Project Management & Administration

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Describe the Project Life Cycle
- ✓ Explain the phases involved in a Construction Project.

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Introduction

Construction project is a high-value, time-bound, special mission with predetermined performance objectives. The project mission is undertaken to achieve certain purpose such as constructing a building for own living, expanding facilities in a factory, developing real estate in property market or promoting a new product for marketing. Each project has a predetermined duration with a definite beginning and an identifiable end. Its starting point is the time when the idea or the need is conceived by the client, and its end marks the time when the mission is accomplished.

The development of a construction project depends upon many factors such as its purpose, nature, size, design-readiness, mode of execution and organisation. The development of a typical construction project, from initiation to its completion, can be broadly divided into four phases. These are initiation including organisation, planning and designing including procurement, execution and control, and close-up. Each phase of a project consists of one or more processes. Project completion is followed up by the product operation phase.

For any construction project, the project organisation is a temporary set up. Although some participants may separate out in one phase, the other move on the next one. The project manager (from the time of resuming the charge) becomes the key participant in all these phases and acts as a catalyst who motivates the participants for achieving the stage objectives and meeting the deadlines.

This unit highlights the various processes involved in different phases of developing and organising the construction projects, It covers a brief detailing of different project phases along with the aspects pertaining to project organisation.

Project Life Cycle

A project life cycle represents the sequential grouping of the project phases, from the beginning to the end of the project (Figure 2.1). The time between the start and completion of a project represents the project life span. In project life cycle, the project starts with a gradual build-up in the use of resources. It is followed by a long-duration plateau and towards the end, there is a rapid run-down as the project draws to a conclusion. Although construction projects differ in many ways, but most of these follow a similar life cycle pattern.

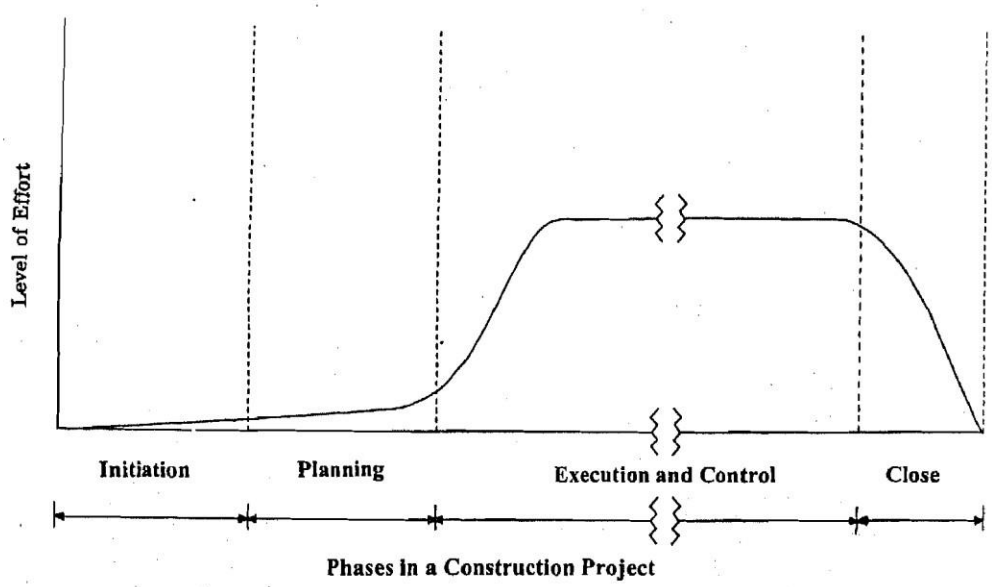

Fig: 1.1

There is a difference between the project life cycle and the project-product life cycle (commonly referred as product life cycle). A product life cycle includes the period from the start of the development of the project; it is followed by the construction of the production facilities. The product production starts after the construction phase and it lasts upto the time when the product reaches its "kill point" due to any reason such as obsolescence, lapse in demand or failure to produce it economically. The product life cycle is made up of its project life cycle plus its useful operation period. The product life cycle, from the point of view of project promoter or investor, can be categorised into three phases, i.e. pre-investment phase, investment phase and the product operation phase.

Note

The probability of successfully completing the project is lowest at the start of the project, and hence, the risk and uncertainty are highest. The probability of completion generally gets progressively higher and the risks reduce as the project continues.

The ability of the stakeholders to influence the final product (facility/service) and the final cost of the project is highest at the start and gets progressively lower as the project continues.

Project Phases and Processes

Each construction project is divided into several sequential phases for management control. Each phase has a start and end in terms of timings. It has defined tasks to be accomplished. In some cases like fast-track turnkey projects, these sequential phases do overlap. The number of phases in a project depends upon the purpose, nature, size, design-readiness, and mode of execution. The conclusion of a project phase is generally followed with the start of the subsequent phase(s). For example, the completion of the designing phase of a building construction project is followed by the subsequent construction phase.

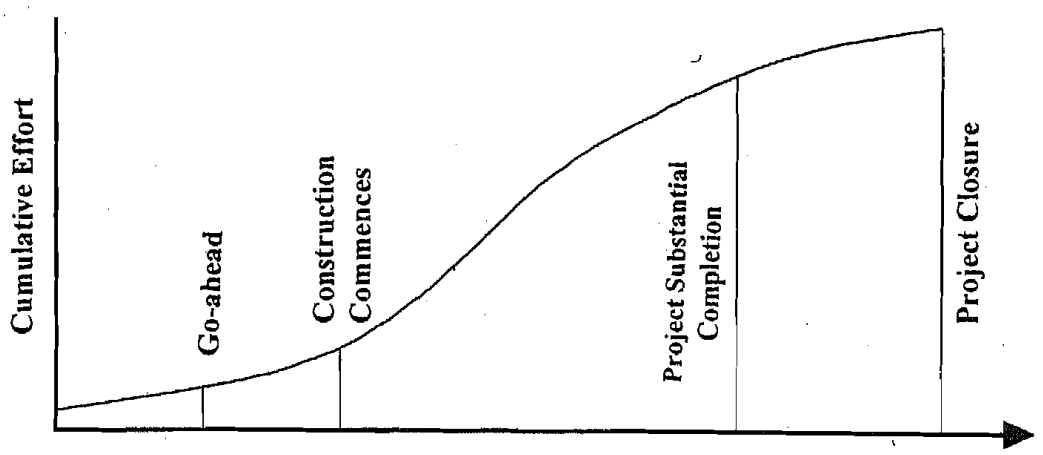

Fig. 1.2 : Project Phases

In a typical construction project, the phases can be categorised as under :

a. Project Initiation Phase
b. Planning and Designing Phase
c. Executing and Control Phase
d. Closing Phase

Project Initiation Phase

It aims at formulation of project scope and implementation strategy, if project is approved for implementation. End of this phase marks the client go-ahead/no-go decision.

Planning and Designing Phase

The objective of this phase is to develop a workable plan to accomplish the project mission. Major contracts are finalised towards the end of this phase.

Executing and Control Phase

It addresses to construction of the facility by coordinating and managing people and other resources as planned, tracking of progress during execution and taking corrective action, when necessary, for accomplishing project objectives.

Closing Phase

It formalises acceptance of the project and brings it to an orderly end.

Project phases are composed of one or more processes. A process involves series of actions to achieve desired results. Each process is fed with inputs, these inputs are processed to produce outputs. An output is a tangible, verifiable work product. These outputs, and consequently the phases, are part of a generally sequential processes in a project life cycle.

Fast Track Approach

Traditionally, the construction management process follows a sequential approach. It start, with the owner's decision to procure a facility, followed by design finalisation by the architect/engineering associates, and is delivered by the contractor under the supervision of the client's consultant - each stage is completed prior to commencement of next stage as shown in Figure 2.3.

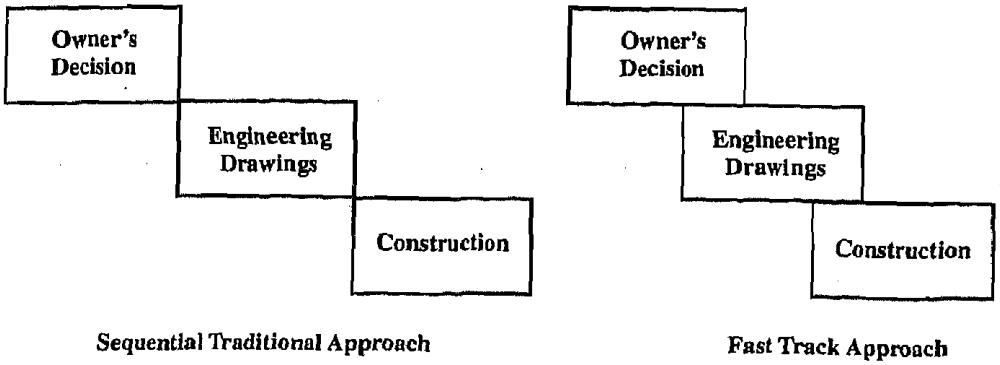

Fig. 1.2 : Project Phases

The sequential traditional approach has the following disadvantages:

(a) The owner's decision regarding the budget for building the facility is generally based on the assessment of the feasibility report without tendering the work. Thus, it lacks the input from the contractor, which may not match the budgeted cost.

(b) It delays the project as the contract is finalised after the entire set of drawings and specifications are completed by the designer for the tendering bids.

(c) Price to be paid by the client increases as the lowest quoted general contractor includes his mark up both on his department executed work, as well as the subcontractor quotation received by him. Ultimately, it is the back-to-back specialist sub-contractor who remains responsible for the quality of work and whose performance guarantee remains with the client till completion of his contract.

(d) In order to secure the contract, the general contractor perceives the works to be of such quality that meets the minimum quality stipulation. Thus, minimum quality and quantity attitudes result in conflict and claims between the client and the contractor.

In the end, it is the owner who pays for time delays and cost of inefficiency inherited in the sequential approach.

At times phases can overlap to some extent provided the risks involved are acceptable. This practice of overlapping phases is called the fast tracking approach. Fast track development approach aims at reducing project construction time by overlapping project development phases, For example, in a building construction, foundation work can commence after its architectural and foundation drawing are ready and it need not wait till completion of all the building drawings.

Fast-track approach requires a high degree of co-ordination and faster information processing to keep pace with the construction. It adds further complications to the already complex projects, but certainly makes them move faster.

Project Initiation Phase

Project initiation phase aims at formulation of project scope and implementation strategy by project need identification, feasibility studies, investment appraisals, financial appraisal, statutory clearance, project definition; development of strategy for execution (project charter) and finally structuring of project organisation including selection of the project manager (if project is approved for implementation). End of initiation phase marks the client go-ahead/no-go decision. Some important initiation processes are explained in subsequent paragraphs.

Need Identification

Construction project need arises for various reasons. Some of these need include development of nation's infrastructure, setting-up of an industry, expanding or diversifying the existing activity, meeting the need of the society, investing in real estates and so on. Such identification has to be done with reference to the corporate strategy and country's development strategies keeping in view, the long time economic policy, so that, when completed, it fits well into the total economic sys tern or development networks, capable of being fully utilised. The Central Government's Planning Commission and Departments of Economic Affairs and Industrial Development give guidance in these matters. Even State Government has industrial development organisations set up for guiding and assisting entrepreneurs.

In business, the key to success lies in getting into the right business at the right time. Identification of such opportunities requires :

Generation of Ideas - The search for promising project ideas is the first step towards establishing a successful venture. Barring truly new ideas which are based on significant technological breakthroughs, most of the project ideas involve combining existing fields of technology or offering variants of present products/services. SWOT Analysis (Strengths, Weaknesses, Opportunities and Threats) can facilitate in stimulating the flaw of ideas.

Monitoring the Environment - Basically, a promising investment idea enables a firm (or entrepreneur) to exploit opportunities in the environment by drawing on its competitive strengths.

Corporate Appraisal - *A* realistic appraisal of corporate strengths and weaknesses is essential for identifying investment opportunities which can be profitably exploited. The broad areas of corporate appraisal and the important aspects to be considered under them include market mage, market share, condition and capacity of plant and machinery, location advantage, track record, cash flows and liquidity and dynamism of top management.

A realistic SWOT appraisal of corporate strengths and weaknesses is essential for identifying investment opportunities which can be profitably exploited.

Pre-feasibility Report and its Clearance

Project formulation report or pre-feasibility report is the document which elicits the preliminary sanction or the first stage clearance by the Government and/or the Board of Directors of the enterprise, for further feasibility study of a project. A clearer report will elicit a faster clearance. The objective of appraisals in the various stages of evolution and project decision is to ensure that the project is viable from the following angles :

- Market demand for the projects end product and plant capacity,
- Materials and inputs,
- Location and site,
- Project engineering and investment costs,
- Plant organization and overhead costs,
- Manpower,
- Implementation schedule,
- Financial and Economic evaluation, and
- Statutory clearance.

While it is true that one should expect a pre-feasibility report to contain precise details and accurate figures, it is necessary that attempts are made to give even in the pre-feasibility report the best available information. Also, if any aspect, favourable or adverse, calls for special attention in making a decision, that aspect should be highlighted in sufficient detail. Particularly to be highlighted is the cost of any foreign process/technology to be acquired, its age and its plan.

Feasibility Study

Techno-economic feasibility study is the next stage of the project development phase where the project scope is described, its size and methods determined; suitability of the site, the required natural resources and raw materials investigated and more accurate estimates made of process and non-process equipment, buildings, offsite facilities and other assets, their costs, etc. and the total feasibility of the proposal studied in-depth and cleared.

Several institutes have published feasibility study guidelines. These institutions include UNIDO Geneva, the World Bank, Planning Commission and so on. The important facets covered in project feasibility analysis are:

- Market analysis
- Technical analysis
- Financial analysis
- Economic analysis
- Ecological analysis

Market Analysis

It is concerned primarily with aggregate demand and market share.

Technical Analysis

It seeks to determine whether the prerequisites for the successful commissioning of the project have 'been considered and reasonably good choices have been made with respect to location, size, process, etc. The important questions considered in technical analysis are:

- preliminary investigations, tests and studies done,
- availability of manpower, raw materials, power, and other inputs,
- construction methodology,
- equipment and machines chosen,
- necessary auxiliary equipments and supplementary works,
- treatment of effluents,
- layout of the site, buildings, and plant, and
- work schedules.

Financial Analysis

It ascertains whether the proposed project will be financially viable in the sense of being able to meet the burden of servicing debt and whether the proposed project will satisfy the return expectations of those who provide the capital. The aspects which have to be looked into while conducting financial appraisal are:

- Investment outlay and cost of project,
- Cost of capital,
- Projected profitability,
- Break-even point,
- Cash flows of the project,
- Projected financial position, and
- Level of risk.

Economic Analysis

It refers to cost benefit analysis which may often be different from its monetary costs and benefits.

Ecological Analysis

It is particularly required for major projects which have significant ecological implications like power plants and irrigation schemes, and environmental-polluting industries.

Feasibility Study Report

Information generally contained in the report is as follows:

- Project background and description,
- Market and plant capacity,

- Materials and input,
- Location and sites,
- Project engineering and investment cost,
- Plant organisation and overhead cost,
- Manpower,
- Implementation schedule, and
- Financial and economic evaluation,
- Prepare a summary sheet for every component, and
- Make a top sheet covering all components, providing separate columns for foreign exchange, local cost and total cost.

Before deciding on investment, the total financial viability of the project is to be examined closely from the angles of profitability or rate of return (ROR), cash flow, and pay-back of investment.
Profitability, cash flow and repayment capacity are computed and analysed from the angle of :

- Net present value of cash flow (NPV), - Speed capital assistance
- Internal rate of return (ROR),
- Payback period (PBP),
- Break-even point (BEP), and
- Sensitivity analysis (SA).

These aspects are covered in capital budgeting.

Investment Appraisal

The feasibility report, if found acceptable, is followed up with investment appraisal. The purpose of appraisal is to conduct an objective assessment for investment decision. It involves critical examination of the techno-economic analysis of feasibility findings, with particular reference to:

- Demand analysis,
- Technical specifications feasibility,
- Strength, weaknesses, opportunity and threat (SWOT) analysis,
- Environment's implications,
- Financial analysis, and
- Economic analysis.

Appraisal of feasibility stage enables a client to:

(a) decide on the project concept, time and costs;
(b) outline the approach needed to taking the project;
(c) appoint key persons like construction project manager or project coordinator, to act as his representatives; and banks
(d) nominate specialist associated agencies such as the architect, designer and consultants, as per the requirements.

Depending upon the nature and complexity of the project, the following may assist the client in making decisions:

(a) **Client representatives**: These include the prospective project manager or his nominee, and the related officials.

(b) **Specialists** : These include the architects, engineers, planners, and finance and management consultants.

(c) Concerned officials of administration and technical departments.

The process of formulation of needs, collection of information, critical examination of concepts and re-examination of needs, may have to be repeated several times over before a project inception finally takes shape.

Sources of Finance

Many project failures resulting from unplanned, untimely and insufficient financing, mainly attributable to commencement of implementation before making adequate funding and disbursement arrangements. Sources of financing differ for the various public, joint and private sector project enterprises. Some of the sources available to the public sector are not available to the private sector, while some others available to the private sector are not available to the public sector.

The main sources of project finance are as follows:

- Commercial banks
- Public deposits
- Debentures/bonds
- Suppliers credits

Project Statutory Clearance

Besides the techno-economic and financial clearances, a good number of other clearances are necessary for project implementation. While some of them are technical requirements, others are statutory - but all regulated by the Government. They are:

- Soil investigation report,
- Clearances under the Monopolies and Restrictive Trade Practices (MRTP) Act,
- Industrial License/Letter of Intent, Basic designs and drawings planning,
- Approval of foreign collaboration,
- Approval for appointment of foreign consultant, Resource planning,
- Foreign exchange clearances, Cost planning and budgeting,
- Import of capital goods,
- Approval for setting up export oriented units,
- Environmental/Pollution Control Clearances,
- Clearances from the International Airport Authority,
- Railway Clearances,

- Electricity Clearances,
- Explosives Clearances,
- Forest Clearances, and
- State Industries Department Clearances.

Project Scope Definition

Finally, the feasibility studies, appraisal and the work breakdown structure lead to the definition of the following aspects relating to the project scope :

- Broad scope of work involved,
- Project objectives,
- Outline execution methodology,
- Preliminary time plan,
- Resources forecasts
- Cash flow pattern and sources of funding
- Outline organization and
- Potential risks and problem areas.

On go-ahead decision, a "Project Charter" for implementation of the project including the aspects covered in project definition, is issued in the form of an executive order. The project charter is supported with corporate plan, policy and procedures.

Project Planning and Design Phase

Planning and design phase aims at formulation of plan of actions for coordinating project activities on a time basis so as to achieve specified objectives.

Planning Processes

In a typical construction project, planning covers the following:

- Basic design and drawing planning,
- Time planning
- Resource planning
- Cost planning and budgeting
- Communications planning
- Quality planning
- Organizational planning
- Risk management planning
- Procurement planning and
- Project development integrated plan

In this planning stage, the project manager, assisted by the chief project planner, performs the key development functions.

These include, but are not limited to, the following:

a. Participate in the finalisation of design, drawings and specifications so as to formulate construction methodology.
b. Prepare project execution preliminary plan and formulate the schedule for processing various contracts.
c. Advise the client on an early purchase of the items of plant and equipment needing a long lead time for procurement.
d. Evolve the pre tender construction plan for each tender package.
e. Scrutinise the tender packages, including drawings and specifications, so as to minimize the discrepancies.
f. Conduct the pre tender briefing to contractors to ensure that the bidders understand the tender documents and the work involved in each tender.
g. Evaluate project costs and compile project budget including preliminary allocations for the various heads of expenditures.
h. Compile a project directive covering the scope of work, work plan, organization, and the policies and procedures for implementing the project.

Designing Processes

Design, drawings and specifications define the construction scope of the project. Designs form the base for determining the functional fitness of the proposed facility, development of the drawings, estimation of cost of the project and the quantity of work, deciding construction time and forecasting cash-flow. During the design process, project information is collected, analysed, communicated and recorded for incorporation into the proposed scope of work. Designing follows three sequential processes as given under.

Schematic Design Process

In the project feasibility stage, the designed architect evaluates the client's requirements. After discussing the alternatives with the client, the designer then prepares conceptual design brief for the client's approval. The schematic design brief includes site plan, facility drawings, outlined specifications and conceptual design for structural, electrical, mechanical and other connected systems. This design document may include preliminary sketches, diagrams and other written documents so as to indicate the project scope, time and cost and describe the outline of the construction methodology.

Design Development Process

This phase commences after approval of schematic designs. The emphasis in this phase shifts to details of constructability, system integration and aesthetics. Drawings in this phase include plan, elevation and section of the facility. It also includes the design of the external services. To quote example, some of the designs developed in a housing project are listed below :

(a) Design of foundation and structure of the buildings,
(b) Structural design of precast elements of the building,
(c) External filtered and unfiltered water supply,
(d) External sewerage system and storm water drain,
(e) External gas supply,
(f) External electric services,
(g) Fire alarm system, and
(h) Clock system.

Drawings and Specifications Documentation Processes

This process includes preparation of the construction drawings and specifications based on approved designs. The construction drawings and specifications form part of the contracted bids.

Drawing Sets

Drawings show the graphical representation of the design intent mostly on a two-dimensional surface for the purpose of conveying data about a specific portion of a project. Drawings indicate the relationships between elements by showing location, identification, dimensions and sizes connection diagram, shape and form; for each material, assembly, components and accessories. Drawings are used in many ways by concerned persons. The traditional users include architect/engineers, owners, contractors and sub-contractors. Drawings are also required by various agencies like financial institutions, lenders, insurance agencies and licensing authorities.

Specifications

These define the qualitative requirements for the products, materials and workmanship upon which the design is based. Specifications also describe the inspection and acceptance procedures. Specifications denote requirements of the owner. Technical specifications documents include material specification, construction requirements, construction method and acceptance criteria. Technical specifications may take several forms and one or more of these can be selected. Example of these are :

- Description in words about the construction to be done, the quality of materials and workmanship, the method of construction, the method of testing, etc.
- Standards published as reference specifications for construction material and processes by government approved professional bodies and engineering societies. The well known organisation publishing standards include Bureau of Indian Standards (BIS), British Standard Institute, Construction Specification Institute and International Standard Organisation (ISO).
- Clients developed standards.

Project Procurement Process

Procurement embraces the acquisition of services, goods and materials, which together make up a project. There are several approaches possible for procuring construction facilities in a project. At one extreme a client wishing to construct a facility may undertake to execute the work through his organisation (do-it-himself departmentally). At the other end of the spectrum is to get the entire work done on turnkey basis through a contractor. There are many in between. In general, procurement in construction can be divided into three main categories, i,e. contractual approach, departmental approach and consultant [including professional construction manager - (CM)] approach.
The contractual option has many advantages. Some of which are:

- Contracted works usually cost less than the departmentally executed work.
- In contracted projects, the owner utilises the services of the contractor's experts/specialists/suppliers rather than training his own staff and facing teething problems in specialised fields.
- The client's risk of variations in cost is covered in contracted work.
- The client can limit his manpower to supervisory roles.
- The client saves on the investment needed to procure the expensive capital equipment.

The competitive construction business of the day requires special resources for different types of construction work and the contractors tend to specialise in a specific area of construction. From this functional angle, the contractors can be classified into different categories. These include general contractors, building contractors, specialist heavy infrastructure contractors, specialist industrial works contractors and contractors offering specialist utility services including electrical, water supply, sewage disposal and HVAC services.

Project Execution and Control Phase

Project Execution Processes

Execution involves establishing direction, communicating vision, motivating and inspiring people to produce desired results. On a project, particularly a larger project, the project manager is generally expected to be the project's leader. Leadership is not, however, limited to the project manager, it may be demonstrated by many different individuals at many different times during the project. Leadership must be demonstrated at all levels of the project (project leadership, technical leadership, team leadership). Typical functions performed by the executives are:

- Project Organisation,
- Resources Mobilisation,
- Scope Quality Assurance Organisation,

- Site Mobilisation,
- Team Development,
- Safety Management, and
- Information Distributions.

Construction involves risky operations in dangerous areas, such as working at heights, working on slippery surfaces and working under material handling equipment. Constantly changing sites, nature of work, construction methodology and technology add new dimension to the safety problems. The unsafe working leads to accidents. The worst sufferer, due to accident is the worker. These accidental unintentional and unsafe acts result in loss of life, limb, time and money. A worker meeting an accident suffers from financial, physical, mental and bread-earning time loss. The accidents add to the avoidable death toll and crippled human population. No amount of money can compensate for the lost life, lost limb or lost time of the family bread earner. These permanent damages to the life of a worker can be avoided. An effective accident prevention programme is the best guarantee against the accidents. According to the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) the employer has the sole responsibility for ensuring safety at construction site. Remember workers safety comes first always and every time.

Project Control Phase

Project plan indicates the path to achieve objectives. During implementation stage, Project Control System aims at ensuring execution of work as per planned schedule and application of corrective measures including re-planning when necessary, to achieve project objectives.
Controlling phase includes the following processes:

- Overall Scope Change Control,
- Resources Control,
- Schedule Control,
- Cost Control,
- Quality Control,
- Risk Response
- Performance Reporting, and
- Contract Administration.

Project Control follows system concept. Each organisational unit in a project, usually referred as Responsibility Centre, can be viewed as a sub-system. These sub-systems are highly interdependent and interactive.
The performance objective of sub systems are stated in terms of parameters to be controlled. These parameters include time progress targets, resources productivity. Standards and work package standard costs and sales targets.

Each sub system accounts for its performance and reports the actual, and the deviation between the planned and the actual performance, to the monitor.
The Project Control Centre manned by the monitor, is the heart of the system: it receives the performance data from the responsibility centres and using scientific tools and techniques, transforms this data into information suggesting remedial courses of actions for achieving objectives. This information, when fed at appropriate levels, results in steering the organizational effort towards attainment of the project objective.

Project Close-Up Phase

The completion of the construction phase of the project includes certain follow-up actions necessary to ensure that the facility constructed functions satisfactorily. Project close up includes the following tasks:

- Administrative Close,
- Contract Close-out, and
- Lessons Learnt.

For proper closing of project:

a) The post completion maintenance is usually entrusted to an agency familiar with the construction. In most cases, the contractor responsible for construction is given this responsibility for one year after completion; and this aspect is included in the scope of work of the contractor.
b) A proper record of the operating instructions and a-built drawings is maintained.
c) The staff and workers necessary for operating and maintaining the facility are trained prior to its taking over.
d) The site is cleared of the left-out of the construction and unwanted materials.
e) The client fully safeguards his interests prior to rendering the completion certificate to the contractor, and also before making the final payments.

After completion by the contractor, it is the project team of the client that hands over the project to him. The team also prepares a project completion report which includes the scope and schedule of work, the important events, the contract executed, the addresses of the suppliers of materials and equipment, the equipment maintenance manual, the as-built drawings, the costs involved, the problems encountered during execution, the lessons learned and the minor defects noticed at the time of handing over.

Project Organisation

Organisation enables a group of people working together with divided tasks and responsibilities, to co-ordinate their activities harmoniously in order to achieve a common goal.
The success of a project depends upon the organisational form and structure, by which and work package standard costs and sales targets. The project management gets the work done, utilising the planned resources of men, material, machines, money and time.
Project orgaisational requirements differ from the corporate organisational needs. Unlike the on-going each project is an entity in itself. It is organised to achieve its mission, within pre-determined objectives. Project is a one-time job with definable parameters and a specific lifespan. As mentioned earlier, project organisation is temporary; it ceases after completion of the project. It undergoes changes in various stages

of the project life cycle to meet the project needs. Its special attributes include its innovation capacity to overcome problems as they arise. It has to be staffed with experienced persons to respond speedily with changing situations and to up decision making**,** its accomplishment is entrusted to a single person - the project manager who acts as the single point of responsibility. The project organisation demands include:

- innovation to overcome problems as they arise,
- experience on which to make sound, efficient decisions,
- rapid response to changing situations, and
- effective control of time, cost and quality objectives.

There are no tailor-made organisation forms and Structures to meet all situations, as there are no two projects which are alike. Organisational designs are dictated by many factors. These include technology, people and size. Therefore, organisational design in each project needs to be customised.

Further Reading:

- ✓ ***Martin Loosemore, (2004), Essentials of Construction Project Management***
- ✓ ***Frank Harris, Ronald McCaffer, (2013), Modern Construction Management***