CHAPTER | SIXTEEN

Project Management

Learning Objectives

After reading this chapter, you should be able to:

- Understand the meaning of the terms "project", "project management" and "project life cycle".
- Discuss the responsibilities and role of a project manager.
- Understand the terms used in network based scheduling techniques.
- Describe the project evaluation and review technique (PERT) and critical path method (CPM).
- Understand the computation of floats or slacks and critical path.
- Determine the probability of meeting scheduled date in PERT analysis.
- Discuss the concept of crashing of CPM networks.

Operations managers must plan, organise and control a variety of manufacturing and service operations. Some of them are one time activities and others are repetitive. Besides, some activities might be continuous or intermittent. The intermittent or job shop production requires *scheduling, loading* and *control techniques* whereas continuous production requires *line balancing techniques*. The one-time activities are generally one-time projects such as construction of a hospital, research and development of a missile or manufacturing an aircraft or building a ship and the like. A different approach known as project approach is used to develop, manufacture and market new products and services.

I PROJECT MANAGEMENT

Project: Unique one-time operations designed to accomplish a specific set of objectives in a limited time frame.

A project is an organised endeavour to accomplish a specified non-routine or low volume task. Although projects are not repetitive, they take significant amount of time to complete and are large-scale or complex enough to be recognised and managed as separate undertakings.

Management of a project differs in several ways from management of a typical business. Operations manager must often organise *project team* to plan and control projects. The objective of a project team is to accomplish its assigned mission and disband. The project teams must ordinarily work to tight time schedules, adhere to strict budgets, report to top management personnel of the organisation and be temporarily removed from their regular jobs. While the project work is proceeding, the remainder of the organisation must continue to produce the organisation's products. Because of the difficulty of simultaneously managing the projects and producing the products and services, operations managers have developed new approaches to managing and controlling projects. The type of techniques required to manage the projects depends on the complexity of the projects. For small projects, Gantt charts are adequate whereas for large and complex projects, the ***critical path method*** (C.P.M) or the ***program evaluation and review technique*** **(P.E.R.T)** would be more effective.

Nature of Projects

Projects go through a series of stages – a life cycle which include *(i)* project definition planning, *(ii)* execution of major activities and *(iii)* phasing out the project. A variety of skill requirements are involved in these stages of the project life cycle. For example, construction of a house can be viewed as a project. In this, initially an idea is presented and its feasibility is assessed. Then plans must be drawn up and approved by the owner as well as the approving authority of the government or regulating agency. The activities involved in the execution of the house construction project are *(i)* site preparation, *(ii)* laying the foundation, *(iii)* building the wall, *(iv)* erecting the door and window frames, *(v)* roofing, *(vi)* electrical wiring and plumbing, *(vii)* installing the bathroom and kitchen fixtures and appliances, *(viii)* interior finishing work, *(ix)* plastering the exterior walls and *(x)* painting and carpentry work.

Projects typically bring together people with diverse knowledge and skills, most of whom remain associated with the project for less than its full life. Some people move from one project to another as needed and others are on deputation to the project, either on a full-time or on a part time basis, from their regular jobs. This is the case in traditional organisations, which take up some special projects within their framework. Also, there are some organizations, which are involved with projects on a regular basis, *for example*, consulting firms, architects, publishers and construction firms.

Project Life Cycle

A project passes through a life cycle that may vary with the size and complexity of the project. Typically a project will pass through the following phases:

1. **The Concept Phase :** During this phase, the organisation realises that a project may be needed or the organisation is requested to propose a plan to perform a project for some customer.
2. **Initial Planning or Feasibility Phase :** During this phase, the project manager plans the project to a level of detail sufficient for initial scheduling and budgeting.
3. **Detailed Planning Phase :** If the project is approved, then detailed scheduling and budgeting is done in this phase.
4. **Organisation Phase :** During this phase, a detailed project definition such as the ***work breakdown structure*** **(WBS)** is examined. A W.B.S is a document similar to bill of material and divides the total work into major packages to be accomplished.

   Table 16.1 shows an abbreviated WBS for an orbital space laboratory vehicle.

   Personal and other resources necessary to accomplish the project are then made available for all or a portion of the project's duration through temporary assignments from other parts of the organisation or by leasing resources or subcontracting portions of the project.
5. **Execution Phase :** During this phase the various activities planned are completed as per the schedule, utilising the allotted resources.
6. **Termination Phase :** This is the phase, during which the project is terminated or disbanded after completion. The personnel who were working in the project are assigned back to their regular jobs or to other jobs in the organisation or to other projects, in this phase.

Project life cycle: The life cycle through which a project passes. Its various phases are (i) The concept phase, (ii) Feasibility phase, (iii) Detailed planning phase, (iv) Organisation phase, (v) Execution phase and (iv) Termination phase.

Table 16.1 : W.B.S. for Orbital Space Laboratory Vehicle

1.0	Command Module
2.0	Laboratory Module
3.0	Launch Propulsion system
3.1	Fuel Supply System
3.1.1	Fuel Tank Assembly
3.1.1.1	Fuel Tank Casing
3.1.1.2	Fuel Tank Insulation
4.0	Guidance System

Importance of Project Management

Organisations need project management because project management *(i)* ensures that customer requirements are met, *(ii)* eliminates duplication of work, *(iii)* reduces the number of tasks that could be overlooked during the project, *(iv)* maximise the use of resources and *(v)* ensures that projects are in control both in terms of project completion time and project cost.

Scheduling large, an often one-time projects is a difficult challenge to operations managers. The stakes in project management are high. Large amounts of money in cost overruns have been wasted due to poor project planning. Unnecessary delays have occurred due to poor scheduling and many firms have gone bankrupt due to poor controls. Hence, project management, which comprises of project planning, project scheduling and project controlling is of strategic importance for both manufacturing and service organisations which one time or another will take on a large and complex project.

Project Organisation

Project organisation: Organisation developed to ensure both continuity of the production system in its day to day activities and the successful completion of the project.

Project organisations have been developed to ensure both continuity of the production system in its day to day activities and the successful completion of projects. A variety of organisational structures are used by enterprises to perform project work. The various considerations in forming a project organisation are:

(a) proportion of the company's work that is performed by projects

(b) the scope and duration of the project

(c) the capabilities of the available personnel

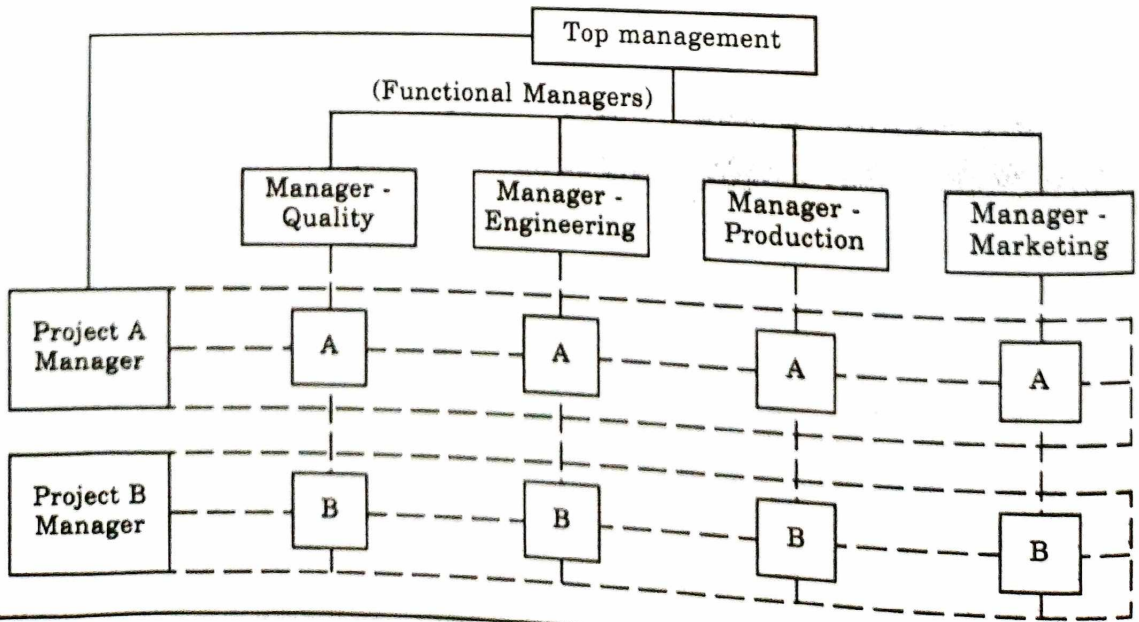
(d) the preferences of the decision makers.

There are four options available in choosing an appropriate organization for projects.

1. **Functional Organisation :** In functional organisations, functional departments are formed that specialise in a particular type of work such as production and sales. These functional departments often are broken into smaller units that focus on special areas within the function. Top management may divide project into work tasks and assign them to the appropriate functional units. The project is then budgeted and managed through the normal management hiearchy.
2. **Project Co-ordinator :** A project may be handled through the organisation as described above, except some one in appointed to co-ordinate the project. The project is still funded through the normal organisation and the functional managers retain responsibility and authority to their portion of the project work. The project co-ordinator meets with the functional managers and provides focus and impetus for the project and may report its status to top management.
3. **Project Matrix :** In a *matrix organisation* a project manager is responsible for completion of the project and often assigned a budget. The project manager contracts with the functional managers for completion of specified parts of the project. The functional managers assign work to employees and co-ordinate work within their areas. The project manager co-ordinates project efforts across the functional units.

Exhibit 16.1 illustrates the concept of a matrix organisation.

Exhibit 16.1 : Matrix Organisation Structure



Groups of persons under each functional manager report to project managers A or B.

4. **Project Team :** A particularly significant project that will have a long duration and require the full time efforts of a group may be run by a project team specially constituted for that purpose. Personnel are assigned full-time to the project and are physically located with other team members. The project has its own management structure and budget as though it were a separate division of the company.

Key Decisions in Project Management

Much of the success of projects depends on certain key managerial decisions. They are:

(i) Deciding which project to implement
(ii) Selecting the project manager
(iii) Selecting the members of the project team
(iv) Managing and controlling project resources
(v) Deciding whether to terminate a project and if so, when

Responsibilities of the Project Manager

The project manager bears the ultimate responsibility for the success or failure of the project. He or she must be capable of working through the members of the project team and others to accomplish the objectives of the project. He or she must be capable of working through the members of the project team and others to accomplish the objectives of the project. The project manager is responsible to effectively manage the following :

(i) The ***work*** i.e., all the necessary activities are accomplished in the desired sequence and the performance objectives are met
(ii) The ***human resources*** employed on the project are properly directed and motivated.
(iii) ***Communication*** i.e., everybody has the information they need to do the work.
(iv) ***Quality***, so that performance objectives are met.
(v) ***Time***, so that the project is completed on schedule
(vi) ***Costs***, so that the project is completed within the budget.

The project manager is responsible for the effective management of:
- **Work**
- **Human resource**
- **Communication**
- **Quality**
- **Time**
- **Costs.**

The Role of a Project Manager

The project manager's job is important and challenging. He is responsible for getting work performed but often has no direct, formal authority over most of the people who perform the work. He must often rely on broader knowledge of the project and skills at negotiation and persuasion to influence participants. He may have the assistance of a staff if the project is large.

Six basic functions that project management must address are

1. **Manage the project's *scope*** to define the goals and work to be done, in sufficient detail to facilitate understanding and correct performance by participants.
2. **Manage the *human resources*** involved in the project.
3. **Manage *communications*** to see that the appropriate parties are informed.
4. **Manage *time* by planning** and meeting a schedule.
5. **Manage *quality*** so that the project's results are satisfactory.
6. **Manage *costs*** so that the project is performed at the minimum practical cost and within budget if possible.

Skills Required for a Project Manager

To be successful is managing a project, a project manager must have the following set of skills:

(i) The ability to motivate and direct team members.
(ii) The ability to make trade off decisions.
(iii) The ability to expedite the work when necessary, solve crisis problems and monitor time budget and technical details.
(iv) The ability to employ strong leadership skills which include the ability to adapt to the changing circumstances that may involve changes to project goals, technical requirements and composition of the project team.
(v) The ability to coordinate and motivate the members of the project team and guide and evaluate their efforts.
(vi) The ability to recognize the need for change and decide what changes are necessary and work to accomplish those changes.
(vii) The ability to maintain and enforce ethical standards and to model ethical behaviour.

Problems in Managing a Project

1. Managing a project can be a complex and challenging assignment.
2. Since projects are one-of-a-kind endeavours, there may be little in the way of experience, normal working relationships or established procedures to guide participants.
3. A project manager may have to co-ordinate diverse efforts and activities to achieve the project goals.
4. Persons from various disciplines and from various parts of the organisation who have never worked together may be assigned to the project for differing spans of time.
5. Subcontractors who are unfamiliar with the organisation may be brought in to carryout major portion of the project.
6. The project may involve a large number of inter related activities performed by persons employed by any one of several different subcontractors.

For the above reasons, it is important that the project leaders have an effective means of identifying and communicating the planned activities and the ways in which they are to be inter related. An effective scheduling and monitoring method is absolutely essential to management of a large project. Network scheduling methods such as PERT and CPM have proven to be highly effective and valuable tools during both the planning and execution phases of projects.

I PROJECT PLANNING AND CONTROL TECHNIQUES

Project Planning

Project planning: All activities that result in a course of action for a project.

Project planning includes all activities that result in a course of action for a project. Planning begins with setting well defined objectives (such as implementing a new management information system). Also, planning involves decision making regarding resources to be committed, completion times, priorities of activities etc. Areas of responsibility must be identified and assigned. Time and resource requirements to perform the work activities must be forecasted and budgeted. Planning also involves establishing project boundaries and identifying controllable and uncontrollable variable that must be managed. Also the performance criteria should be stated related to the project objectives and in measures of time, cost and quality characteristics.

Project Scheduling

Project Scheduling: Establishes times and sequences of the various phases of the project.

Project scheduling establishes times and sequences of the various phases of the project. In project scheduling, the project manager considers the various activities of an overall project

and the tasks that must be accomplished and relates them co-herently to one another over the projects time horizon.

Techniques for scheduling projects include Gantt charts and network techniques such as PERT and CPM. Gantt charts do not reflect the interrelationship among resources or the precedence relationships among project activities. Network techniques overcome this shortcoming of Gantt charts by including a precedence relationships.

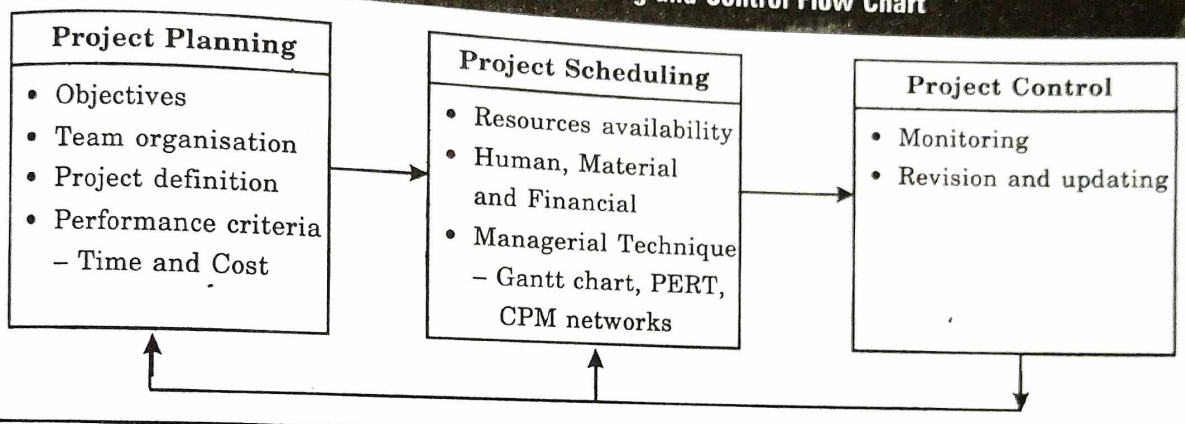
Project control: Activities designed to measure the status of component activities of a project, transmit data to a control centre where it is compared with the performance standard and initiate corrective action when required.

Project Control

Project controls are activities designed to measure the status of component activities of a project, transmit data to a control centre where it is compared with the performance standard and initiate corrective action when required.

Exhibit 16.2 shows the project planning and control flow chart.

Exhibit 16.2 : Project Planning and Control Flow Chart



Box 16.2 shows the activities and decisions involved in project management.

Box 16.2 : Project Management Activities and Decisions

(A) **Project Planning**
- (i) Identifying the project customer.
- (ii) Establishing the end product or service.
- (iii) Setting project objectives.
- (iv) Estimating the resources and time required for the entire project.
- (v) Deciding the form of the organisation for the project.
- (vi) Appointing key personnel (*e.g.*, Project manager).
- (vii) Defining major tasks required.
- (viii) Establishing a budget.

(B) **Project Scheduling**
- (i) Developing a detailed work breakdown structure.
- (ii) Estimating time required for each task.
- (iii) Sequencing the task in the proper order.
- (iv) Developing a start/finish time for each task.
- (v) Developing a detailed budget for each task.
- (vi) Assigning people to tasks.

(C) **Project Control**
- (i) Monitoring actual time, cost and performance.
- (ii) Comparing planned figures to actual figures.
- (iii) Determining whether corrective action is needed.
- (iv) Evaluating alternative corrective action.
- (v) Taking appropriate corrective action.

Network Fundamentals

A network diagram is a model that uses small circles (nodes) connected by lines or branches (arcs) to represent precedence relationships. Networks are frequently used to show the precedence relationships among the activities.