a huge project management problem that can only be solved with proper experience and foresight.

**5. Lack of accountability**

A project team performs really well when every member feels responsible and tries to fulfill the role assigned to them.

**6. Scope creep**

Scope creep is a natural and expected phenomenon for any project. There are times when it can be beneficial but mostly the cons outweigh the pros. 52% of project teams reported facing

scope creep in 2017 and the trend is continuing upwards. Clients who don't precisely know what they want and have vague requirements are one of the biggest project management challenges for both managers and the project team.

### 7. Inadequate risk management

Having the foresight to identify potential „what if“ scenarios and making up contingency plans is an important aspect of project management. Projects rarely go exactly as planned because there are so many variables that can create unlimited possibilities.

### 8. Unrealistic deadlines

Having an impossible deadline is another project management challenges that can severely affect the quality of the end product. Any effective project manager knows the capability of the project team and negotiates the project timeline accordingly by prioritizing deadlines and project tasks.

### 9. The limited engagement of stakeholders

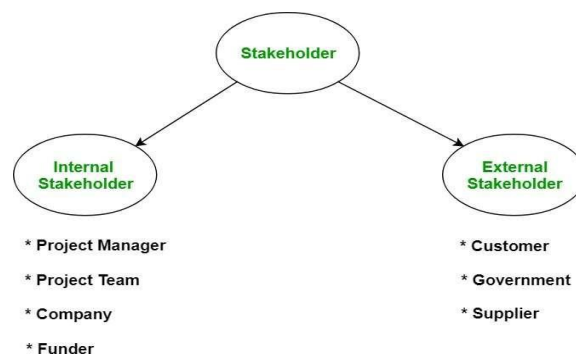
It is important for project managers to ensure that all the project stakeholders are on the same page and have a clear vision of the project. An uninvolved client can cause a lot of problems in the final stages of a project so it's important to consider the customer's feedback and keep them updated throughout the project.

### 1.5 Stakeholders:

In simple words, **anyone having any type of relation/interest in the project is known as stakeholder.** The term Software Project Stakeholder refers to, “a person, group or company that is directly or indirectly involved in the project and who may affect or get affected by the outcome of the project”.

### What is Stakeholder Identification?

It is the process of identifying a person, group or a company which can affect or get affected by a decision, activity or the outcome of the software project. It is important in order to identify the exact requirements of the project and what various stakeholders are expecting from the project outcome.



**Type of Stakeholders:****1. Internal Stakeholder:**

An internal stakeholder is a person, group or a company that is directly involved in the project. For example,

1. **Project Manager:** Responsible for managing the whole project. Project Manager is generally never involved in producing the end product but he/she controls, monitors and manages the activities involved in the production.
2. **Project Team:** Performs the actual work of the project under the Project Manager including development, testing, etc.
3. **Company:** Organization who has taken up the project and whose employees are directly involved in the development of the project.
4. **Funders:** Provides funds and resources for the successful completion of the project.

**2. External Stakeholder:**

An external stakeholder is the one who is linked indirectly to the project but has significant contribution in the successful completion of the project.

For example,

1. **Customer:** Specifies the requirements of the project and helps in the elicitation process of the requirement gathering phase. Customer is the one for whom the project is being developed.
2. **Supplier:** Supplies essential services and equipment for the project.
3. **Government:** Makes policies which helps in better working of the organization.

**1.6. Goals and Objectives:**

- Objectives focus on the desired outcomes of the project rather than the tasks in it.
- Define what the project team must achieve for project success
- Different stakeholders have different objectives the Project objectives identify the shared intentions of the project.
- Objectives could be written as a set of statements following the opening words “the project will be a success if ...”
- Customers can order our products online rather than to build an E-Commerce application
- A project Authority needs to be identified explicitly with overall authority over the project often called project steering committee with responsibility for setting, monitoring, modifying of these objectives.
- This committee contains user, development and management representatives.



- To achieve an objective we must achieve certain goals or sub-objectives first.
- Informally this can be expressed as a set of statements following the words.
- “To reach objective..... The following must be in place .....”
- Reducing staff costs... the goal might be development costs are within certain budget.

**SMART** refers to criteria for setting goals and objectives, namely that these goals are: Specific, Measurable, Attainable, Relevant, and Time-bound. The idea is that every project goal must adhere to the SMART criteria to be effective. Therefore, when planning a project's objectives, each one should be:

- *Specific: The goal should target a specific area of improvement or answer a specific need.*
- *Measurable: The goal must be quantifiable, or at least allow for measurable progress.*
- *Attainable: The goal should be realistic, based on available resources and existing constraints.*
- *Relevant: The goal should align with other business objectives to be considered worthwhile.*
- *Time-bound: The goal must have a deadline or defined end.*

### **1.7. Step Wise Project Planning:**

Planning is the most difficult process in project management. The framework described is called the Stepwise method to help to distinguish it from other methods.

Planning is the most difficult process in project management. A major step in project planning is to plan in outline first and then in more detail. Stepwise Project Planning

Step 0: Select project

Step 1: Identify project scope and objectives

Step 2: Identify project infrastructure

Step 3: Analyze project characteristics

Step 4: Identify project products and activities

Step 5: Estimate effort for each activity.

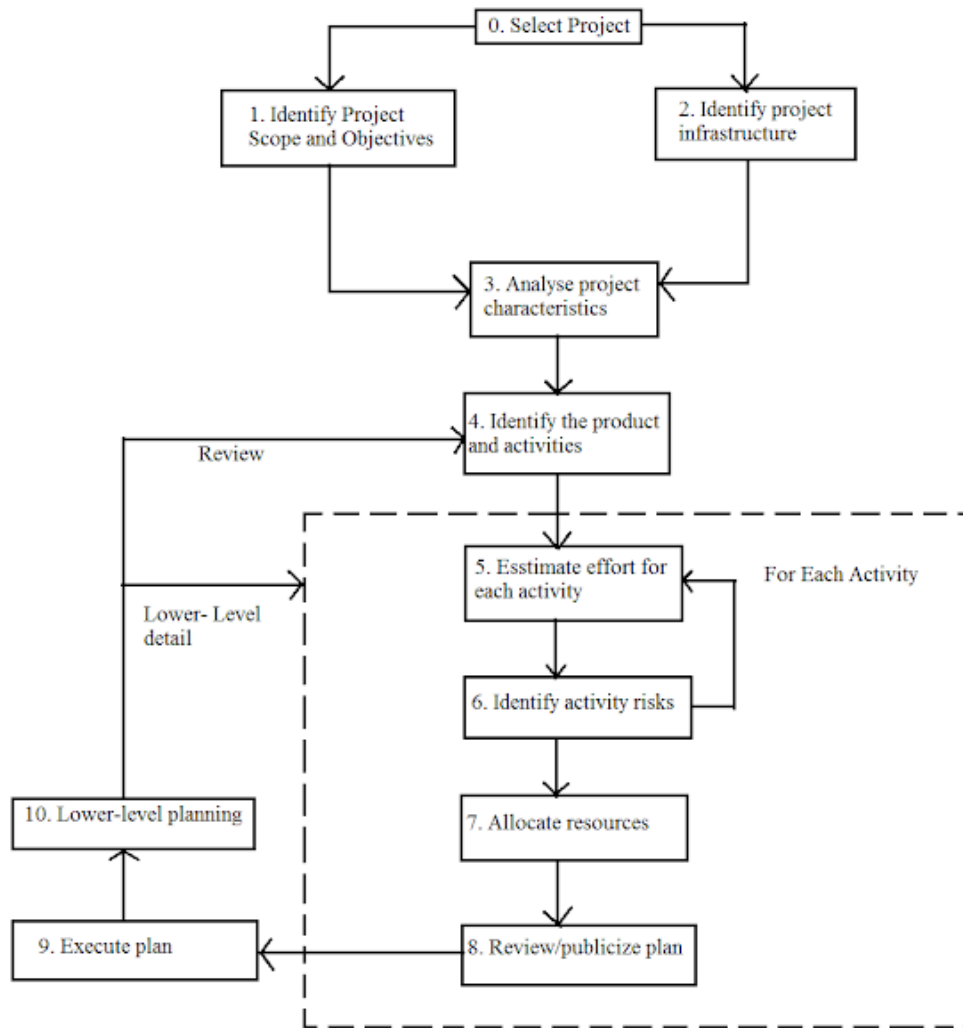
Step 6: Identify activity risks.

Step 7: Allocate resources

Step 8 Review / Publicize plan

Step 9 &10: Execute plan / lower level of planning

Each step of project planning has different activities to perform. Following the description of each step with its activities



## Step 0: Select Project

This is called step 0 because in a way of project planning, it is outside the main project planning process. Feasibility study suggests us that the project is worthwhile or not.

### Step 1: Identify project scope and objectives

The activities in this step ensure that all parties to the project agree on the objectives and are committed to the success of the project.

*Step 1.1: Identify objectives and practical measures of the effectiveness in meeting those objectives*

*Step 1.2: Establish a project authority*

*Step 1.3: Stakeholder analysis - identify all stakeholders in the project and their interests.*

*Step 1.4: Modify objectives in the light of stakeholder analysis.*

*Step 1.5: Establish methods of communication with all parties.*

## Step 2: Identify project infrastructure

Projects are rarely carried out in a vacuum. There is usually some kind of infrastructure into which the project must fit. Where the project managers are new to the organization they must find out the precise nature of this infrastructure.

*Step 2.1: Identify relationship between the project and strategic planning*

*Step 2.2: Identify installation standard and procedures*

*Step 2.3: Identify project team organization*

## Step 3: Analyze project characteristics

The general purpose of this part of planning operation is to ensure that the appropriate methods are used for the project.

*Step 3.1: Distinguish the project as either objectives- or product-driven.*

*Step 3.2: Analyze other project characteristics (including quality –based ones)*

*Step 3.3: Identify high-level project risks*

*Step 3.4: Take into account use requirements concerning implementation*

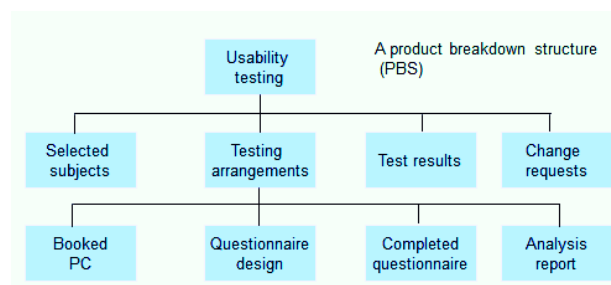
*Step 3.5: Select development methodology and life-cycle approach*

*Step 3.6: Review overall resource estimates*

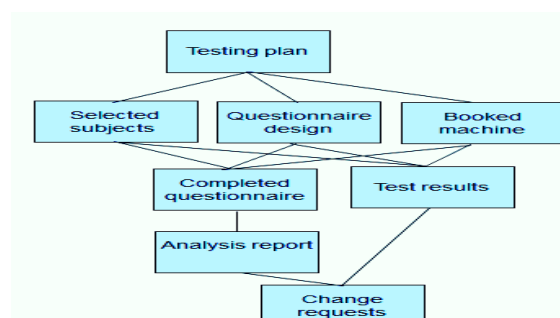
## Step 4: Identify project products and activities

The more detailed planning of the individual activities now takes place. The longer term planning is broad and in outline, while the more immediate tasks are planned in some detail.

*Step 4.1: Identify and describe project products (or deliverables)*

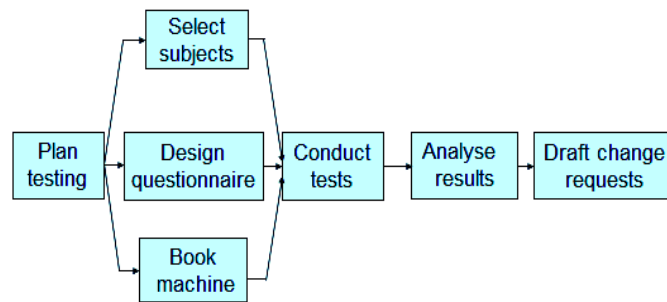


*Step 4.2: Document generic product flows*

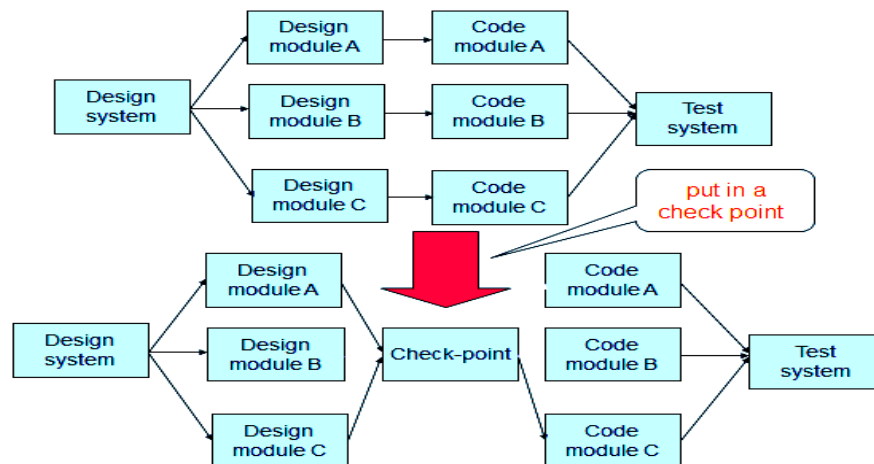


*Step 4.3: Recognize product instances*

*Step 4.4: Produce ideal activity network*



*Step 4.5: Modify the ideal to take into account need for stages and checkpoints*



**Step 5: Estimate effort for each activity**

*Step 5.1: Carry out bottom-up estimates*

- Distinguish carefully between effort and elapsed time

*Step 5.2: Revise plan to create controllable activities*

- Breakup very long activities into a series of smaller ones
- Bundle up very short activities

**Step 6: Identify activity risks**

*Step 6.1: Identify and quantify activity based risks*

- Damage if risk occurs
- Likelihood if risk occurring

*Step 6.2: Plan risk reduction and contingency measures*

- Risk reduction: activity to stop risk occurring
- Contingency: action if risk does occurs

*Step 6.3: Adjust overall plans and estimates to take account of risks*

Step 7: Allocate resources

*Step 7.1: Identify and allocate resources*

*Step 7.2: Revise plans and estimates to take into account resource constraints*

Step 8: Review/ Publicize plans

*Step 8.1: Review quality aspects of the project plan*

*Step 8.2: Document plans and obtain agreement*

Step 9 and 10: Execute plan. Lower levels of planning

Once the project is underway, plans will need to be drawn up in greater detail for each activity as it becomes due. Detailed and lower level of planning of the later stages will need to be delayed because more information will be available nearer the start of the stage. Project planning is an iterative process. As the time approaches for the particular activities to be carried out they should be re-planned in more detail

### **1.8 Project Scope:**

Project scope is the part of project planning that involves determining and documenting a list of specific project goals, deliverables, tasks, costs and deadlines.

Project scope is a way to **set boundaries** on your project and define exactly what goals, deadlines, and project deliverables you'll be working towards. By clarifying your project scope, you can ensure you hit your project goals and objectives without delay or overwork.

Project scope is a part of the project planning process that documents specific goals, deliverables, features, and budgets. The scope document details the list of activities for the successful completion of the project.

The scope is defined by understanding the project requirements and the client's expectations.

The scope statement usually contains,

- Project objectives
- Project deliverables
- Exclusions
- Project constraints and
- Project assumptions.

8 Key Steps to Developing a Project Scope Statement:

1. Understand why the project was initiated. ...
2. Define the key objectives of the project. ...
3. Outline the project statement of work. ...

4. Identify major deliverables. ...
5. Select key milestones. ...
6. Identify major constraints. ...
7. List scope exclusions. ...
8. Obtain sign-off.

### **1.9. Project Products & deliverables:**

Projects create deliverables, which are simply the results of the project or the processes in the project. That means a deliverable can be something as big as the objective of the project itself or the reporting that is part of the larger project.

Another way to put that is that there are inputs and outputs in any type of project. That being what you put into the project, such as data, resources, etc., and then what comes out, which are the deliverables. Again, those deliverables can be a product or service and it can also be the documentation that is part of the project closure to show that the project is complete and everything has been signed off.

There is a distinction between project and product deliverables. Project deliverables are such outputs as the project plans, project reports and even meeting minutes. Product deliverables, on the other hand, could be hardware, software, mobile applications, contracts, or even test assessment results.

The deliverables that clients and stakeholders expect at the end of the project are the product or service, of course, but there is also paperwork, as noted. These documents, when completed, are deliverables that clients and stakeholders need in order to evaluate the progress or completion of the project.

This paperwork can include:

- Signed contracts
- Finalized expense reports
- Other types of project reports which show how work is proceeding versus project plan estimations

Deliverables can vary according to the project's specifications and the stakeholders' requirements. But all clients and stakeholders want deliverables that thoroughly wrap up the project at its closure and measure performance against expectations throughout the project. Project managers' reports are the means by which these types of deliverables are presented to clients and stakeholders. Different stakeholders have different needs, so flexibility and customization is important for effective reporting. In order to meet their needs, project management software must be able to filter the many data inputs to deliver the proper output.

**1.9. Project activities / SDLC Process:**

- SDLC is a methodology for developing a software product adopted by most of the software organizations.
- It includes a comprehensive plan outlining how to code, maintain, patch and remodel or improve the specific software.
- The life cycle represents a process for enhancing the quality of software and the entire development cycle.
- Each phase of SDLC produces outputs which act as inputs for the next stage.
- The requirements translate into the design. The developers pick the design specs, write the code, and produce a build. Testers validate the developed product as per the requirement. After completing the testing, the product will move to deployment.

The Software Development Life Cycle comprises of the following phases:

**Planning Phase**

- It is the very first phase of the SDLC which first determines whether there is a need or not for a new system to fulfill the strategic business objectives.
- After that, a high-level plan is being worked out with business intent to procure the resources required for creating, modifying or upgrading a service or the solution. The goal of this step is to define the scope of the problem and devise solutions.
- The term resources refer to the HW/SW requirement, costs, time, benefits and a few other essential items.
- QA (quality assurance) activity identification, project risk assessment also happen in this phase. Next, the feasibility study is a kind of technical analysis which aims to find out the most efficient ways to complete the project without any risk.

**Analysis Phase**

- This phase begins with the team collecting and assessing the functional requirement of the project. It is one of SDLC's initial and critical stages. It gets carried out by the senior developers/testers of the team with information from the client, the pre-sales, market studies and domain specialists of the industry. These inputs help in planning the project approach and to perform the feasibility analysis based on the financial, operational and technical aspects.
- After getting through the requirement analysis, the next activity is to publish a clear definition of each of them in the form of a document.

You suppose to share it with the customer or with the business analyst for the approval. This artifact is the Software

**Requirement Specification a.k.a. SRS:** It lists out every product requirements with sufficient details needed to start the design and development activities.

### **Design Phase**

- SRS details act as the single point of reference for Software architects to chart out the best design for product development. Usually, it is a practice to come out with multiple solutions and prepare a Design Document Specification a.k.a. DDS with a detailed solution approach.
- Now, the DDS has to go through for the approvals from all the key stakeholders. Several factors like the risks, robustness, modularity, cost, and timelines play significant roles in deciding upon the design approach for the implementation.
- The final design solution mentions what all modules it should have, their architecture, workflows, entity, and data-flow diagrams along with the third-party dependencies if any. The DDS should even provide a clear view of the internal structure of the components to prevent any confusion later.

### **Build Phase**

- This stage has many names such as the Development or Coding or Implementation phase.
- It is where the real development begins by following the design guidelines. The dev team writes code for each module as per the definition laid down by the DDS. A well-written design document which has sufficient, structured and apt details can make coding relatively easy and assist the developer to finish on time.
- Every organization has a sort of coding standards, guidelines and best practices which intend to produce quality and reusable code. All the programmers should know and practice them while working on a development task. He or she must be mindful of the IDE, compilers (e.g., GCC/MSVC), interpreters (e.g., Python LINT), and debuggers (e.g., WINDBG, GDB). The selection of the programming language depends upon the nature of the software to build and also its ability to develop faster

### **Testing Phase Alias – QA/Validation phase**

- Some testing happens in almost all the stages of the Software Development Life Cycle. For example: Reviewing the SRS, DDS, unit testing of individual modules, all such activities are some forms of validation.



- Even though, the product requires extensive testing to confirm that each component and all the functionalities work in line with the customer requirements. Also, it is a formal phase of the SDLC in which the QA team produces a testing plan, write test cases, log defects, perform regression and make sure the software attains the highest of the quality standard.

### **Deployment Phase Alias – Acceptance or Beta evaluation phase**

- After the Software testing finishes successfully, the product gets ready to ship to the customer for the deployment. In some organization, they split this phase into sub-phases as per their business policies. They first do a release specifically for a market-facing group of people and get it tested in a real-time environment for their acceptance. It is a sort of User Acceptance testing a.k.a. UAT. Their inputs may lead to fixing some usability bugs or enhancements crucial for the market perspective or can also give a green status for delivering it to the target customers. After the product is out for delivery to the market, it enters into the maintenance phase.

### **Maintenance Phase Alias – Operations phase**

- After the software clears all the SDLC phases without any issues, then it goes into the maintenance stage. It allows the customers to request for upgrades and get the fixes/patches for problems internally or externally identified. Most of the software companies adhere to all the seven steps to deliver the product with maximum possible quality.

## **1.10. Project Estimation:**

For an effective management accurate estimation of various measures is a must. With correct estimation managers can manage and control the project more efficiently and effectively.

Project estimation may involve the following:

- **Software size estimation**
  - Software size may be estimated either in terms of KLOC (Kilo Line of Code) or by calculating Number of function points in the software. Lines of code depend upon coding practices and Function points vary according to the user or software requirement.
- **Effort estimation**
  - The managers estimate efforts in terms of personnel requirement and man-hour required to produce the software. For effort estimation software size should be known. This can either be derived by managers' experience, organization's historical data or software size can be converted into efforts by standard formula.

- **Time estimation**

- Once size and efforts are estimated, the time required to produce the software can be estimated. An effort required is segregated into sub categories as per the requirement specifications and interdependency of various components of software. Software tasks are divided into smaller tasks, activities or events by Work Breakthrough Structure (WBS). The tasks are scheduled on day-to-day basis or in calendar months. The sum of time required to complete all tasks in hours or days is the total time invested to complete the project.

- **Cost estimation**

- This might be considered as the most difficult of all because it depends on more elements than any of the previous ones. For estimating project cost, it is required to consider -
  - Size of software
  - Software quality
  - Hardware
  - Additional software or tools, licenses etc.
  - Skilled personnel with task-specific skills
  - Travel involved
  - Communication
  - Training and support

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