

LECTURE ONE: CONSTRUCTION PROJECT MANAGEMENT

INTRODUCTION

Proper Management plays a vital role in each and every individual construction activity from the inception stage. It will be a challenging task to plan, monitor, construct and execute the project at various levels. The project manager will be the most responsible and crucial person to perform all the activities effectively within a specified time duration without compromising the quality aspect of the construction. Improper management, cheap construction techniques, poor quality construction materials, improper coordination among the people, unskilled manpower leads to the natural failure of any minor and mega level projects. Sometimes a small error in any stage of construction might cause the collapse of structure naturally. The construction project needs sufficient men, material, machinery for successful completion of the project. There are many factors that determine the outcome of a project but the main parameters that can sufficiently define a construction project are size, complexity, quality, productivity, completion time and cost.

Project management is the art and science of mobilizing and managing people, materials, equipment and money to complete the assigned project work on time within budgeted costs and specified technical performance standards. It aims at achieving the specified objectives efficiently and effectively by managing human energies and optimizing the non-human resources placed at their disposal. The overall aim of the management in an enterprise is to create within the enterprise, an environment which will facilitate the accomplishment of its objectives. The major functions of project management are planning, organizing, procuring, leading and controlling. Planning involves deciding in advance what is to be done, how and in what order it is to be done in order to achieve the objectives. Organizing is the process of establishing a structural relationship among functions of people, so as to formulate an effective machinery for streamlining the achievement of assigned objectives. Procuring implies managing and keeping manned, the positions created by organization structure and providing them the right quality resources at the right time. These resources include people, materials, machinery and money. Directing or leading involves influencing people so as to

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enable them to contribute to organizational goals efficiently and effectively. Controlling involves monitoring of the performance and applying corrective measures in case of deviations from the plan.

PROJECT LIFE CYCLE

Each project has a predetermined duration with a definite beginning and an identifiable end. Its starting point is the time when the idea is conceived by the client, and its end marks the time when the mission is accomplished. The time span between the start and completion of a project represents the project life cycle, which varies from few months to few years. Although construction projects differ in many ways, the life span of a project follows a similar pattern. The life cycle of a typical construction project can be broadly divided into the following stages:

- a) Formulation stage
 - Project idea conception
 - Feasibility studies
 - Investment appraisal
 - Project definition
- b) Mobilization stage---This covers preparation of:
 - Project preliminary plan
 - Designs and drawings
 - Specifications and contract finalization
 - Resources mobilization and earmarking funds
- c) Construction stage—This includes:
 - Planning and controlling execution
 - Inducting resources
 - Construction and commissioning
 - Final handling over to the client

Although some participants may separate out in one stage, the other move on the next one. The project manager is the key participant in all these stages and acts as a catalyst who motivates the participants for achieving the stage objective.

Feasibility or Inception Stage:

The major construction projects are undertaken to meet the particular needs of a client. The first step in the development of a project is to analyse the needs of the client. This requires a critical examination of the needs through feasibility studies. The feasibility study evaluates

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project potential by examining technical feasibility, economic viability and financial implications.

Mobilization or Preparation Stage:

The mobilization stage aims at processing the project preliminaries so as to enable the commencement of the construction stage. This is achieved by the following:

- a) Compiling detailed design and drawings, specifications, and bills of quantities, so as to complete all the documents necessary for contracting works.
- b) Planning project execution—This includes the work programme, manpower plan, materials plan, plant and machinery utilization plan, work-organization and mobilization plan, and project budget or cost plan. This process also continues during the construction stage.
- c) Tendering and appointing contracts, especially those needed for commencement of the work.

Execution Stage:

Most of the construction projects are executed through the contract system. The contract documents define the contracted scope of the work of each contractor. They also provide the contractual relationship between the construction manager of the contractors and the project manager. The contract agreement is based on mutual trust between the contracting parties, both of whom have their share of responsibilities and obligations.

MAJOR TYPES OF CONSTRUCTION

Broadly the major construction projects can be grouped into 'Building Construction', 'Infrastructure construction', 'Industrial Construction' and 'Special-purpose projects'

1. Building Construction:

Building works include residential and commercial complexes, educational and recreational facilities, hospitals & hotels, warehouse and marketing facilities. 'Buildings' constitute the largest segment of construction of construction business.. The construction business serves mankind by providing shelter and services for its habitation, educational, recreational, social and commercial needs. The building works are mostly designed by the Architect/Engineering firms, and are financed by public and private sector and individuals.

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1.A. Residential Housing Construction:

Residential housing construction includes single-family houses, multi-family dwellings, and high-rise apartments. During the development and construction of such projects, the developers or sponsors who are familiar with the construction industry usually serve as surrogate owners and take charge, making necessary contractual agreements for design and construction, and arranging the financing and sale of the completed structures. Residential housing designs are usually performed by architects and engineers, and the construction executed by builders who hire subcontractors for the structural, mechanical, electrical and other specialty work.

The residential housing market is heavily affected by general economic conditions, tax laws, and the monetary and fiscal policies of the government. Often, a slight increase in total demand will cause a substantial investment in construction, since many housing projects can be started at different locations by different individuals and developers at the same time. This market is highly competitive, with potentially high risks as well as high rewards.

1.B. Institutional and Commercial Building Construction:

Institutional and commercial building construction encompasses a great variety of project types and sizes, such as schools and universities, medical clinics and hospitals, recreational facilities and sports stadiums, retail chain stores and large shopping centers, warehouses and light manufacturing plants, and skyscrapers for offices and hotels. The owners of such buildings may or may not be familiar with construction industry practices, but they usually are able to select competent professional consultants and arrange the financing of the constructed facilities themselves. Specialty architects and engineers are often engaged for designing a specific type of building, while the builders or general contractors undertaking such projects may also be specialized in only that type of building.

Because of the higher costs and greater sophistication of institutional and commercial buildings in comparison with residential housing, this market segment is shared by fewer competitors. Since the construction of some of these buildings is a long process which once started will take some time to proceed until completion, the demand is less sensitive to general economic conditions than that for speculative housing. Consequently, the owners may confront an oligopoly of general contractors who compete in the same market. In an oligopoly situation, only a limited number of competitors exist, and a firm's price for services may be based in part on its competitive strategies in the local market.

2.Specialized Industrial Construction:

These works include construction of manufacturing, processing and industrial plants like steel mills, petroleum refineries and consumer-goods factories. Industrial works also include connected utility services, environmental works and human needs facilities. These works involve heavy investment and are highly specialized. Industrial constructions are financed by government, public and private enterprises.

Specialized industrial construction usually involves very large scale projects with a high degree of technological complexity, such as oil refineries, steel mills, chemical processing plants and coal-fired or nuclear power plants. The owners usually are deeply involved in the development of a project, and prefer to work with designers-builders such that the total time for the completion of the project can be shortened. They also want to pick a team of designers and builders with whom the owner has developed good working relations over the years.

Although the initiation of such projects is also affected by the state of the economy, long range demand forecasting is the most important factor since such projects are capital intensive and require considerable amount of planning and construction time. Governmental regulation can also profoundly influence decisions on these projects.

3.Infrastructure and Heavy Construction:

These are capital intensive and heavy- equipment oriented works which involve movement of large quantity of bulk materials like earth, steel and concrete. These works include dams, and canals, highways and airports, railways and bridges, oil/gas pipe lines and transmission lines, large water supply and sewage disposal networks, docks and harbours, nuclear and thermal power plants, and other specialist construction activities which build-up the infrastructure for the growth of the economy. These works are designed by the specialist engineering firms and are mostly financed by the government/public sector.

Infrastructure and heavy construction includes projects such as highways, mass transit systems, tunnels, bridges, pipelines, drainage systems and sewage treatment plants. Most of these projects are publicly owned and therefore financed either through bonds or taxes. This category of construction is characterized by a high degree of mechanization, which has gradually replaced some labor intensive operations.

The engineers and builders engaged in infrastructure construction are usually highly specialized since each segment of the market requires different types of skills. However,

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demands for different segments of infrastructure and heavy construction may shift with saturation in some segments.

4. Special Purpose Projects:

These include environmental works, emergencies, remedial works, installation and commissioning of equipment, and complex key operations.

Project Classification: Based on the completion time and value of works, various types of construction projects can be further classified as under:

- Project completion time basis
 - Long duration projects(over 10years)
 - Medium duration projects(3 to 10 years)
 - Short duration projects(few months to 3 years)
 - Special short-term projects(less than 1 year)
- Project value basis
 - Mega value projects(say over \$1000million)
 - Large value projects(\$100 million to \$1000 million)
 - Medium value projects(\$10 million to \$100 million)
 - Small value project (less than \$10 million)

SELECTION OF PROFESSIONAL SERVICES

The type of services selected depends to a large degree on the type of construction and the experience of the owner in dealing with various professionals in the previous projects undertaken by the firm. Generally, several common types of professional services may be engaged either separately or in some combination by the owners.

1.Financial Planning Consultants

At the early stage of strategic planning for a capital project, an owner often seeks the services of financial planning consultants such as certified public accounting (CPA) firms to evaluate the economic and financial feasibility of the constructed facility, particularly with respect to various provisions of central, state and local tax laws which may affect the investment decision. Investment banks may also be consulted on various options for financing the facility in order to analyze their long-term effects on the financial health of the owner organization.

2. Architectural and Engineering Firms

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Traditionally, the owner engages an architectural and engineering (A/E) firm or consortium as technical consultant in developing a preliminary design. The A/E firm completes the design and may also provide on site quality inspection during construction. Thus, the A/E firm acts as the prime professional on behalf of the owner and supervises the construction to insure satisfactory results. This practice is most common in building construction. In the past two decades, this traditional approach has become less popular for a number of reasons, particularly for large scale projects.

3. Design/Construct Firms

A common trend in industrial construction, particularly for large projects, is to engage the services of a design/construct firm. By integrating design and construction management in a single organization, many of the conflicts between designers and constructors might be avoided. In particular, designs will be closely scrutinized for their constructability. However, an owner engaging a design/construct firm must insure that the quality of the constructed facility is not sacrificed by the desire to reduce the time or the cost for completing the project. Also, it is difficult to make use of competitive bidding in this type of design/construct process.

One of the most obvious advantages of the integrated design/construct process is the use of phased construction for a large project. In this process, after the completion of the design of the first phase, construction can begin without waiting for the completion of the design of the second phase, etc. If proper coordination is exercised, the total project duration can be greatly reduced. Another advantage is to exploit the possibility of using the turnkey approach whereby an owner can delegate all responsibility to the design/construct firm which will deliver to the owner a completed facility that meets the performance specifications at the specified price.

4. Professional Construction Managers

In recent years, a new breed of construction managers (CM) offers professional services from the inception to the completion of a construction project. These construction managers mostly come from the ranks of A/E firms or general contractors who may or may not retain dual roles in the service of the owners. In any case, the owner can rely on the service of a single prime professional to manage the entire process of a construction project. However, the construction managers are appreciated by some owners but not by others.

5. Operation and Maintenance Managers

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Owners may prefer to contract the operation and maintenance of constructed facilities to professional managers. Understandably, it is common to find in-house staff for operation and maintenance in specialized industrial plants and infrastructure facilities, and the use of outside managers under contracts for the operation and maintenance of rental properties such as apartments and office buildings. However, there are exceptions to these common practices.

6.Facilities Management

Some owners and developers are receptive to adding strategic planning at the beginning and facility maintenance as a follow-up to reduce space-related costs in their real estate holdings. Facilities management is the discipline of planning, designing, constructing and managing space. It involves developing corporate facilities policy, long-range forecasts, real estate, space inventories, projects (through design, construction and renovation), building operation and maintenance plans and furniture and equipment inventories.

Some architectural/engineering firms and construction management firms with computer-based expertise, together with interior design firms, are offering such front-end and follow-up services in addition to the more traditional services in design and construction.