UNIT 1

PLANNING

1.1 Introduction

Planning is the first primary function of management that precedes all other functions. The planning function involves the decision of what to do and how it is to be done? So managers focus a lot of their attention on planning and the planning process. Let us take a look at the eight important steps of the planning process.

Meaning of Planning

Planning is ascertaining prior to what to do and how to do. It is one of the primary managerial duties. Before doing something, the manager must form an opinion on how to work on a specific job. Hence, planning is firmly correlated with discovery and creativity. But the manager would first have to set goals. Planning is an essential step what managers at all levels take. It needs holding on to the decisions since it includes selecting a choice from alternative ways of performance.

1.2 Features/Nature/Characteristic of Planning:

1. Planning contributes to Objectives:

Planning starts with the determination of objectives. We cannot think of planning in absence of objective. After setting up of the objectives, planning decides the methods, procedures and steps to be taken for achievement of set objectives. Planners also help and bring changes in the plan if things are not moving in the direction of objectives.

For example, if an organization has the objective of manufacturing 1500 washing machines and in one month only 80 washing machines are manufactured, then changes are made in the plan to achieve the final objective.

2. Planning is Primary function of management:

Planning is the primary or first function to be performed by every manager. No other function can be executed by the manager without performing planning function because objectives are set up in planning and other functions depend on the objectives only.

For example, in organizing function, managers assign authority and responsibility to the employees and level of authority and responsibility depends upon objectives of the company. Similarly, in staffing the employees are appointed. The number and type of employees again depends on the objectives of the company. So planning always proceeds and remains at first position as compared to other functions.

3. Pervasive:

Planning is required at all levels of the management. It is not a function restricted to top level managers only but planning is done by managers at every level. Formation of major plan and framing of overall policies is the task of top level managers whereas departmental managers form plan for their respective departments. And lower level managers make plans to support the overall objectives and to carry on day to day activities.

4. Planning is futuristic/Forward looking:

Planning always means looking ahead or planning is a futuristic function. Planning is never done for the past. All the managers try to make predictions and assumptions for future and these predictions are made on the basis of past experiences of the manager and with the regular and intelligent scanning of

5. Planning is continuous:

Planning is a never ending or continuous process because after making plans also one has to be in touch with the changes in changing environment and in the selection of one best way.

So, after making plans also planners keep making changes in the plans according to the requirement of the company. For example, if the plan is made during the boom period and during its execution there is depression period then planners have to make changes according to the conditions prevailing.

6. Planning involves decision making:

The planning function is needed only when different alternatives are available and we have to select most suitable alternative. We cannot imagine planning in absence of choice because in planning function managers evaluate various alternatives and select the most appropriate. But if there is one alternative available then there is no requirement of planning.

For example, to import the technology if the license is only with STC (State Trading Co-operation) then companies have no choice but to import the technology through STC only. But if there is 4-5 import agencies included in this task then the planners have to evaluate terms and conditions of all the agencies and select the most suitable from the company's point of view.

7. Planning is a mental exercise:

It is mental exercise. Planning is a mental process which requires higher thinking that is why it is kept separate from operational activities by Taylor. In planning assumptions and predictions regarding future are made by scanning the environment properly. This activity requires higher level of intelligence. Secondly, in planning various alternatives are evaluated and the most suitable is selected which again requires higher level of intelligence. So, it is right to call planning an intellectual process.

1.3 Planning Process

As planning is activity there are certain reasonable measures for every manager to follow:

(1) Setting Objectives

- This is the primary step in the process of planning which specifies the objective of organization i.e. what an organization wants to achieve.

- The planning process begins with the setting of objectives.

- Objectives are end results which the management wants to achieve by its operations.

- Objectives are specific and are measurable in terms of units.

- Objectives are set for the organization as a whole for all departments and then departments set their own objectives within the framework of organizational objectives.

- **Example:**

- *A mobile phone company sets the objective to sell 2, 00,000 units next year, which is double the current sales.*

- **(2) Developing Planning Premises**

- Planning is essentially focused on the future and there are certain events which are expected to affect the policy formation.

- Such events are external in nature and affect the planning adversely if ignored.

- Their understanding and fair assessment are necessary for effective planning.

- Such events are the assumptions on the basis of which plans are drawn and are known as planning premises.

- **Example:**

- The mobile phone company has set the objective of 2, 00,000 units sale on the basis of forecast done on the premises of favorable Government policy towards digitization of transactions.

(3) Identifying Alternative Courses of Action

- Once objectives are set, assumptions are made.

- Then the next step is to act upon them.

- There may be many ways to act and achieve objectives.

- All the alternative courses of action should be identified.

Example:

The Mobile Company has many alternatives like reducing price, increasing advertising and promotion, after sale service etc.

(4) Evaluating Alternative Course of Action

- In this step, the positive and negative aspects of each alternative need to be evaluated in the light of objectives to be achieved.

- Every alternative is evaluated in terms of lower cost, lower risks, and higher returns, within the planning premises and within the availability of capital.

Example:

The mobile phone company will evaluate all the alternatives and check its pros and cons.

(5) Selecting One Best Alternative

- The best plan which is the most profitable plan and with minimum negative effects is adopted and implemented.

- In such cases, the manager's experience and judgment play an important role in selecting the best alternative.

Example:

Mobile Phone Company selects more T.V advertisements and online marketing with great after sales service.

(6) Implementing the Plan

- This is the step where other managerial functions come into the picture.

- This step is concerned with "DOING WHAT IS REQUIRED"

- In this step, managers communicate the plan to the employees clearly to convert the plans into action.

- This step involves allocating the resources, organizing for labor and purchase of machinery.

- **Example:**

- Mobile phone company hires salesman on a large scale, creates T.V advertisement, and starts online marketing activities and set up service workshops

(7) Follow up Action

- Monitoring the plan constantly and taking feedback at regular intervals is called follow-up.

- Monitoring of plans is very important to ensure that the plans are being implemented according to the schedule.

- Regular checks and comparisons of the results with set standards are done to ensure that objectives are achieved.

Example:

A proper feedback mechanism was developed by the mobile phone company throughout its branches so that the actual customer response, revenue collection, employee response, etc. could be known.

1.4 Importance/Significance of Planning:

1. Planning provides Direction:

Planning is concerned with predetermined course of action. It provides the directions to the efforts of employees. Planning makes clear what employees have to do, how to do, etc. By stating in advance how work has to be done, planning provides direction for action. Employees know in advance in which direction they have to work. This leads to Unity of Direction also. If there were no planning, employees would be working in different directions and organization would not be able to achieve its desired goal.

2. Planning Reduces the risk of uncertainties:

Organizations have to face many uncertainties and unexpected situations every day. Planning helps the manager to face the uncertainty because planners try to foresee the future by making some assumptions regarding future keeping in mind their past experiences and scanning of business environments. The plans are made to overcome such uncertainties. The plans also include unexpected risks such as fire or some other calamities in the organization. The resources are kept aside in the plan to meet such uncertainties.

3. Planning reduces over lapping and wasteful activities:

The organizational plans are made keeping in mind the requirements of all the departments. The departmental plans are derived from main organizational plan. As a result there will be co-ordination in different departments.

On the other hand, if the managers, non-managers and all the employees are following course of action according to plan then there will be integration in the activities. Plans ensure clarity of thoughts and action and work can be carried out smoothly.

4. Planning Promotes innovative ideas:

Planning requires high thinking and it is an intellectual process. So, there is a great scope of finding better ideas, better methods and procedures to perform a particular job. Planning process forces managers to think differently and assume the future conditions. So, it makes the managers innovative and creative.

5. Planning Facilitates Decision Making:

Planning helps the managers to take various decisions. As in planning goals are set in advance and predictions are made for future. These predictions and goals help the manager to take fast decisions.

6. Planning establishes standard for controlling:

Controlling means comparison between planned and actual output and if there is variation between both then find out the reasons for such deviations and taking measures to match the actual output with the planned. But in case there is no planned output then controlling manager will have no base to compare whether the actual output is adequate or not.

7. Focuses attention on objectives of the company:

Planning function begins with the setting up of the objectives, policies, procedures, methods and rules, etc. which are made in planning to achieve these objectives only. When employees follow the plan they are leading towards the achievement of objectives. Through planning, efforts of all the employees are directed towards the achievement of organizational goals and objectives.

1.5 Limitations of Planning:

1. Planning leads to rigidity:

Once plans are made to decide the future course of action the manager may not be in a position to change them. Following predefined plan when circumstances are changed may not bring positive results for organization. This kind of rigidity in plan may create difficulty.

2. Planning may not work in dynamic environment:

Business environment is very dynamic as there are continuously changes taking place in economic, political and legal environment. It becomes very difficult to forecast these future changes. Plans may fail if the changes are very frequent.

The environment consists of number of segments and it becomes very difficult for a manager to assess future changes in the environment. For example there may be change in economic policy, change in fashion and trend or change in competitor's policy. A manager cannot foresee these changes accurately and plan may fail if many such changes take place in environment.

3. It reduces creativity:

With the planning the managers of the organization start working rigidly and they become the blind followers of the plan only. The managers do not take any initiative to make changes in the plan according to the changes prevailing in the business environment. They stop giving suggestions and new ideas to bring improvement in working because the guidelines for working are given in planning only.

4. Planning involves huge Cost:

Planning process involves lot of cost because it is an intellectual process and companies need to hire the professional experts to carry on this process.

Along with the salary of these experts the company has to spend lot of time and money to collect accurate facts and figures. So, it is a cost-consuming process. If the benefits of planning are not more than its cost then it should not be carried on.

5. It is a time consuming process:

Planning process is a time-consuming process because it takes long time to evaluate the alternatives and select the best one. Lot of time is needed in developing planning premises. So, because of this, the action gets delayed. And whenever there is a need for prompt and immediate decision then we have to avoid planning.

Plan:

Plan is a document that outlines how goals are going to be met. It is a specific action proposed to help the organization achieve its objectives. There may be more than one way and means of reaching a particular goal but with the help of logical plans, objectives of an organization could be easily achieved.

Single Use Plans:

Single use plans are one time use plan. These are designed to achieve a particular goal that once achieved will not reoccur in future. These are made to meet the needs of unique situations. The duration or length of single use plan depends upon the activity or goal for which it is made. It may last one day or it may last for weeks or months if the project for which it is made is long.

Standing Plans:

Standing plans are also known as Repeat Use Plans. These plans focus on situations which occur repeatedly. Standing plans are used over and over again. They are made once but retain their value over a period of years. Although some revisions and updates are made in these plans from time to time.

1.6 Types of Plans:

Planning is a pervasive function which means it is not the task of top level managers only but managers working at different levels perform planning function. The plans framed by top level manager may differ from the plans formed by middle and lower level managers. The different types of plans or common plans formed by the managers at different levels are:

Objectives – Rules

Strategy – Programmes

Policies – Methods

Procedures – Budgets

1.7 Objectives:

Objectives are the ends towards which the activities are directed. They are the end result of every activity. An objective:

(a) Should be related to single activity;

(b) Should be related to result and not to activity to be performed;

(c) It must be achievable or feasible.

For example, increase in sale by 10% or decrease in rejections by 2%.

1.8 Forecasting

Organizations use forecasting methods of production and operations management to implement production strategies. Forecasting involves using several different methods of estimating to determine possible future outcomes for the business. Planning for these possible outcomes is the job of operations management**.**

Additionally, operations management involves the managing of the processes required to manufacture and distribute products. Important aspects of operations management include creating, developing, producing and distributing products for the organization.

1.9 Advantages of Forecasting

An organization uses a variety of forecasting models to assess possible outcomes for the company. The methods used by an individual organization will depend on the data available and the industry in which the organization operates. The primary advantage of forecasting is that it provides the business with valuable information that the business can use to make decisions about the future of the organization. In many cases forecasting uses qualitative data that depends on the judgment of experts.

Disadvantages of Forecasting Models

It is not possible to accurately forecast the future. Because of the qualitative nature of forecasting, a business can come up with different scenarios depending upon the interpretation of the data. For this reason, organizations should never rely 100 percent on any forecasting model. However, an organization can effectively use forecasting models with other tools of analysis to give the organization the best possible information about the future. Making a decision on a bad forecast can result in financial ruin for the organization, so an organization should never base decisions solely on a forecast.

UNIT-2

PROJECT MANAGEMENT

2.1 Introduction

Project management is the practice of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time. The primary challenge of project management is to achieve all of the project goals within the given constraints.[1] This information is usually described in project documentation, created at the beginning of the development process. The primary constraints are scope, time, quality and budget.[2] The secondary—and more ambitious—challenge is to optimize the allocation of necessary inputs and apply them to meet pre-defined objectives

The objective of project management is to produce a complete project which complies with the client's objectives. In many cases the objective of project management is also to shape or reform the client's brief to feasibly address the client's objectives. Once the client's objectives are clearly established they should influence all decisions made by other people involved in the project – for example project managers, designers, contractors and sub-contractors. Ill-defined or too tightly prescribed project management objectives are detrimental to decision making.

2.2 project management Types

project management that is referred to as IT project management and which specializes in the delivery of technical assets and services that are required to pass through various lifecycle phases such as planning, design, development, testing, and deployment. Biotechnology project management focuses on the intricacies of biotechnology research and development. Localization project management includes many standard project management practices even though many consider this type of management to be a very different discipline. It focuses on three important goals: time, quality and budget. Successful projects are completed on schedule, within budget, and according to previously agreed quality standards.

2.3 Approaches of project management

A 2017 study suggested that the success of any project depends on how well four key aspects are aligned with the contextual dynamics affecting the project; these are referred to as the four P's

- Plan: The planning and forecasting activities.
- Process: The overall approach to all activities and project governance.
- People: Including dynamics of how they collaborate and communicate.
- Power: Lines of authority, decision-makers, organograms, policies for implementation and the like.

There are a number of approaches to organizing and completing project activities, including: phased, lean, iterative, and incremental. There are also several extensions to project planning, for example based on outcomes (product-based) or activities (process-based).

Regardless of the methodology employed, careful consideration must be given to the overall project objectives, timeline, and cost, as well as the roles and responsibilities of all participants and stakeholders.

[1.4] Traditionally (depending on what project management methodology is being used), project management includes a number of elements: four to five project management process groups, and a control system. Regardless of the methodology or terminology used, the same basic project management processes or stages of development will be used. Major process groups generally include:

- Initiation
- Planning
- Production or execution
- Monitoring and controlling
- Closing

2.4 Initiating

Initiating process group processes

The initiating processes determine the nature and scope of the project.[35] If this stage is not performed well, it is unlikely that the project will be successful in meeting the business' needs. The key project controls needed here are an understanding of the business environment and making sure that all necessary controls are incorporated into the project. Any deficiencies should be reported and a recommendation should be made to fix them.

The initiating stage should include a plan that encompasses the following areas. These areas can be recorded in a series of documents called Project Initiation documents. Project Initiation documents are a series of planned documents used to create order for the duration of the project. These tend to include:

RACI (Q) chart. At least one Responsible and exactly one Accountable person are designated for each project and planning activity in project management simulation SimulTrain.

- project proposal (idea behind project, overall goal, duration)
- project scope (project direction and track)
- product breakdown structure (PBS) (a hierarchy of deliverables / outcomes and components thereof)
- work breakdown structure (WBS) (a hierarchy of the work to be done, down to daily tasks)
- responsibility assignment matrix (RACI) (roles and responsibilities aligned to deliverables / outcomes)
- tentative project schedule (milestones, important dates, deadlines)
- analysis of business needs and requirements against measurable goals

- review of the current operations

- financial analysis of the costs and benefits, including a budget

- stakeholder analysis, including users and support personnel for the project

- project charter including costs, tasks, deliverables, and schedules

- SWOT analysis: strengths, weaknesses, opportunities, and threats to the business

Planning

After the initiation stage, the project is planned to an appropriate level of detail (see example of a flow-chart). The main purpose is to plan time, cost and resources adequately to estimate the work needed and to effectively manage risk during project execution. As with the Initiation process group, a failure to adequately plan greatly reduces the project's chances of successfully accomplishing its goals.

Project planning generally consists of

- determining the project management methodology to follow (e.g. whether the plan will be defined wholly up front, iteratively, or in rolling waves);

- developing the scope statement;

- selecting the planning team;

- identifying deliverables and creating the product and work breakdown structures;

- identifying the activities needed to complete those deliverables and networking the activities in their logical sequence;

- estimating the resource requirements for the activities estimating time and cost for activities;

- developing the schedule;

- developing the budget;

- risk planning;

- developing quality assurance measures;

- Formal approval to begin work.

Additional processes and such as planning for communications and for scope management, identifying roles and responsibilities, determining what to purchase for the project and holding a kick-off meeting are also generally advisable.

For new product development projects, conceptual design of the operation of the final product may be performed concurrent with the project planning activities, and may help to inform the planning team when identifying deliverables and planning activities.

Executing

While executing we must know what can be the planned terms that need to be executed. The execution/implementation phase ensures that the project management plan's deliverables are executed accordingly. This phase involves proper allocation, co-ordination and management of human resources and any other resources such as material and budgets. The output of this phase is the project deliverables.

Project Documentation

Documenting everything within a project is key to being successful. To maintain budget, scope, effectiveness and pace a project must have physical documents pertaining to each specific task.

With correct documentation, it is easy to see whether or not a project's requirement has been met. To go along with that, documentation provides information regarding what has already been completed for that project. Documentation throughout a project provides a paper trail for anyone who needs to go back and reference the work in the past.

In most cases, documentation is the most successful way to monitor and control the specific phases of a project. With the correct documentation, a project's success can be tracked and observed as the project goes on. If performed correctly documentation can be the backbone to a project's success.

Monitoring and controlling

Monitoring and controlling process group processes

Monitoring and controlling consists of those processes performed to observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken, when necessary, to control the execution of the project. The key benefit is that project performance is observed and measured regularly to identify variances from the project management plan.

Monitoring and controlling includes:

- Measuring the ongoing project activities ('where we are');
- Monitoring the project variables (cost, effort, scope, etc.) against the project management plan and the project performance baseline (where we should be);
- Identifying corrective actions to address issues and risks properly (How can we get on track again);
- Influencing the factors that could circumvent integrated change control so only approved changes are implemented.

  - In multi-phase projects, the monitoring and control process also provides feedback between project phases, to implement corrective or preventive actions to bring the project into compliance with the project management plan.

  - Project maintenance is an ongoing process, and it includes:

In multi-phase projects, the monitoring and control process also provides feedback between project phases, to implement corrective or preventive actions to bring the project into compliance with the project management plan.

Project maintenance is an ongoing process, and it includes:

- Continuing support of end-users
- Correction of errors
- Updates to the product over time

Monitoring and controlling cycle

In this stage, auditors should pay attention to how effectively and quickly user problems are resolved.

Over the course of any construction project, the work scope may change. Change is a normal and expected part of the construction process. Changes can be the result of necessary design modifications, differing site conditions, material availability, contractor-requested changes, value engineering and impacts from third parties, to name a few. Beyond executing the change in the field, the change normally needs to be documented to show what was actually constructed. This is referred to as change management. Hence, the owner usually requires a final record to show all changes or, more specifically, any change that modifies the tangible portions of the finished work. The record is made on the contract documents – usually, but not necessarily limited to, the design drawings. The end product of this effort is what the industry terms as-built drawings, or more simply, "as built." The requirement for providing them is a norm in construction contracts.

Construction document management is a highly important task undertaken with the aid of an online or desktop software system, or maintained through physical documentation. The increasing legality pertaining to the construction industry's maintenance of correct documentation has caused the increase in the need for document management systems.

When changes are introduced to the project, the viability of the project has to be re-assessed. It is important not to lose sight of the initial goals and targets of the projects. When the changes accumulate, the forecasted result may not justify the original proposed investment in the project. Successful project management identifies these components, and tracks and monitors progress so as to stay within time and budget frames already outlined at the commencement of the project.

Closing

Closing process group processes.

Closing includes the formal acceptance of the project and the ending thereof. Administrative activities include the archiving of the files and documenting lessons learned.

This phase consists of:

- **Contract closure**: Complete and settle each contract (including the resolution of any open items) and close each contract applicable to the project or project phase.
- **Project close**: Finalize all activities across all of the process groups to formally close the project or a project phase

Also included in this phase is the Post Implementation Review. This is a vital phase of the project for the project team to learn from experiences and apply to future projects. Normally a Post Implementation Review consists of looking at things that went well and analyzing things that went badly on the project to come up with lessons learned.

Project controlling and project control systems

Project controlling (also known as Cost Engineering) should be established as an independent function in project management. It implements verification and controlling function during the processing of a project to reinforce the defined performance and formal goals. The tasks of project controlling are also:

- the creation of infrastructure for the supply of the right information and its update
- the establishment of a way to communicate disparities of project parameters
- the development of project information technology based on an intranet or the determination of a project key performance indicator system (KPI)
- divergence analyses and generation of proposals for potential project regulations
- the establishment of methods to accomplish an appropriate project structure, project workflow organization, project control and governance
- creation of transparency among the project parameters

Fulfillment and implementation of these tasks can be achieved by applying specific methods and instruments of project controlling. The following methods of project controlling can be applied:

- investment analysis
- cost–benefit analysis
- value benefit analysis
- expert surveys
- simulation calculations
- risk-profile analysis

Project control is that element of a project that keeps it on track, on-time and within budget. Project control begins early in the project with planning and ends late in the project with post-implementation review, having a thorough involvement of each step in the process. Projects may be audited or reviewed while the project is in progress. Formal audits are generally risk or compliance-based and management will direct the objectives of the audit. An examination may include a comparison of approved project management processes with how the project is actually being managed. Each project should be assessed for the appropriate level of control needed: too much control is too time-consuming, too little control is very risky. If project control is not implemented correctly, the cost to the business should be clarified in terms of errors and fixes.

Control systems are needed for cost, quality, communication, time, change, procurement, and human resources. In addition, auditors should consider how important the projects are to the financial how reliant the stakeholders are on controls, and how many controls existing. Auditors should review the development process and procedures for how they are implemented. The process of development and the quality of the final product may also be assessed if needed or requested.

A business may want the auditing firm to be involved throughout the process to catch problems earlier on so that they can be fixed more easily. An auditor can serve as a controls consultant as part of the development team or as an independent auditor as part of an audit.

Businesses sometimes use formal systems development processes. These help assure systems are developed successfully. A formal process is more effective in creating strong controls, and auditors should review this process to confirm that it is well designed and is followed in practice. A good formal systems development plan outlines:

- A strategy to align development with the organization's broader objectives

- Standards for new systems

- Project management policies for timing and budgeting

- Procedures describing the process

- Evaluation of quality of change

Characteristics of projects

There are five important characteristics of a project. (i) It should always have a specific start and end dates. (ii) They are performed and completed by a group of people. (iii) The output is delivery on unique product or service. (iv) They are temporary in nature. (v) It is progressively elaborated. Example: Designing a new car, writing a book.

2.5 Project Complexity

Complexity and its nature play an important role in the area of project management. Despite having number of debates on this subject matter, studies suggest lack of definition and reasonable understanding of complexity in relation to management of complex projects. As it is considered that project complexity and project performance are closely related, it is important to define and measure complexity of the project for project management to be effective.

By applying the discovery in measuring work complexity described in Requisite Organization and Stratified Systems Theory classifies projects and project

Work (stages, tasks) into basic 7 levels of project complexity based on such criteria as time-span of discretion and complexity of a project's output:

- Level 1 Project – improve the direct output of an activity (quantity, quality, time) within a business process with targeted completion time up to 3 months.

  .

Level 2 Project – develop and improve compliance to a business process with targeted completion time from 3 months to 1 year

- Level 3 Project – develop, change and improve a business process with targeted completion time from 1 to 2 years.

- Level 4 Project – develop, change and improve a functional system with targeted completion time from 2 to 5 years.

- Level 5 Project – develop, change and improve a group of functional systems / business function with targeted completion time from 5 to 10 years.

- Level 6 Project – develop, change and improve a whole single value chain of a company with targeted completion time from 10 to 20 years.

- Level 7 Project – develop, change and improve multiple value chains of a company with target completion time from 20 to 50 years.[47]

Benefits from measuring Project Complexity are to improve project people feasibility by:

- Match the level of a project's complexity with effective targeted completion time of a project

- Match the level of a project's complexity with the respective capability level of the project manager

- Match the level of a project task's complexity with the respective capability of the project members

2.6 Project Managers

A project manager is a professional in the field of project management. Project managers are in charge of the people in a project. People are the key to any successful project. Without the correct people in the right place and at the right time a project cannot be successful. Project managers can have the responsibility of the planning, execution, controlling, and closing of any project typically relating to the construction industry, engineering, architecture, computing, and telecommunications. Many other fields of production engineering, design engineering, and heavy industrial have project managers.

A project manager needs to understand the order of execution of a project to schedule the project correctly as well as the time necessary to accomplish each individual task within the project. A project manager is the person accountable for accomplishing the stated project objectives on the behalf of the client. Project Managers tend to have multiple years' experience in their field. A project manager is required to know the project in and out while supervising the workers along with the project. Typically in most construction, engineering, architecture and industrial projects, a project manager has another manager working alongside of them who is typically responsible for the execution of task on a daily basis. This position in some cases is known as a superintendent. A superintendent and project manager work hand in hand in completing daily project task. Key project management responsibilities include creating clear and attainable project objectives, building the project requirements, and managing the triple constraint (now including more constraints and calling it competing constraints) for projects, which is cost, time, quality and scope for the first three but about three additional ones in current project management. A typical project is composed of a team of workers who work under the project manager to complete the assignment within the time and budget targets. A project manager normally reports directly to someone of higher stature on the completion and success of the project.

A project manager - also known as an integrator, a coordinator or an orchestrator - is often a client representative and has to determine and implement the exact needs of the client, based on knowledge of the firm they are representing. The ability to adapt to the various internal procedures of the contracting party, and to form close links with the nominated representatives, is essential in ensuring that the key issues of cost, time, quality and above all, client satisfaction, can be realized.

2.7 Project Management Success Criteria

There is a tendency to confuse the project success with project management success. They are two different things. Project management have typical success criteria is different from project success criteria. The project management is said to be successful if the given project is completed within the agreed upon time, met the agreed upon scope and within the agreed upon budget. The combination of cost, time and quality has often been referred to as the "iron triangle" a project is said to be successful, when it succeeds in achieving the expected business case.

2.8 The Project Life Cycle (Phases)

The project manager and project team have one shared goal: to carry out the work of the project for the purpose of meeting the project's objectives. Every project has a beginning, a middle period during which activities move the project toward completion, and an ending (either successful or unsuccessful). A standard project typically has the following four major phases (each with its own agenda of tasks and issues): initiation, planning, implementation, and closure. Taken together, these phases represent the path a project takes from the beginning to its end and are generally referred to as the project "life cycle."

Initiation Phase

During the first of these phases, the initiation phase, the project objective or need is identified; this can be a business problem or opportunity. An appropriate response to the need is documented in a business case with recommended solution options. A feasibility study is conducted to investigate whether each option addresses the project objective and a final recommended solution is determined. Issues of feasibility ("can we do the project?") and justification ("should we do the project?") are addressed.

Once the recommended solution is approved, a project is initiated to deliver the approved solution and a project manager is appointed. The major deliverables and the participating work groups are identified, and the project team begins to take shape. Approval is then sought by the project manager to move onto the detailed planning phase.

Planning Phase

The next phase, the planning phase, is where the project solution is further developed in as much detail as possible and the steps necessary to meet the project's objective are planned. In this step, the team identifies all of the work to be done. The project's tasks and resource requirements are identified, along with the strategy for producing them. This is also referred to as "scope management." A project plan is created outlining the activities, tasks, dependencies, and timeframes. The project manager coordinates the preparation of a project budget by providing cost estimates for the labor, equipment, and materials costs. The budget is used to monitor and control cost expenditures during project implementation.

Once the project team has identified the work, prepared the schedule, and estimated the costs, the three fundamental components of the planning process are complete. This is an excellent time to identify and try to deal with anything that might pose a threat to the successful completion of the project. This is called risk management. In risk management, "high-threat" potential problems are identified along with the action that is to be taken on each high-threat potential problem either to reduce the probability that the problem will occur or to reduce the impact on the project if it does occur. This is also a good time to identify all project stakeholders and establish a communication plan describing the information needed and the delivery method to be used to keep the stakeholders informed.

Finally, you will want to document a quality plan, providing quality targets, assurance, and control measures, along with an acceptance plan, listing the criteria to be met to gain customer acceptance. At this point, the project would have been planned in detail and is ready to be executed.

Implementation (Execution) Phase

During the third phase, the implementation phase, the project plan is put into motion and the work of the project is performed. It is important to maintain control and communicate as needed during implementation. Progress is continuously monitored and appropriate adjustments are made and recorded as variances from the original plan. In any project, a project manager spends most of the time in this step. During project implementation, people are carrying out the tasks, and progress information is being reported through regular team meetings. The project manager uses this information to maintain control over the direction of the project by comparing the progress reports with the project plan to measure the performance of the project activities and take corrective action as needed.

The first course of action should always be to bring the project back on course (i.e., to return it to the original plan). If that cannot happen, the team should record variations from the original plan and record and publish modifications to the plan. Throughout this step, project sponsors and other key stakeholders should be kept informed of the project's status according to the agreed-on frequency and format of communication. The plan should be updated and published on a regular basis.

Status reports should always emphasize the anticipated end point in terms of cost, schedule, and quality of deliverables. Each project deliverable produced should be reviewed for quality and measured against the acceptance criteria. Once all of the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure.

Closing Phase

During the final closure, or completion phase, the emphasis is on releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources, and communicating the closure of the project to all stakeholders. The last remaining step is to conduct lessons-learned studies to examine what went well and what didn't. Through this type of analysis, the wisdom of experience is transferred back to the project organization, which will help future project teams.

Example: Project Phases on a Large Multinational Project

A U.S. construction company won a contract to design and build the first copper mine in northern Argentina.

There was no existing infrastructure for either the mining industry or large construction projects in this part of South America. During the initiation phase of the project, the project manager focused on defining and finding a project leadership team with the knowledge, skills, and experience to manage a large complex project in a remote area of the globe. The project team set up three offices. One was in Chile, where large mining construction project infrastructure existed. The other two were in Argentina. One was in Buenos Aries to establish relationships and Argentinian expertise, and the second was in Catamarca—the largest town closes to the mine site. With offices in place, the project start-up team began developing procedures for getting work done, acquiring the appropriate permits, and developing relationships with Chilean and Argentine partners.

During the planning phase, the project team developed an integrated project schedule that coordinated the activities of the design, procurement, and construction teams. The project controls team also developed a detailed budget that enabled the project team to track project expenditures against the expected expenses. The project design team built on the conceptual design and developed detailed drawings for use by the procurement team. The procurement team used the drawings to begin ordering equipment and materials for the construction team; develop labor projections; refine the construction schedule; and set up the construction site. Although planning is a never-ending process on a project, the planning phase focused on developing sufficient details to allow various parts of the project team to coordinate their work and allow the project management team to make priority decisions.

The implementation phase represents the work done to meet the requirements of the scope of work and fulfill the charter. During the implementation phase, the project team accomplished the work defined in the plan and made adjustments when the project factors changed. Equipment and materials were delivered to the work site, labor was hired and trained, a construction site was built, and all the construction activities.

The closeout phase included turning over the newly constructed plant to the operations team of the client. A punch list of a few remaining construction items was developed and those items completed. The office in Catamarca was closed, the office in Buenos Aries archived all the project documents, and the Chilean office was already working on the next project. The accounting books were reconciled and closed, final reports written and distributed, and the project manager started on a new project.

UNIT-3

INITIAL PROJECT COORDINATION

3.1 Project Negotiation

Negotiation is a form of decision making in which two or more parties talk with one another in an effort to resolve their opposing interests.

Bargaining describes the competitive, win-lose situations.

Negotiation describes win-win situations (mutually acceptable solutions)

Characteristics of negotiation situations

Negotiation is one of several mechanisms by which people can resolve conflicts. Characteristics:

1. There are two or more parties. Negotiation can be between individuals, within groups, and between groups.
2. There is a conflict of needs and desires between two or more parties
3. The parties negotiate by choice; they think they can get a better deal by negotiating than by simply accepting what the other side will voluntarily give them or let them have.
4. We expect a give and take process; both sides will modify their opening position in order to reach an agreement.
5. The parties prefer to negotiate and search for agreement rather than to fight openly. Usually people can invent their own solutions for resolving a conflict.
6. Successful negotiation involves the management of tangibles and also the resolution of intangibles.
    - Intangible: underlying psychological motivations that may directly or indirectly influence the parties during a negotiation.

- Need to win; beat the counter-party, or avoid losing.
- Need to look good, competent or tough.
- Need to defend an important principle or precedent.
- Need to appear fair, honorable, to protect one's reputation
- Need to maintain a good relationship.

Some factors that fuel competitive behaviors:

- Rivalry
- Time pressure
- Public exposure
- Attorneys

Interdependence

Parties need each other in order to achieve their preferred objectives or outcomes.

- Independent parties are able to meet their own needs without the help and assistance of others.
- Dependent parties must rely on others for what they need. The dependent party must accept and accommodate to that provider's whims and idiosyncrasies.
- Interdependent parties have interlocking goals; parties need each other in order to accomplish their objectives

- Types of interdependence
  - Zero-sum or distributive situation
  - Non-zero-sum or integrative situation
- Alternatives shape interdependence

Whether you should or should not agree on something in a negotiation depends entirely upon the attractiveness to you of the best available alternative.

- BATNA (best alternative to a negotiated agreement)

Negotiators need to understand their own BATNA and the other party's BATNA. A person's BATNA's value is always relative to the possible settlements available in the current negotiation.

Mutual adjustment

Adaptation through influence. Negotiation transforms over time, and mutual adjustment is one of the key causes of these changes.

- Mutual adjustment and concession making

When one party agrees to make a change in his position, a concession has been made. Concessions restrict the range of options within which a solution or agreement will be reached. When a party makes a concession, the bargaining zone, and the difference between the preferred acceptable settlements) is further constrained.

- Two dilemmas in mutual adjustment
  - Dilemma of honesty; how much of the truth to tell the other party
  - Dilemma of trust; how much should negotiators believe what the other party tells them

The search for an optimal solution through the processes of giving information and making concessions is greatly aided by trust and a belief that you are being treated honestly and fairly. Outcome perceptions can be shaped by managing how the receiver views the proposed result.

Perceptions of the trustworthiness and credibility of the process can be enhanced by conveying images that signal fairness and reciprocity in proposals and concessions.

Satisfaction with negotiation is as much determined by the process through which an agreement is reached as with the actual outcome obtained.

Value claiming and value creation

- Negotiators must be able to recognize situations that require more of one approach than the other.

Distributive bargaining is most appropriate when time and resources are limited, when the other is likely to be competitive, and when there is no likelihood of future interaction with the other party

- Negotiators must be versatile in their comfort and use of both major strategic approaches

There is no single best, preferred or right way to negotiate.

- Negotiator perceptions of situations tend to be biased toward seeing problems as more distributive/competitive than they really are.

Differences among negotiators:

- Differences in interests
- Differences in judgment about the future
- Differences in risk tolerance
- Differences in time preference

While value is often created by exploiting common interests, differences can also serve as the basic for creating value.

3.2 Project Partnering

Project partnering may be a solution to the traditional adversarial relationship between owner and contractor. Partnering allows both sides to form common goals and objectives, and create a trusting, productive relationship that is beneficial to both parties. Guidelines to project partnering are outlined. The step-by step guide for partnering is: begin early in the process, obtain top management commitment, select team members, appoint a champion, select facilitators, conduct an initial workshop, and follow up on all of the partnering activities. There are some potential weak points in the partnership relationship. There may be a change in one of the businesses, an inequitable level of commitment, poor communication or a general lack of momentum. Approached appropriately, partnering can save costs, and be a win-win for both the contractor and the owner.

3.3 Project Charter in Project Management

What is a project charter in project management? A project charter is a formal, typically short document that describes your project in its entirety — including what the objectives are, how it will be carried out, and who the stakeholders are. It is a crucial ingredient in planning out the project because it is used throughout the project lifecycle.

Project Charter Overview

The project charter typically documents:

- Reasons for the project

- Objectives and constraints of the project

- Who the main stakeholders are

- Risks identified

- Benefits of the project

- General overview of the budget

Project Charter

1. Understand project goals and objectives. Identify the project vision and determine the scope of the project

2. Define project organization. List all of the essential roles for the project, including customers, stakeholders, and day-to-day project team.

3. Create an implementation plan. Outline major milestones, dependencies and timeline for the entire team and stakeholders.

4. List potential problem areas. No one wants to be a downer, but adding potential risks and issues to the project charter helps everyone think ahead should the worst happen.

3.4 Conflict

A potential consequence of interdependent relationships is conflict. Conflict can result from the strongly divergent needs of the two parties or form misperceptions and misunderstandings. Conflict can occur when the two parties are working towards the same goal and generally want the same outcome or when both parties wan very different outcomes.

- Definitions

Sharp disagreement or opposition, as of interests, ideas, etc. It includes the perceived divergence of interest, or a belief that the parties' current aspirations cannot be achieved simultaneously. Conflict results from the interaction of interdependent people who perceived incompatible goals and interference from each other in achieving those goals.

- Levels of conflict

1. Intrapersonal or intra psychic conflict. Sources of conflict can include ideas, thoughts, emotions, values, predispositions, or drives that are in conflict with each other.
2. Interpersonal conflict
3. Intragroup conflict
4. Intergroup conflict. At this level, conflict is quite intricate because of the large number of people involved and the multitudinous ways they can interact with each other.

- Functions and dysfunctions of conflict.

Most people initially believe that conflict is bad or dysfunctional. These are some elements that contribute to conflict's destructive image.

1. Competitive, win-lose goals.

2. Misperception and bias. Perceptions become distorted. People come to view things consistently with their own perspective of the conflict.

3. Emotionality. Anxious, irritated, annoyed, angry, or frustrated.

4. Decreased communication.

5. Blurred issues.

6. Rigid commitments.

7. Magnified differences, minimized similarities.

8. Escalation of the conflict.

However, conflicts can also be productive. (Table is missing)

- Factors that make conflict easy or difficult to manage

Conflict diagnostic model (table is missing)

Effective conflict management

Dual concerns model.

- Concern about their own outcomes
- Concern about the other's outcomes

3.5 An Overview of Cost Estimation

Put another way, the United States Government Accountability Office defines cost estimation as "the summation of individual cost elements, using established methods and valid data, to estimate the future costs of a program, based on what is known today."

It further defines the basic characteristics of credible cost estimation as including:

- Clear identification of tasks
- Broad participation in preparing estimates
- Availability of valid data
- Standardized structures for the estimates
- Provisions for program uncertainties
- Recognition of inflation
- Excluded costs
- Independent reviews of estimates
- Revision of estimates for significant program changes

12-Step Process for Cost Estimation

The U.S. government has identified a 12-step process that results in reliable and valid cost estimates. Those twelve steps are outlined below.

1. **Define Estimate's Purpose:** Determine the purpose of the estimate, the level of detail which is required, who receives the estimate and the overall scope of the estimate.

2. **Develop Estimating Plan:** Assemble a cost-estimating team, and outline their approach. Develop a timeline, and determine who will do the independent cost estimate. Finally, create the team's schedule.

3. **Define Characteristics:** Create a baseline description of the purpose, system and performance characteristics. This includes any technology implications, system configurations, schedules, strategies and relations to existing systems. Don't forget support, security, risk items, testing and production, deployment and maintenance, and any similar legacy systems.

4. **Determine Estimating Approach:** Define a work breakdown structure (WBS), and choose an estimating method that is best suited for each element in the WBS. Cross-check for cost and schedule drivers; then create a checklist.

5. **Identify Rule and Assumptions:** Clearly define what is included and excluded from the estimate, and identify specific assumptions.

6. **Obtain Data:** Create a data collection plan, and analyze data to find cost drivers.

7. **Develop Point Estimate:** Develop a cost model by estimating each WBS element.

8. **Conduct Sensitivity Analysis:** Test sensitivity of costs to changes in estimating input values and key assumptions, and determine key cost drivers.

9. **Conduct Risk and Uncertainty Analysis:** Determine the cost, schedule and technical risks inherent with each item on the WBS and how to manage them.

10. **Document the Estimate:** Have documentation for each step in the process to keep everyone on the same page with the cost estimate.

11. **Present Estimate to Management:** Brief decision-makers on cost estimates to get approval.

12. **Update Estimate:** Any changes must be updated and reported on. Also, perform a postmortem where you can document lessons learned.

Challenges of Cost Estimation

There are many factors that are uncertain when cost estimating. For example, if the project is not like prior ones, then experience won't help guide you. If the planning horizon is further out, the greater the uncertainty. That said, the longer the project's duration, the less in focus cost estimations will be.

Then there is the team: the level of skill and experience available are going to have a big factor on overall costs of the project.

Project Cost Estimation Techniques

These entire factors impact project cost estimation, making it difficult to come up with precise estimates. Luckily, there are techniques that can help with developing more accurate cost estimation.

Analogous Estimating

Seek the help of experts who have experience in similar projects, or use your own historical data. If you have access to relevant historical data, try analogous estimating, which can show precedents that help define what your future costs will be in the early stages of the project.

Statistical Modeling

There is statistical modeling, or parametric estimating, which also uses historical data of key cost drivers and then calculates what that costs would be if the duration or another aspect of the project is changed.

Bottom-Up Estimating

A more granular approach is bottom-up estimating, which uses estimates of individual tasks and then adds those up to determine the overall cost of the project.

4.3 The **program** (or **project**) **evaluation and review technique** (**PERT**) is a statistical tool used in project management, which was designed to analyze and represent the tasks involved in completing a given project.

First developed by the United States Navy in 1958, it is commonly used in conjunction with the critical path method (CPM) that was introduced in 1957.

"PERT" was developed primarily to simplify the planning and scheduling of large and complex projects. It was developed for the U.S. Navy Special Projects Office in 1957 to support the U.S. Navy's Polaris nuclear submarine project. It found applications all over industry. An early example was it was used for the 1968 Winter Olympics in Grenoble which applied PERT from 1965 until the opening of the 1968 Games.

Events and activities

In a PERT diagram, the main building block is the event, with connections to its known predecessor events and successor events.

- PERT event: a point that marks the start or completion of one or more activities. It consumes no time and uses no resources. When it marks the completion of one or more activities, it is not "reached" (does not occur) until all of the activities leading to that event have been completed.

- Predecessor event: an event that immediately precedes some other event without any other events intervening. An event can have multiple predecessor events and can be the predecessor of multiple events.

- Successor event: an event that immediately follows some other event without any other intervening events. An event can have multiple successor events and can be the successor of multiple events.

Besides events, PERT also knows activities and sub-activities:

- PERT activity: the actual performance of a task which consumes time and requires resources (such as labor, materials, space, machinery). It can be understood as representing the time, effort, and resources required to move from one event to another. A PERT activity cannot be performed until the predecessor event has occurred.

- PERT sub-activity: a PERT activity can be further decomposed into a set of sub-activities. For example, activity A1 can be decomposed into A1.1, A1.2 and A1.3. Sub-activities have all the properties of activities; in particular, a sub-activity has predecessor or successor events just like an activity. A sub-activity can be decomposed again into finer-grained sub-activities.

Time

PERT has defined four types of time required to accomplish an activity:

- Optimistic time: the minimum possible time required to accomplish an activity (o) or a path (O), assuming everything proceeds better than is normally expected

- Pessimistic time: the maximum possible time required to accomplish an activity (p) or a path (P), assuming everything goes wrong (but excluding major catastrophes).

- Most likely time: the best estimate of the time required to accomplish an activity (m) or a path (M), assuming everything proceeds as normal.

- Expected time: the best estimate of the time required to accomplish an activity (the) or a path (TE), accounting for the fact that things don't always proceed as normal (the implication being that the expected time is the average time the task would require if the task were repeated on a number of occasions over an extended period of time).

$$te = (o + 4m + p) \div 6$$

- standard deviation of time : the variability of the time for accomplishing an activity (σ_{te}) or a path (σ_{TE})

$$\sigma_{te} = (p - o) \div 6$$

Management tools

PERT supplies a number of tools for management with determination of concepts, such as:

- It is a measure of the excess time and resources available to complete a task. It is the amount of time that a project task can be delayed without causing a delay in any subsequent tasks (free float) or the whole project (total float). Positive slack would indicate ahead of schedule; negative slack would indicate behind schedule; and zero slack would indicate on schedule.

- Critical path: the longest possible continuous pathway taken from the initial event to the terminal event. It determines the total calendar time required for the project; and, therefore, any time delays along the critical path will delay the reaching of the terminal event by at least the same amount.

- Critical activity: An activity that has total float equal to zero. An activity with zero free float is not necessarily on the critical path since its path may not be the longest.

- Lead time: the time by which a predecessor event must be completed in order to allow sufficient time for the activities that must elapse before a specific PERT event reaches completion.

  Lag time: the earliest time by which a successor event can follow a specific PERT event.

- Fast tracking: performing more critical activities in parallel

- Crashing critical path: Shortening duration of critical activities

Implementation

The first step for scheduling the project is to determine the tasks that the project requires and the order in which they must be completed. The order may be easy to record for some tasks (building a house, the land must be graded before the foundation can be laid) while difficult for others (there are two areas that need to be graded, but there are only enough bulldozers to do one). Additionally, the time estimates usually reflect the normal, non-rushed time. Many times, the time required to execute the task can be reduced for an additional cost or a reduction in the quality.

Example

In the following example there are seven tasks, labeled A through G. Some tasks can be done concurrently (A and B) while others cannot be done until their predecessor task is complete (C cannot begin until A is complete).

PERT Summary Report Phase 2, 1958

Initially PERT stood for Program Evaluation Research Task, but by 1959 was already renamed. It had been made public in 1958 in two publications of the U.S. Department of the Navy, entitled Program Evaluation Research Task, Summary Report, Phase 1.and Phase 2.In a 1959 article in The American Statistician the main Willard Fazar, Head of the Program Evaluation Branch, Special Projects Office, U.S. Navy, gave a detailed description of the main concepts of the PERT. He explained:

Through an electronic computer, the PERT technique processes data representing the major, finite accomplishments (events) essential to achieve end-objectives; the inter-dependence of those events; and estimates of time and range of time necessary to complete each activity between two successive events. Such time expectations include estimates of "most likely time",

"Optimistic time" and "pessimistic time" for each activity. The technique is a management control tool that sizes up the outlook for meeting objectives on time; highlights danger signals requiring management decisions; reveals and defines both method and slack in the flow plan or the network of sequential activities that must be performed to meet objectives; compares current expectations with scheduled completion dates and computes the probability for meeting scheduled dates; and simulates the effects of options for decision — before decision. The concept of PERT was developed by an operations research team staffed with representatives from the Operations Research Department of Booz Allen Hamilton; the Evaluation Office of the Lockheed Missile Systems Division; and the Program Evaluation Branch, Special Projects Office, of the Department of the Navy.

PERT Guide for management use, June 1963

Ten years after the introduction of PERT in 1958 the American librarian Brennan published a selected bibliography with about 150 publications on PERT and CPM, which had been published between 1958 and 1968. The origin and development was summarized as follows:

PERT originated in 1958 with the ... Polaris missile design and construction scheduling. Since that time, it has been used extensively not only by the aerospace industry but also in many situations where management desires to achieve an objective or complete a task within a scheduled time and cost expenditure; it came into popularity when the algorithm for calculating a maximum value path was conceived.

PERT and CPM may be calculated manually or with a computer, but usually they require major computer support for detailed projects. A number of colleges and universities now offer instructional courses in both.

For the subdivision of work units in PERT another tool was developed: the <u>Work Breakdown Structure</u>. The Work Breakdown Structure provides "a framework for complete networking, the Work Breakdown Structure was formally introduced as the first item of analysis in carrying out basic PERT/COST."

Three-point Estimate

Another approach is the three-point estimate, which comes up with three scenarios: most likely, optimistic and pessimistic ranges. These are then put into an equation to develop estimation.

Reserve Analysis

Reserve analysis determines how much contingency reserve must be allocated. This approach tries to wrangle uncertainty.

Cost of Quality

Cost of quality uses money spent during the project to avoid failures and money applied after the project to address failures. This can help fine-tune your overall project cost estimation. And comparing bids from vendors can also help figure out costs.

Dynamic Tools

Whenever you're estimating costs, it helps to use software to collect all of your project information. Use online software to define your project teams, tasks and goals. Even manage your vendors and track costs as the project unfolds. We'll show you how.

How ProjectManager.com Can Help with Cost Estimation

ProjectManager.com is software that has features to help create a more accurate project cost estimate. Our online Gantt chart can be used to help you track costs and expenditures for projects and tasks.

UNIT 4

NETWORK TECHNIQUES

Meaning of Network Technique:

Network technique is a technique for planning, scheduling (programming) and controlling the progress of projects. This is very useful for projects which are complex in nature or where activities are subject to considerable degree of uncertainty in performance time. This technique provides an effective management, determines the project duration more accurately, identifies the activities which are critical at different stages of project completion to enable to pay more attention on these activities, analysis the scheduling at regular interval for taking corrective action well in advance, facilitates in optimistic resources use.

Objectives of Network Analysis:

Network analysis entails a group of techniques for presenting information relating to time and resources so as to assist in the planning, scheduling, and controlling of projects. The information, usually represented by a network, includes the sequences, interdependencies, interrelationships, and criticality of various activities of the project.

A network analysis has following objectives:

1. Powerful tool of planning, scheduling and control.

2. Shows the inter-relationships of the activities of a project or a programme.

. Minimizes total cost where the cost of delays and cost of resources required to carry out the tasks can be measured.

4. Minimize total time where required e.g. in maintenance of production-line machinery in a factory.

5. Minimization of idle resources.

6. Minimize production delays.

7. To provide systematic approach in planning and scheduling.

8. Follow an integrated approach and bring about better coordination between the departments.

9. Focuses attention on critical activities of the project.

10. Provides up-to-date status information.

4.2 Main advantages of the network system are as follows:

1. Detailed and thoughtful planning provides better analysis and logical thinking.

2. Identifies the critical activities and focus them to provide greater managerial attention.

3. Network technique enables to forecast project duration more accurately.

4. It is a powerful tool.

4.3   The **critical   path   method** (**CPM**),   or **critical   path   analysis** (**CPA**),   is an algorithm for scheduling a set of project activities. It is commonly used in conjunction with the program evaluation and review technique (PERT). A critical path is determined by identifying the longest stretch of dependent activities and measuring the time [2] required to complete them from start to finish.

Components

The essential technique for using CPM is to construct a model of the project that includes the following:

1. A list of all activities required to complete the project (typically categorized within a <u>work breakdown structure</u>),

2. The time (<u>duration</u>) that each activity will take to complete,

3. The dependencies between the activities and,

4. Logical end points such as milestones or <u>deliverable</u> items.

Using these values, CPM calculates the <u>longest path</u> of planned activities to logical end points or to the end of the project, and the earliest and latest that each activity can start and finish without making the project longer. This process determines which activities are "critical" (i.e., on the longest path) and which have "total float" (i.e., can be delayed without making the project longer). In project management, a critical path is the sequence of project network activities which add up to the longest overall duration, regardless if that longest duration has float or not. This determines the shortest time possible to complete the project. There can be 'total float' (unused time) within the critical path. For example, if a project is testing a solar panel and <u>task</u> 'B' requires 'sunrise', there could be a scheduling constraint on the testing activity so that it would not start until the scheduled time for sunrise. This might insert dead time (total float) into the schedule on the activities on that path prior to the sunrise due to needing to wait for this event. This path, with the constraint-generated total float would actually make the path longer, with total float being part of the shortest possible duration for the overall project. In other words, individual tasks on the critical path prior to the constraint might be able to be delayed without elongating the critical path; this is the 'total float' of that task. However, the time added to the project duration by the constraint is actually <u>critical path drag</u>, the amount by which the project's duration is extended by each critical path activity and constraint.

A project can have several, parallel, near critical paths; and some or all of the tasks could have 'free float' and/or 'total float'. An additional parallel path through the network with the total durations shorter than the critical path is called a sub-critical or non-critical path. Activities on sub-critical paths have no drag, as they are not extending the project's duration.

CPM analysis tools allow a user to select a logical end point in a project and quickly identify its longest series of dependent activities (its longest path). These tools can display the critical path (and near critical path activities if desired) as a cascading waterfall that flows from the project's start (or current status date) to the selected logical end point.

Visualizing critical path schedule

Although the activity-on-arrow diagram (PERT Chart) is still used in a few places, it has generally been superseded by the activity-on-node diagram, where each activity is shown as a box or node and the arrows represent the logical relationships going from predecessor to successor as shown here in the "Activity-on-node diagram".

Activity-on-node diagram showing critical path schedule, along with total float and critical path drag computations

In this diagram, Activities A, B, C, D, and E comprise the critical or longest path, while Activities F, G, and H are off the critical path with floats of 15 days, 5 days, and 20 days respectively. Whereas activities that are off the critical path have float and are therefore not delaying completion of the project, those on the critical path will usually have critical path drag, i.e., they delay project completion. The drag of a critical path activity can be computed using the following formula:

1. If a critical path activity has nothing in parallel, its drag is equal to its duration. Thus A and E have drags of 10 days and 20 days respectively.
2. If a critical path activity has another activity in parallel, its drag is equal to whichever is less: its duration or the total float of the parallel activity with the least total float. Thus

since B and C are both parallel to F (float of 15) and H (float of 20), B has a duration of 20 and drag of 15 (equal to F's float), while C has a duration of only 5 days and thus drag of only 5. Activity D, with duration of 10 days, is parallel to G (float of 5) and H (float of 20) and therefore its drag is equal to 5, the float of G.

These results, including the drag computations, allow managers to prioritize activities for the effective management of project, and to shorten the planned critical path of a project by pruning critical path activities, by "fast tracking" (i.e., performing more activities in parallel), and/or by "crashing the critical path" (i.e., shortening the durations of critical path activities by adding resources).

Critical path drag analysis has also been used to optimize schedules in processes outside of strict project-oriented contexts, such as to increase manufacturing throughput by using the technique and metrics to identify and alleviate delaying factors and thus reduce assembly lead time.[10]

Crash duration

'Crash duration' is a term referring to the shortest possible time for which an activity can be scheduled. It can be achieved by shifting more resources towards the completion of that activity, resulting in decreased time spent and often a reduced quality of work, as the premium is set on speed. Crash duration is typically modeled as a linear relationship between cost and activity duration; however, in many cases a convex function or a step function is more applicable.

Expansion

Originally, the critical path method considered only logical dependencies between terminal elements. Since then, it has been expanded to allow for the inclusion of resources related to each activity, through processes called activity-based resource assignments and resource optimization techniques such as Resource Leveling and Resource smoothing. A resource-leveled schedule may include delays due to resource bottlenecks (i.e., unavailability of a resource at the required time), and may cause a previously shorter path to become the longest or most "resource critical" path while a resource-smoothed schedule avoids impacting the critical path by using only free and total float.[14] A related concept is called the critical chain, which attempts to protect activity and project durations from unforeseen delays due to resource constraints.

Since project schedules change on a regular basis, CPM allows continuous monitoring of the schedule, which allows the project manager to track the critical activities, and alerts the project manager to the possibility that non-critical activities may be delayed beyond their total float, thus creating a new critical path and delaying project completion. In addition, the method can easily incorporate the concepts of stochastic predictions, using the PERT and event chain methodology.

Currently, there are several software solutions available in industry that use the CPM method of scheduling; see list of project management software. The method currently used by most project management software is based on a manual calculation approach developed by Fondahl of Stanford University.

Flexibility

A schedule generated using the critical path techniques often is not realized precisely, as estimations are used to calculate times: if one mistake is made, the results of the analysis may change. This could cause an upset in the implementation of a project if the estimates are blindly believed, and if changes are not addressed promptly. However, the structure of critical path

Analysis is such that the variance from the original schedule caused by any change can be measured, and its impact either ameliorated or adjusted for. Indeed, an important element of project postmortem analysis is the 'as built critical path' (ABCP), which analyzes the specific causes and impacts of changes between the planned schedule and eventual schedule as actually implemented.

Advantages

- PERT chart explicitly defines and makes visible dependencies (precedence relationships) between the work breakdown structure (commonly WBS) elements.
- PERT facilitates identification of the critical path and makes this visible.
- PERT facilitates identification of early start, late start, and slack for each activity.
- PERT provides for potentially reduced project duration due to better understanding of dependencies leading to improved overlapping of activities and tasks where feasible.
- The large amount of project data can be organized and presented in diagram for use in decision making.
- PERT can provide a probability of completing before a given time.

Disadvantages

- There can be potentially hundreds or thousands of activities and individual dependency relationships.
- PERT is not easily scalable for smaller projects.
- The network charts tend to be large and unwieldy, requiring several pages to print and requiring specially-sized paper.
- The lack of a timeframe on most PERT/CPM charts makes it harder to show status, although colors can help, e.g., specific color for completed nodes.

4.5 Overview of project controls

Project controls are all-encompassing for project definition, planning, execution, and completion; assisting in the entire lifecycle of your project. As we said before, the use of controls will vary according to individual project demands, but project controls address, organize, and of course control the following aspects of your project management system:

1. Developing your project strategy; defining methods that will enhance the future PM software use and project outcomes

2. Development, updates, and maintenance scheduling for the PM software

3. Estimating project costs; engineering and controlling costs and assessing project value

4. Managing risks; assessing and analyzing project risks, and cataloging past risks and how to avoid future risks

5. Earned schedule and earned value management, including both work and organizational breakdown structures

6. Controlling project documentation

7. Diagnosing project scheduling and costs with forensic assessment procedures

8. Oversight and quality assessment of supplied materials

9. Comprehensive integration of the elements of control and other domains of project management

The importance of project controls

Now that you know the scope of what project controls provide for your PM software, let us go over why these controls are important. The opposite of control is chaos, disorganization, bedlam, which are plain anathema to successful project management.

Successful project execution first begins with planning the process of execution. So how do project controls fit in?

To craft a well-thought-out plan for executing your projects can only happen if you have a sufficient set of controls in place for your project scheduling methods. A project control system that will work for your company goals is essential to take full advantage of your PM software and guarantee smooth sailing.

The concept of project management has been in place going back to the mid-20th century. Over the course of the past several decades, it has been demonstrated time and time again how a lack of adequate planning and the thoroughly attentive monitor can almost certainly result in project failure. Hence, the development of PM software in conjunction with project control tools is aimed at fixing scheduling missteps.

Remember how we mentioned that project controls save you time and money?

An IBC 2000 Project Control Best Practice Study carried out by Independent Project Analysis identified that good project control practices reduce execution schedule slip by 15%. NPV (net project value) is also increased when project controls are utilized and provide schedule improvements. When put into proper practice, project controls can improve project costs by 10%.

Think of PM software as your right-hand man. Project controls are what and how you tell him to assist and support you in your endeavors.

We also had mentioned that project controls will be contingent up the scope and breadth of your project's requirements. So, how do you set your controls in place?

UNIT 5.

PURPOSES OF EVALUATION

5.1 Project Audit

A project audit is a formal review of a project, often intended to assess the extent to which project management standards are being upheld.

Audits are generally carried out by a specially designated audit department, the Project Management Office, an approved management committee or an external auditor.

Whoever is responsible for performing the audit must be in charge of the designated authority and issue related recommendations.

The final objective of a project audit is to ensure that the project meets the standards of project management through investigation and evaluation.

1. Ensure the quality of products and services

A project audit acts as a quality assurance tool. It reviews the project life cycle evaluating the results yielded during the different stages, from the design phase to implementation.

When reviewing the design phase, a project audit evaluates the thoroughness of the design concepts, including the analysis of alternative designs.

Furthermore, it is assessed whether the solution is ready for the pilot test and finally, during the implementation review, the project audit assesses and confirms the implementation at each site where the product is adopted.

The identification of the errors during the process contributes to the resolution of the problems and to understand if the project should continue through a go/no-go decision at each stage.

2. Ensure the quality of project management

A project audit ascertains that the project management satisfies the standards by assessing whether it complies with the organization's policies, processes and procedures. It evaluates the methodology used to help identify gaps in order to introduce the required improvements.

3. Identify the business risk

Project audits support the identification of business factors where risks may reside, which could affect budget, time, environment and quality.

After all, the organization itself is keen to achieve a positive outcome to the project.

The project audit assesses the feasibility of the project in terms of affordability and performance by providing transparency and assessing costs, time and resources.

Apply a review and equalization approach when it comes to controlling the budget, examining data that includes estimated and actual costs, as well as costs of meeting goals.

4. Improve project performance

The monitoring of the various phases of the project life cycle can contribute to the improvement of the project team's performance.

The audit also helps to improve the budget and resource allocation.

Identifying priorities, corrective measures and preventive actions can lead to a positive project outcome. The troubleshooting process allows the project team to provide solutions and helps prevent similar problems from recurring in the future.

5. Learn

A project audit can deliver learning opportunities through assessments of project management expertise.

Providing reviews and feedback allows individuals and project teams to ponder their own performance.

Audit policies and activation procedures

In order to achieve the benefits expected from a **project audit**, each stage, element and outcome of the audit process must be clearly set out and openly disclosed, including:

- **Audit mission** statement: this document should clearly define the purposes, objectives, authority and limits of the audit operation, as well as the type of audits to be conducted.

- **Specification of audit competencies**: a detailed specification of the auditor's skills and experience, showing that the audit staff possesses adequate expertise to audit the project.

- **Roles and responsibilities of the actors involved**: a detailed statement of all the roles and responsibilities covered by the audit, both for the person conducting the audit and for the project team – including the project manager, team members, project sponsors, clients and any stakeholder.

- **'Trigger' audit criteria**: a complete list of all the criteria on the basis of which projects will be selected for an audit. It would be too costly and time-consuming and would defeat the purpose of the audit process itself. Thus, specific criteria should be established to identify projects to be audited on the basis of risk, complexity, internal value, costs, etc.

- **Audit start procedures**: a description of the procedures for the initiation of the audit, including the process by which individual project managers are informed of an outstanding audit and the related preparation requirements.

- **Audit execution procedures**: a list of audit procedures that cover the methods to be used during the audit. This varies according to the type and timing of each audit, but may include personal interviews with project staff, document reviews, questionnaires and more.

- **Audit reporting procedures**: a specification of the audit reporting procedures, which covers how and the way in which the audit results will be reported and reviewed. In order to minimize the threatening nature of the project audit, all parties should be fully aware of how the results will be disclosed and used within the organization.

- **Audit redress procedures**: a specification of all procedures to be followed to appeal and/or dispute the reported audit results.

When one or more projects **fail to successfully complete an audit**, this does not necessarily mean that the project manager or team is at fault...

Perhaps the **project management standards** are not adequately scaled and tailored to the needs of the project or organization?

Maybe a **lack of training or communication** is the cause that led to the negative result?

Basically, project audits are rarely well received and are often controversial, but if performed correctly they provide unprecedented opportunities for <u>learning from mistakes</u> and the identification of important problems that would inevitably lead to the failure of the project.

5.3 The audit lifecycle

The audit lifecycle comprises all the steps from audit planning until closing any possible observation detected during the audit execution. The lifecycle can be divided into different parts with different activities in each of them:

• **Audit Preparation**

- Requirements from sponsors request

- Pre-audit questionnaire request to the company to be audited

- Risk Evaluation performance

- Objectives and Audit Approach definition

- Agenda preparation and sending

- Audit records preparation

5.4 Project Audit Report

1. Project Audit Interview Checklist - Project Managers

Use this project audit checklist when interviewing a project manager to determine the project's success criteria and key objectives. This interview should be conducted at the start of the project audit to prioritize which project managers to interview and assist with questionnaire development. This checklist includes fields to capture the following information:

1. Key questions to assess readiness of project management team and alignment of plans

2. Crucial details of the project including parties involved, success criteria and objectives

3. Important elements of Project Scope Statement and Project Charter.

2. Project Audit Questionnaire - Project Team Members

A project audit questionnaire is used as part of a project audit to interview project team members to identify concerns, challenges and opportunities related to the project. Conduct the interview by capturing the following information:

1. Gather general feedback on the project including understanding of objectives, senior communication, collaboration and safety (if required)

2. Ask questions related to concerns of the overall project and challenges faced in daily work

3. Ask the team member to identify opportunities for improvement within their role or others

4. Provide any additional notes and takeaways from the interview

5. Gather signature from the project team member

3. Project Audit Questionnaire - Project Stakeholders

Use this project audit questionnaire template to gain project stakeholders' insight on how to effectively approach essential areas for project success. This template lets project managers conduct interview research by involving questions about:

1. Appropriate ways to accomplish business goals and objective

2. Possible individuals or groups that need to be involved as key stakeholders

3. Best strategies to deal with business competitors

4. How to measure performance and how to address/ prevent performance hurdles

REFERENCES

1.	Books	1. Principles of Management – T. Ramasamy, Himalaya Publishing House
		2. Project Management- Samule J Mantel, Jr, Jack R. Meredith, Scott M. Shafer,
		3. Margaret M, Sutton with M.R. Gopalan, Wiley India Pvt. Ltd.,
		4. Successful Project Management- Milton D. Rosenau, Jr., Cregory D. Githens, Wiley India Pvt. Ltd.
		5. Project Management- Vasant Desai, Himalaya Publishing House
		6. Project Management : A Managerial Approach, Jack R. Meredith, Samuel J. Mantel Jr. Wiley India Pvt. Ltd.
2.	Websites	1.https://www.managementstudyguide.com/business-policy.htm
		2.http://www.yourarticlelibrary.com