



# Software Project Management Unit- 1 Notes

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**DEPARTMENT OF CSE (IOT)**  
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**SOFTWARE PROJECT MANAGEMENT**

**UNIT I - PROJECT EVALUATION AND PROJECT PLANNING**

**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). A Project can be characterized as:

- Every project may have a unique and distinct goal.
- Project is not routine activity or day-to-day operations.
- Project comes with a start time and end time.
- Project ends when its goal is achieved hence it is a temporary phase in the lifetime of an organization.
- Project needs adequate resources in terms of time, manpower, finance, material and knowledge-bank.

**Software Project**

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.

**Importance of software project management**

Software is said to be an intangible product. Software development is a kind of all new streams in world business and there's very little experience in building software products. Most software products are tailor made to fit client's requirements. The most important is that the underlying technology changes and advances so frequently and rapidly that experience of one product may not be applied to the other one. All such business and environmental constraints bring risk in software development hence it is essential to manage software projects efficiently.



The image above shows triple constraints for software projects. It is an essential part of software organization to deliver quality product, keeping the cost within client's budget constrain and deliver the project as per scheduled. There are several factors, both internal and external, which may impact this triple constrain triangle. Any of three factors can severely impact the other two. Therefore, software project management is essential to incorporate user requirements along with budget and time constraints.

### **Activities Methodologies**

**Activities of Project Management:** Project management plan begins with a set of activities that are involved in the development process.

- Overview of the project
- Project deliverables
- Managerial processes
- Technical processes
- Work packages
- Schedule of the project
- Budget estimation

**Characteristics of Project:** Some of the characteristics of project include-

- Planning of process is required;
- Clear objectives have to be specified;
- Project must have a predetermined time span;
- Involves different phases of work;
- Resources used on the project are constrained.;
- Non-routine tasks are involved.

## **Activities Covered by SPM**

A software project is considered as a software application with specific elements associated with each type of project. The lists of activities involved in software project management are:

- Feasibility Study;
- Planning Phase;
- Project Execution.

## **Feasibility Study**

A valid business case implies a prospective project. The necessary information required for the proposed application is gathered. Initial requirement stage is quite complex and difficult. The client is aware of the problems but not sure of how to achieve the solution. Estimation becomes an important factor in the development of the product. Developmental and operational costs have to be estimated along with the benefits of the system. For a complex project, the feasibility study can have sub phases and strategic planning becomes essential in prioritizing the range of potential software developments. Group of projects are termed as a planned programme of development.

Feasibility studies aim to objectively and rationally uncover the strengths and weaknesses of the existing business or proposed venture, opportunities and threats as presented by the environment, the resources required to carry through, and ultimately the prospects for success. In its simplest term, the two criteria to judge feasibility are cost required and value to be attained. As such, a well-designed feasibility study should provide a historical background of the business or project, description of the product or service, accounting statements, details of the operations and management, marketing research and policies, financial data, legal requirements and tax obligations. Generally, feasibility studies precede technical development and project implementation.

## **Technology and System Feasibility**

The assessment is based on an outline design of system requirements in terms of Input, Processes, Output, Fields, Programs, and Procedures. This can be quantified in terms of volumes of data, trends, frequency of updating, etc. in order to estimate whether the new system will perform adequately or not. Technological feasibility is carried out to determine

Whether the company has the capability, in terms of software, hardware, personnel and expertise, to handle the completion of the project when writing a feasibility report, the following should be taken to consideration:

- A brief description of the business
- The part of the business being examined
- The human and economic factor
- The possible solutions to the problems

At this level, the concern is whether the proposal is both technically and legally feasible.

### **Economic Feasibility**

Economic analysis is the most frequently used method for evaluating the effectiveness of a new system. More commonly known as cost/benefit analysis, the procedure is to determine the benefits and savings that are expected from a candidate system and compare them with costs. If benefits outweigh costs, then the decision is made to design and implement the system. An entrepreneur must accurately weigh the cost versus benefits before taking an action.

**Cost-based study:** It is important to identify cost and benefit factors, which can be categorized as follows: Development costs and Operating costs. This is an analysis of the costs to be incurred in the system and the benefits derivable out of the system.

**Time-based study:** This is an analysis of the time required to achieve a return on investments. The future value of a project is also a factor.

### **Legal Feasibility**

Legal feasibility determines whether the proposed system conflicts with legal requirements, e.g. a data processing system must comply with the local Data Protection Acts.

### **Operational Feasibility**

Operational feasibility is a measure of how well a proposed system solves the problems, and takes advantage of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development.

### **Schedule Feasibility**

A project will fail if it takes too long to be completed before it is useful. Typically this means estimating how long the system will take to develop, and if it can be completed in a given time period using some methods like payback period. Schedule feasibility is a measure of how reasonable the project timetable is.

## Planning Phase

The planning phase comes into existence only if the proposed project is a prospective one. This is found only by the outcome of the feasibility study phase. In case of complex project, a detailed plan is not needed during the initial stage of planning phase. Instead, an outline plan is formulated for the whole project except for the first phase, which has a detailed one. As the project steps into different phases, a detailed plan for each stage can be developed as they are approached this will provide a clear idea about what should be done at every stages of the development.

The **Project Planning Phase** is the second phase in the *project life cycle*. It involves creating of a set of plans to help guide your team through the execution and closure phases of the project. The plans created during this phase will help you to manage time, cost, quality, change, risk and issues. They will also help you manage staff and external suppliers, to ensure that you deliver the project on time and within budget.

In the Planning Phase, the team defines the solution in detail what to build, how to build it, who will build it, and when it will be built. During this phase the team works through the design process to create the solution architecture and design, writes the functional specification, and prepares work plans, cost estimates, and schedules for the various deliverables.

The Planning Phase culminates in the Project Plans Approved Milestone, indicating that the project team, customer, and key project stakeholders agree on the details of the plans. Plans prepared by team members for areas such as communications, test, and security, are rolled up into a master plan that the program manager coordinates. The team's goal during this phase is to document the solution to a degree that the team can produce and deploy the

Solution in a timely and cost-effective manner. These documents are considered living documents, meaning they will be updated continuously throughout the Planning Phase.

Diligent work in the Planning Phase, which often involves several iterations of plans and schedules, should mitigate risks and increase chances for success. The team continues to identify all risks throughout the phase, and it addresses new risks as they emerge.

## **Project Execution**

There are two phases of project execution namely design and implementation. The boundary between these two phases must be clearly understandable. Design is about thinking and decision making about the form of the products which has to be created. Implementation lays down the activities that have to be carried out to create these products. Planning and design phase are difficult to separate at the most detailed level because planning decisions are influenced by design decisions. For example, if a software product development has five components then it must have five sets of activities defined for each component.

Project execution is the process from after the contract is signed to the point where the technology is ready for operational use. New and modified products must be ready from a technological and operational point of view before installation and operational use. This is achieved by carrying out the project planning process followed by the project execution process. A successful project execution process will make a new or modified product ready from a technological and operational point of view.

The project planning process will identify technical gaps related to the product itself, environment, standards, governing documents, verification, handling and documentation. The technology qualification program (TQP) is a project plan that describes activities and decision gates for a specific product required to close these gaps.

The project planning process may also identify gaps related to vendor's organization. These gaps must be corrected prior to project execution and is not a part of the TQP. A preliminary TQP will be worked out by the vendor as a part of their tender. The TQP will be finalized in co-operation with the operator prior to contract award. There will be no need for

the TQP when a product can be delivered off the shelf in accordance with operator's technical requirements.

The TQP describes required activities related to 'development and qualification testing (QT) in the above figure. Technology readiness is achieved when the TQP activities are executed and accepted.

The manufacturing and factory acceptance testing (FAT) is controlled by the quality plan. The operational preparations are controlled by the operational manager. Operational readiness is achieved when the manufacturing and operational preparations are finalized and accepted.

Vendors have quality assurance (QA) systems to provide quality in all steps of their services. These QA systems shall be used to establish the TQP and quality plans during the project planning process. Operators have requirements and recommended practices that shall be used during the operational preparation process. Still there is need for a practical summary of the entire project execution process as it will be for new technology. Such summary is wanted by completion- and drilling engineers responsible for the project planning process and will be used to control the content of the TQP and quality plan worked out by the vendors.

This need has resulted in the development of a guideline describing the entire project execution process. The guideline is fitted to operator needs and has thus emphasis on qualification activities. The guideline is made for well technology, but the main principles can be used for most technology elements.

## **Plan, Methods & Methodologies**

An **activity plan** is based on some method of work. To test software the following list is assumed.

- Requirement analysis for the software;
- Develop test cases for each requirement;
- Creating test scripts , expected results ;
- Comparison of actual result with the expected result;
- Identifying the discrepancies.



A **method** denotes a kind of activity.

A **plan** takes the method and converts it to activities. Every activity identified must contain the start and end dates, the responsible person to carry out the activity, what tools and materials are used.

Complex procedures can be handled in sequence or in parallel manner. The output of first method will be the input of the second method; the second one's output might be the input of the third one and so on. Methods grouped together are termed as methodologies. For example, object oriented design is a methodology made up of several methods.

In strategic planning, resource allocation is a plan for using available resources, for example human resources, especially in the near term, to achieve goals for the future. It is the process of allocating resources among the various projects or business units. The plan has two parts: Firstly, there is the basic allocation decision and secondly there are contingency mechanisms. The basic allocation decision is the choice of which items to fund in the plan, and what level of funding it should receive, and which to leave unfunded: the resources are allocated to some items, not to others.

There are two contingency mechanisms. There is a priority ranking of items excluded from the plan, showing which items to fund if more resources should become available; and there is a priority ranking of some items included in the plan, showing which items should be sacrificed if total funding must be reduced.

## **Software Process/Phases of SPM**

### **1. Project conception and initiation**

An idea for a project will be carefully examined to determine whether or not it benefits the organization. During this phase, a decision making team will identify if the project can realistically be completed.

### **2. Project definition and planning**

A project plan, project charter and/or project scope may be put in writing, outlining the work to be performed. During this phase, a team should prioritize the project, calculate a budget and schedule, and determine what resources are needed.

### **3. Project launch or execution**

Resources' tasks are distributed and teams are informed of responsibilities. This is a good time to bring up important project related information.

### **4. Project performance and control**

Project managers will compare project status and progress to the actual plan, as resources perform the scheduled work. During this phase, project managers may need to adjust schedules or do what is necessary to keep the project on track.

### **5. Project close**

After project tasks are completed and the client has approved the outcome, an evaluation is necessary to highlight project success and/or learn from project history. Projects and project management processes vary from industry to industry; however, these are more traditional elements of a project. The overarching goal is typically to offer a product, change a process or to solve a problem in order to benefit the organization.

## **Categorization of Software Projects**

The Categories are

- Compulsory versus voluntary users
- Information System versus Embedded Systems
- Outsourced Projects
- Objective-driven development

Information system interfaces with the organization whereas an embedded system interfaces with a machine. Typical example for an information system can be inventory system maintained by an organization. An embedded system or an industrial system can be a process control system such as maintaining air conditioning equipment in a company.

Projects are also defined by producing a product or meeting the objectives. A project that produces the product must meet all kinds of client requirements. The produced product must be justified by the client. The project is also required to satisfy certain objectives. The objectives can guide and motivate individual or groups to perform well in their assigned tasks.

In general, software projects have an objective-driven stage that recommends the new system to meet identified requirements and a project-driven stage to actually develop the product.

### **Setting Objectives**

To develop a successful project, the project manager and the team members must be aware of the factors that lead them to success. There must be well-defined objectives accepted by all the people involved in the development process. A project authority must be identified to have an overall authority over the project. This authority is governed by a project steering committee also called as a project management board. Day-to-day activities must be reported to the steering committee by the project manager at regular intervals. Any changes to the defined objectives can be done only by the steering committee.

An effective objective's scope for an individual must be within the individual's control. Objectives can be broken down into goals or sub-objectives in order to achieve them. **SMART** technique is used for a well-defined objective.

- **Specific**; Concrete and well-defined; Up to the point.
- **Measurable**: measures of effectiveness.
- **Achievable**; power within the individual or the group.
- **Relevant**: satisfy the purpose of the project.
- **Time-oriented**: time limit for successful achievement of the project.

The objectives are met only when the system becomes operational. Performance measures deals the reliability of the operational system and predictive measures are done during the development of the project by measuring the effectiveness of the developing system.

### **Management Principles**

- **Division of Work** - According to this principle the whole work is divided into small tasks. The specialization of the workforce according to the skills of a person, creating specific personal and professional development within the labor force and therefore

Increasing productivity; leads to specialization which increases the efficiency of labor.

- **Authority and Responsibility** - This is the issue of commands followed by responsibility for their consequences. Authority means the right of a superior to give orders and enhance order to his subordinates; responsibility means obligation for performance.
- **Discipline** - It is obedience, proper conduct in relation to others, respect of authority, etc. It is essential for the smooth functioning of all organizations.
- **Unity of Command** - This principle states that each subordinate should receive orders and be accountable to one and only one superior. If an employee receives orders from more than one superior, it is likely to create confusion and conflict.
- **Unity of Direction** - All related activities should be put under one group, there should be one plan of action for them, and they should be under the control of one manager.
- **Subordination of Individual Interest to Mutual Interest** - The management must put aside personal considerations and put company objectives first. Therefore the interests and goals of the organization must prevail over the personal interests of individuals.
- **Remuneration** - Workers must be paid sufficiently as this is a chief motivation of employees and therefore greatly influences productivity. The quantum and methods of remuneration payable should be fair, reasonable and rewarding of effort.
- **The Degree of Centralization** - The amount of power wielded with the central management depends on company size. Centralization implies the concentration of decision making authority at the top management.
- **Line of Authority/Scalar Chain** - This refers to the chain of superiors ranging from top management to the lowest rank. The principle suggests that there should be a clear line of authority from top to bottom linking all managers at all levels.
- **Order** - Social order ensures the fluid operation of a company through authoritative procedure. Material order ensures safety and efficiency in the workplace. Order should be acceptable and under the rules of the company.

- **Equity** - Employees must be treated kindly, and justice must be enacted to ensure a just workplace. Managers should be fair and impartial when dealing with employees, giving equal attention towards all employees.
- **Stability of Tenure of Personnel** - Stability of tenure of personnel is a principle stating that in order for an organization to run smoothly, personnel (especially managerial personnel) must not frequently enter and exit the organization.
- **Initiative** - Using the initiative of employees can add strength and new ideas to an organization. Initiative on the part of employees is a source of strength for organization because it provides new and better ideas. Employees are likely to take greater interest in the functioning of the organization.
- **Esprit de Corps/Team Spirit** - This refers to the need of managers to ensure and develop morale in the workplace; individually and communally. Team spirit helps develop an atmosphere of mutual trust and understanding. Team spirit helps to finish the task on time.

### **Management Control**

The following are common types of management control.

- Structures: Organizational structures such as authority, roles, accountability, responsibility and separation of concerns.
- Objectives
- Performance Management.
- Task Assignment
- Setting Expectations
- Supervision.
- Measurements
- Monitoring

### **Project Portfolio Management**

Project portfolio management provides an overview of all the projects that an organization is undertaking or is considering.

The concerns of project portfolio management include:

- Identifying which project proposals are worth implementation
- Assessing the amount of risk of failure that a potential project has
- Deciding how to share limited resources, including staff time and finance, between projects

The three key aspects of project portfolio management are

- Portfolio Definition
- Portfolio Management
- Portfolio Optimization

### **Cost Benefit Evaluation Technology**

The Cost Benefit Evaluation techniques are

- Net profit
- Payback period
- Return on Investment
- Net Present Value
- Internal Rate of Return

#### **Net Profit**

- The difference between the total costs and the total income over the life of the project is calculated as net profit.
- Net profits do not involve the timing of the cash flows. When there are many projects, the net profit of preferable projects is done on selection criteria.
- Some projects incomes are returned only towards the end of the project. This is a major disadvantage which means that the investment must be funded for longer time.
- Estimates in distant future are less reliable than the short-term estimates which are more preferable.

#### **Payback Period**

- The time taken to break even or pay back the initial investment is the payback period.

- The project with the shortest payback period will be taken based on organizations that wish to minimize the time limit.
- The payback period is simple to calculate but sensitive to forecasting errors.
- The limitation of the payback period is that it ignores the overall profitability of the project.

### **Return on Investment (ROI)/ Return on Costs (ROC)**

- The accounting rate of return or the return on investment compares the net profitability to the investment required.
- Return on Investment (ROI) is calculated using the given formulae;  

$$\text{ROI} = [\text{AVERAGE ANNUAL PROFIT} / \text{TOTAL INVESTMENT}] * 100$$
- The ROI provides simple, easy to calculate the measure of return on capital.
- The limitations of ROI are that it takes no account of the timing of the cash flows and does not bother about the compound interest.

### **Net Present Value**

- Net present value is a project evaluation technique that is determined by the profitability of the project and the timing of the cash flows produced.

- The annual rate of return with respect to discounted future earnings is termed as the discount rate.
- The net present value of any future cash flow is calculated by the formulae:

$$\text{Present value} = \text{value in year } t / (1+r)^t$$

Where 'r' denotes the discount rate expressed as a decimal value,

't' represents the number of years of future cash flows.

- Net present value can also be calculated by multiplying the cash flow by the appropriate discount factor.
- NPV for a project is obtained by summing the discounted values and discounting each cash flows.
- The discount rates must be standard and it should reflect the interest rates as nominal with similar projects which is uncertain with NPV method.
- Using NPV, the measure of profitability of comparable projects is not directly concerned with earnings from other investments which are quoted as a percentage interest rate.

### **RiskEvaluation**



- Risk is associated with almost every project. Risk can become an important factor when the project is not able to meet its objectives.
- Every possible risk must be identified, analyzed and minimized during the development of the software system.

### **Risk Identification**

- Every project evaluation involves risk handling issues.
- All possible risks are identified and must be quantified with their potential measures of evaluation.
- A project risk matrix can be implemented in creating a checklist of all possible risks and classify them based on their relative importance.
- The risk matrix contains values of high, medium and low based on their likelihood.
- Some factors classified in the risk project matrix contains, delivery of software, development budget exceeded limit, estimation of maintenance costs, response time targets and so on.

### **Risk Ranking**

- Based on the risk identified, ranking can be established for projects.
- Evaluating projects based on the risk project matrix gives a clear picture of how to rank the different risks that occurs in projects.
- Risk ranking involves giving scores to projects based on priorities defined for each risk in the project.

### **NPV and Risk**

- Risky projects always have a higher discount rate for the net present value calculation.
  - The risk level may be very high for a specific project due to rise in NPV value. So based on risk scores, projects are classified as high, medium and low level.
  - It is better to have an additional risk premium factor to have an consistent method in developing the project.
- 
- Discounted cash flow techniques can be used to evaluate the net present value of future cash flow taken into account the interest rates and uncertainty.

## **Risk in Cost benefit analysis**

- Cost-benefit analysis focuses on the estimated cost defined for the project compared with the actual costs incurred in the development process.
- Evaluation of risk involves the possible outcomes of the project by estimating the probability of occurring.
- A group of cash flow forecasts associated with each probability of occurring can be defined and the value summarizes the cost or benefit of each possible outcome weighted with its relative probability.
- Basically, cost-benefit analysis is done for evaluation of larger projects which are subject to uncertainty.
- It is most appropriate to evaluate a portfolio of projects to determine the overall profitability.

## **Risk Profile Analysis**

- Risk profiles are constructed using sensitivity analysis which involves the sensitivity factors that affect the project costs or benefits.
- For example, the original estimate of a project was calculated with plus or minus 5% of risk, then calculating the expected costs and benefits for each of the estimating factor results in evaluating the sensitivity of the project.
- Sensitivity analysis identifies the factors that yields a success to the project and decide about whether to carry on with the project or lay off.
- The sensitivity analysis takes into account every risk factor, and evaluates on the possible chances of a particular outcome of the project.

## **Strategic program management**

### **Programme Management Definition**

A classical definition of programme management by D.C.Ferns, “**a group of projects** that are maintained in a coordinated way to gain benefits that would not be possible where the projects to be managed independently”.

### **Different forms of Programme Management**

There are various forms of programme management exists. They are

- Strategic programmes

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- Business cycle programmes
- Infrastructure programmes
- Research and development programmes

### **Strategic Programmes**

- Portfolio programme models define a strategic domain process within the organization.

- Group of projects can lead to single strategy.
- Organizations can be grouped together and every activity associated with each distinct project can be controlled and coordinated manner as a programme.

### **Business Cycle Programmes**

- A project portfolio is a group of projects carried out under the sponsorship or management of an organization.
- Prioritizing projects must be based on decisions made by the project manager to handle them in different situations.
- If one project needs more resources than expected, expenses can be incorporated from other projects giving preference to the former one.
- Importance must be given to individual projects inside the portfolio.

### **Infrastructure Programmes**

- Organizations differ in the way they exist. Some of them have distinct departments while others have integrated systems.
- Each department might be unique in handling different information having distinct databases defined.
- A uniform infrastructure will allow sharing of applications between various departments which would help in the development process.

### **Research and Development Programmes**

- Innovative companies develop new products that are too risky. If the new product fails in the market, it will be difficult to handle the situation.
- On the other hand, the new product becomes success, then there will be huge reap in the business organization.
- Certain development projects results in a good planned project. But projects that are too risky if successful yields more benefit than the innovative ones.

- A risk involved fluctuates in a innovative project. Research projects leading to new discovery results in technological revolution that affect the market.
- For example, internet and World Wide Web has helped in adopting innovative and researchdevelopment programmes.

## **Strategic Programme Management**

- A programme manager must possess these qualities:
  - Managing simultaneous projects inside the portfolio
  - Resources must be well understood
  - Utilization of resources must be attained
  - Optimal usage of specialist staff for specific tasks
- When portfolios of projects contribute to a common objective, it leads to strategic management.
- To have consistent and uniformity of projects, a business objective is defined to coordinate the project at a different level.
- Large organizations typically have a large and complicated organizational structure. For example, government department like OGC (Office of Government Commerce) has defined effective guidelines for the strategic programme development.

## **Creating a Programme**

- The various phases involved in creating a programme are defined as:
  - Creation of programme mandate
  - Programme brief
  - Vision statement
  - Blueprint of programme
  - Programme portfolio

### **Creation of programme mandate**

- A programme mandate contains a formal document containing:
  - New services the programme delivers

- Benefit of organization by new services
  - Meeting the corporate goals and other initiatives
- A programme director is nominated within the organization to provide an initial leadership for the programme. The programme director must be from the sponsoring group which has already identified the need for the programme.

### **Programme brief**

- A programme brief defines the feasibility study of the programme. It includes:
- Preliminary vision statement highlighting the capacity of the organization.
  - Benefits generated from the programme
  - Risks and other issues involved
  - Estimated cost, effort and time limit for completion

### **Vision statement**

- The vision statement describing the sponsoring group with a more detailed planning process.
- To govern the day to day responsibilities a programme manager is appointed from within the project management team for running the programme.
- Programme manager along with the project development team analyzes the vision statement and formulates a refined plan for implementing the process.

### **Blueprint of programme**

- The description of the vision statement and the changes that have been made to the structure and the operations are represented in the blueprint.
- A blueprint must emphasize on:
- Requirement of business models for the new process
  - Staff requirement by the organization
  - Resources requirements
  - Data and information requirements
  - Cost, effort, performance and service level requirements

### **Programme portfolio**

- Initially, a list of projects are created along with its objectives to create a programme portfolio.
- An outline schedule of the entire development process is presented by the sponsoring group with all estimation factors.
- Groups are identified with similar interest and drawn out as a stakeholder map.
- A communication strategy and plan shows the appropriate information flow between stakeholders.

The preliminary plan produces the project portfolio, estimation of costs, expected benefits, risks identified and the resources needed

### **Stepwise Project Planning**

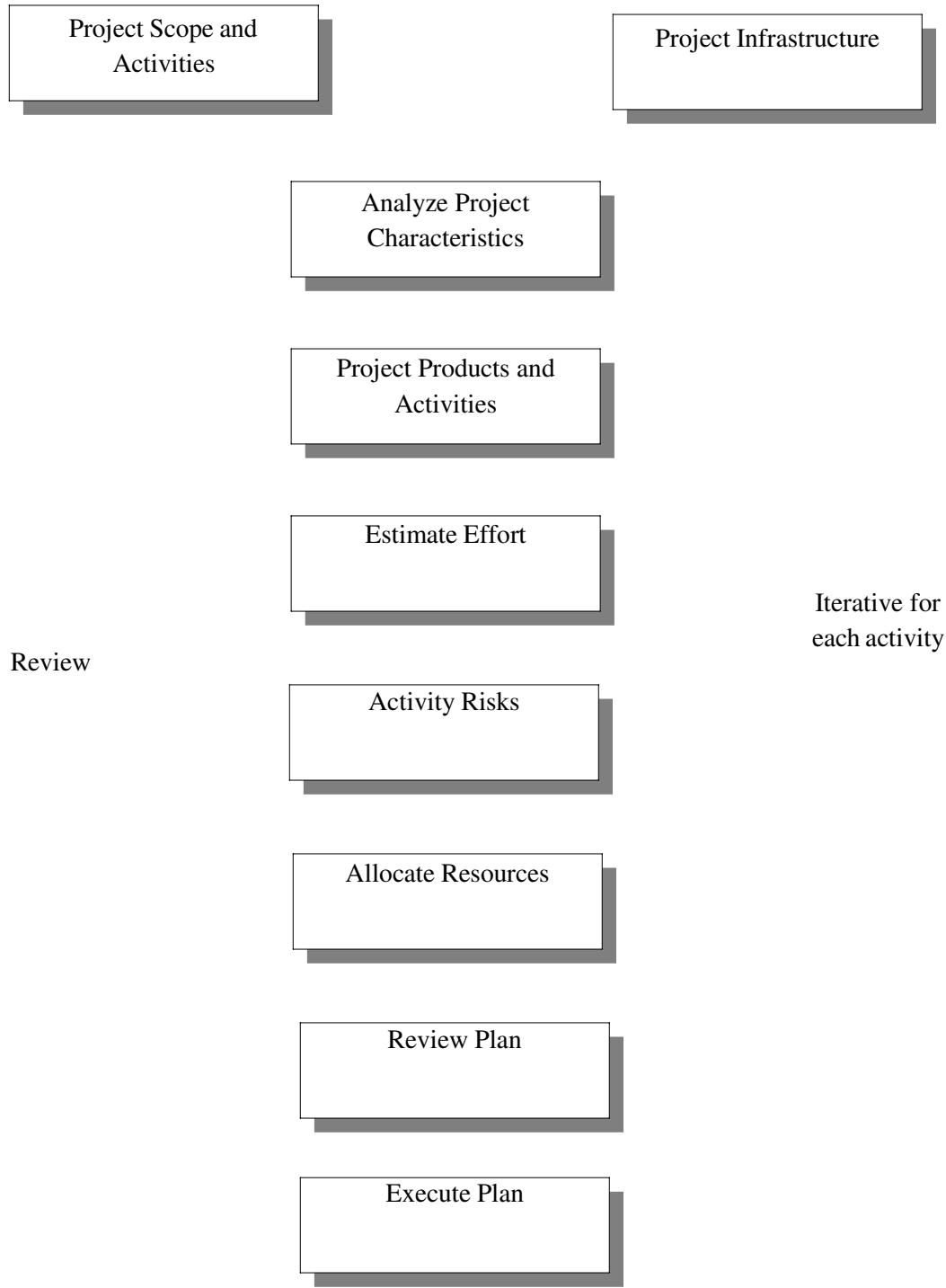
#### **Outline of Step Wise Project Planning**

The framework of basic steps in project planning illustrates the various activities involved in the development process.

An outline of Step Wise planning is listed below:

- Selecting project
- Project scope & objectives
- Project infrastructure
- Analyze project characteristics
- Project products and activities
- Estimation effort
- Activity risks
- Allocate resources
- Review plan
- Execute plan

## Selecting Project





## Step 0: Selecting Project

- This is the initial step which starts well outside the project planning process.
- Feasibility study of the project helps in choosing the appropriate one.
- Strategic planning process helps in evaluating the metrics of selecting the project.
- Different methodologies are inevitable, stemming directly from the questions of what constitutes a methodology and what are a methodology's underlying principles.
- Projects differ according to size, composition, priorities, and criticality.
- The people on a project have different biases based on their experiences, principles, and fears.
- These issues combine so that, what is optimal differs across projects.
- Projects are undertaken to produce a product or a service for various reasons.
- This includes factors like market share, financial benefits, return on investment, customer retention and loyalty, and public perceptions.
- Organizations might receive several projects at a time. They have to select the best among the received projects request.
- They make decisions based on the best information they have about a particular project at a given point of time when selecting the project.

## Step 1: Project Scope and Objectives

- Every stakeholder involved in the project must agree on the objectives defined in determining the success of the project.
- Scope statements may take many forms depending on the type of project being implemented and the nature of the organization.
- The scope statement details the project deliverables and describes the major objectives.
- The objectives should include measurable success criteria for the project.
- The Scope Statement should be written before the Statement of work and it should capture, in very broad terms, the product of the project, for example, *"developing a software based system to capture and track orders for software."*

- The Scope Statement should also include the list of users using the product, as well as the features in the resulting product.
- As a baseline scope statements should contain:
  - The project name
  - The project charter
  - The project owner, sponsors, and stakeholders
  - The problem statement
  - The project goals and objectives
  - The project requirements
  - The project deliverables
  - The project non-goals
  - Milestones
  - Cost estimates
- In more project oriented organizations the scope statement may also contain these and other sections:
  - Project Scope Management Plan
  - Approved change requests
  - Project assumptions and risks
  - Project acceptance criteria
- The project objectives are identified and practical measures are analyzed in achieving them
- A project authority must be identified to have an overall authority over the project.
- Identify different stakeholders involved in the development of the project.
- Changes in the objectives must be in a controlled manner.
- Interaction and communication among all parties must be straight forward.

## Step 2: Project Infrastructure

- Project Infrastructure refers to the organizational structure, processes, tools, techniques and training an organisation puts in place to make projects more successful.
- Organisational Structure – Organisational structure including such support mechanisms as project management office, project recruiting function, financial monitoring area etc. It also covers lines of communication and escalation.
- Processes – Typically methodologies, checklists and guidelines
- Tools – Software and templates
- Techniques – Repeatable processes such as kick off meetings, PIRs, analysis techniques, etc.
- Training – Formal and informal training and reference documentation
- Organization must give priorities for multiple projects to be carried out.
- Strategic decisions must be documented within the strategic plan in identifying the relationship between multiple projects.
- Change control must be implemented without affecting the original objectives.
- Configuration and procedural standards are defined for quality checks at regular intervals of the SDLC process and documented in separate manual.
- Measurement programme determines the control policy and monitors the progress of the project.
- Project manager must have an overall control of any project planning and control standards adopted.
- Project leader takes the responsibility of building the project team as an organized, well-built and effective one yielding excellent results.
- Team members must work together as a team and resolve conflicts.

### **Step 3: Analyze Project Characteristics**

- The project is categorized as either product-driven or an objective-driven.
- A project has several characteristics:
  - \* Projects are unique.
  - \* Projects are temporary in nature and have a definite beginning and ending date.

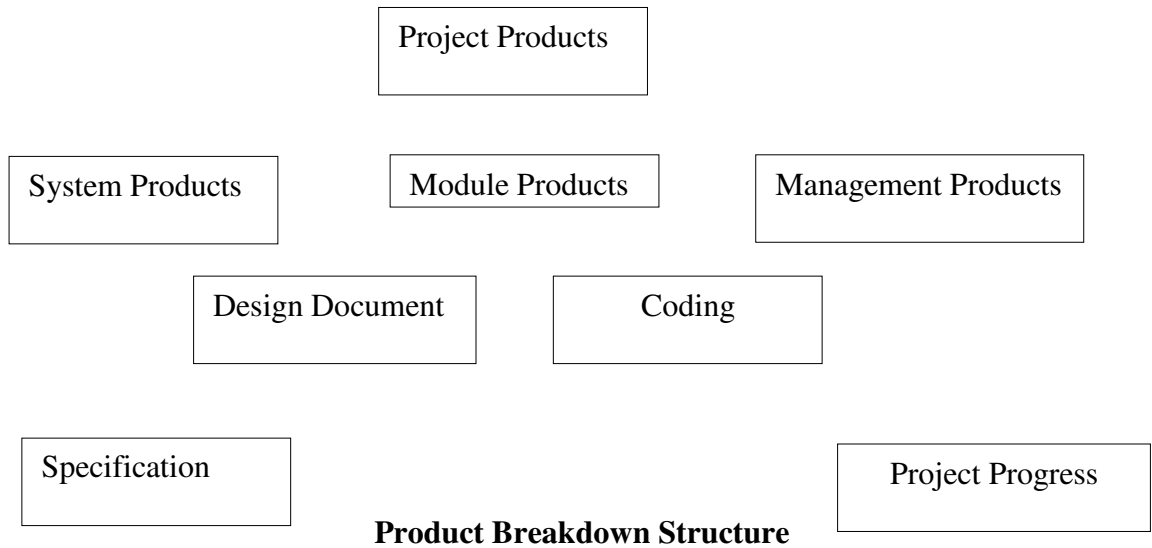
\* Projects are completed when the project goals are achieved or it's determined the project is no longer viable.

\* A successful project is one that meets or exceeds the expectations of your stakeholders.

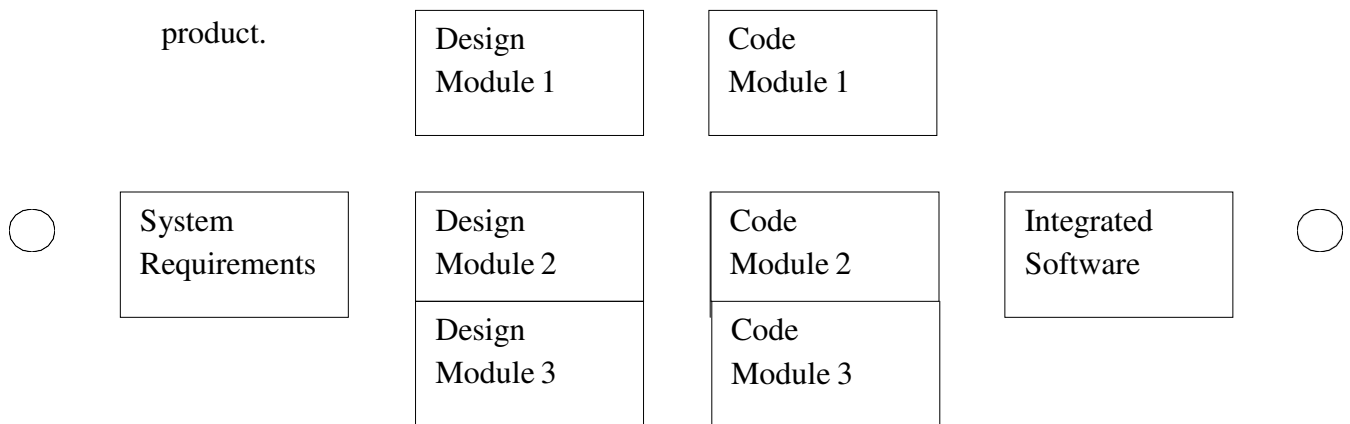
- As the system is developed, the product is driven out of the defined objectives.
- The project must be analyzed based on its quality requirements.
- Projects are prone to higher risk which needs to be handled without affecting the product created.
- In implementing the product, user requirements are given due importance.
- Appropriate methodology and SDLC process must be chosen to suit the current product.
- Review the overall resource estimates.

#### **Step 4: Project Products and Activities**

- Identify the project deliverables i.e. the end product that has to be given over to the client.
- Some products are identified as intermediate products during the creation of deliverables.
- Project products can be System products, module products or management products.
- Technical products include training materials and operating instructions in managing the quality of the project.
- Describe the project products into components and sub-components related to individual modules in each step.
- Every activity must be carried out for each stage of the development process.
- Management products include progress of the project that is developed.
- Product descriptions contain the identity, purpose, derivation, composition, form, relevant standard and the quality criteria that apply.
- Not all products are independent. Some products depend on other products for their creation.



- Product flow diagram represents the flow of the product being developed.
- Product instances must be recognized when a product is related to more than one product.



### Sample Activity Network

- An activity network is created for generating the product that depends on another product describing every task associated with it.
- Sequencing of activities minimizes the overall duration for the project.

- For a complex project, the entire project can be divided into stages and checkpoints can be formulated at each specific stage for compatibility.
- Milestones represent the completion of important stages of the project.

### Step 5: Estimating Effort

- The effort estimation for the staff required, the probable duration and the non-staff resources needed for every activity is determined.
- These estimates depend on the type of the activity.
- Effort is the amount of work that has to be done.
- Software development efforts estimation is the process of predicting the most realistic use of effort required to develop or maintain software based on incomplete, uncertain and/or noisy input.
- Effort estimates may be used as input to project plans, iteration plans, budgets, investment analyses, pricing processes and bidding rounds.
- Elapsed time is the time between the start and end of a task.
- With all the activities defined, the overall duration of the project can be calculated using the activity network.
- For longer activities it will be difficult to control the project over estimating factors.
- There are many ways of categorizing estimation approaches. The top level categories are the following:
  - Expert estimation: The quantification step, i.e., the step where the estimate is produced based on judgmental processes.
  - Formal estimation model: The quantification step is based on mechanical processes, e.g., the use of a formula derived from historical data.
  - Combination-based estimation: The quantification step is based on a judgmental or mechanical combination of estimates from different sources.
- The uncertainty of an effort estimate can be described through a prediction interval (PI). An effort PI is based on a stated certainty level and contains a minimum and a maximum effort value.

- The most common measures of the average estimation accuracy is the MMRE (Mean Magnitude of Relative Error), where MRE is defined as:

$$\text{MRE} = |\text{actual effort} - \text{estimated effort}| / |\text{actual effort}|$$

- Psychological factors potentially explaining the strong tendency towards over-optimistic effort estimates that need to be dealt with to increase accuracy of effort estimates.
- These factors are essential even when using formal estimation models, because much of the input to these models is judgment-based.
- Factors that have been demonstrated to be important are: Wishful thinking, anchoring, planning fallacy and cognitive dissonance.
- The psychological factors found in work by Jorgensen and Grimstad describes,
  - It's easy to estimate what you know.
  - It's hard to estimate what you know you don't know.
  - It's very hard to estimate things that you don't know you don't know.

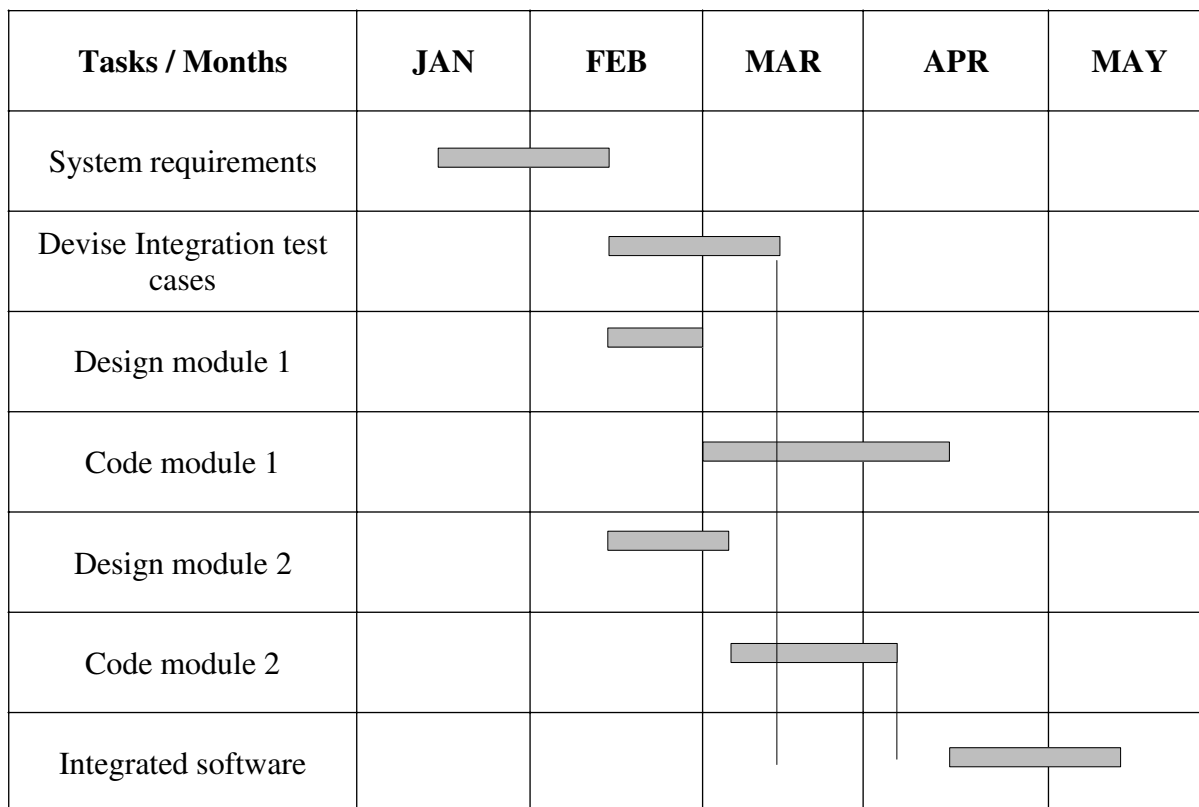
## Step 6: Identify Activity Risks

- Activity based risks are identified for every activity based on number of assumptions.
- Risk planning reduces the impact of identified risks.
- To materialize the risk, contingency plans are specified.
- New activities can reduce risks to a certain extent when there is change in plans.
- Risks fall into three broad categories — controllable known, uncontrollable known and unknown.
- The former two, are those risks happen before they can determine how to manage them. This is done using root cause analysis.
- As the name implies its goal is to look for the root cause on the problem and solve it at that point.
- The four ways of handling risk are:
  - **Avoidance** - Take action to avoid the risk
  - **Mitigation** - Define actions to take when the risk occurs
  - **Transfer** - Have someone else handle the risk i.e. insurance
  - **Acceptance** - Identify the risk as acceptable and let it happen.

- Determining which option to choose is primarily financial, but schedule and manpower may be involved.
- As a tool, a number of "checklist" opinions for looking at each of these options.
- Contingency planning is briefly discussed for scope, resource and schedule.

### Step 7: Allocate Resources

- Resource allocation is used to assign the available resources in an economic way. It is part of resource management. In project management, resource allocation is the scheduling of activities and the resources required by those activities while taking into consideration both the resource availability and the project time.
- Staff needed and available are identified for each activity and allocated their respective tasks.



**Gantt chart showing staff tasks**

- Staff priority list is generated based on the task allotted to them because some staffs are used for more than one task.



- A Gantt chart pictorially represents when activities have to take place and which one has to be executed at the same time.
- The chart represents when staff will be carrying out the tasks in each month. It also shows staff involved in more than one task.
- When allocating resources the constraints associated is estimated and included in the overall cost.

## Step 8: Review Plan

- When a task is completed it leads to the quality review. These quality checks have to be passed before the activity is completely signed-off.
- Every plan has to be documented and all stakeholders must have agreed to all constraints and understand the project.
- There are some steps involved in project plan review.
  - **Define the problem:** This activity provides the background for decisions about the scope and focus of the Project Review. Here are some simple questions the Project Review Team can ask themselves before creating a plan for the project. Use our Planning Tool to capture the background on your project.
    - ❖ What, if any, review work has already been done?
    - ❖ What is the problem we are trying to solve?
    - ❖ What would success look like?
    - ❖ Scope the Project. How big was it? How long did it take? How many people were involved?
    - ❖ What is the investment the team would like to make?
  - **Determine the focus:** The focus of the Project Review is the question that the team will ask themselves as they investigate the events that occurred during the project. This is the fundamental question that will guide the decisions that the team will make while planning the Project Review. It is always stated as a question. A commonly used question that project teams ask is:
    - ❖ What are the root causes of events that determined or impacted resources, schedule, or quality?

- **Select the appropriate tools:** Now that the scope, the goal and the problem are known, the data set needed for the project review is identified along with the various activities that will be used.
- **Identify the participants:** The Project Review Leadership Team guides the Postmortem effort. As a group they determine the focus of the investigation, select the tools that will be used, review the output from each step, decide who should participate in each activity, and are responsible for reporting lessons learned and recommendations for action. The Project Review Team usually consists of the movers and shakers that drove the project or event. They work together to manage the Project Review process. The team should consist of folks most intimate with the project including any of the following representatives:
  - ❖ Project Managers
  - ❖ Product Managers
  - ❖ Development Leads
  - ❖ Quality Leads
  - ❖ Content Experts
  - ❖ Customer Support Leads
  - ❖ Management
- **Document the review plan:** The project review template can be used so that everyone responsible for implementation has a copy of the plan.

### **Step 9: Execute Plan**

- Finally, the execution of the project is drawn with each specified activity as it is approached.
- Detailed planning of later stages is necessary because more information will be available than the start stage.
- Project planning and execution becomes an iterative process where as each activity which is to be carried out approaches, they should be reviewed in detail