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Introduction to Construction Industry

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Construction Project Management (CE 110401346)

1 – Introduction to Construction

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Construction

- Construction is the process that sets up a portable plant, bring material to the site, and on completion of the work moves the plant away, leaving its output standing
- Output: all immobile structures (airports, buildings, dams, roads and tunnels, power plants, municipal treatment plants, pipelines ...etc)

Project

- Project: A temporary effort undertaken to create a unique product or service.
- “Any undertaking with a defined *STARTING* and *ENDING* point and defined *OBJECTIVES* by which completion is identified. In practice, most projects depend on limited *RESOURCES* by which the objectives of the project are accomplished.”
- Project Management Institute

Characteristics of the Construction Industry

- The physical nature of the product:
 - Large, heavy and expensive
 - Required over a wide geographical area
 - Customer tailored
 - A large part of components manufactured elsewhere
- The ultimate use of the product is:
 - As a mean to further production
 - As an addition to or improvement of the infrastructure of the economy (e.g., roads)
 - As a social investment (e.g., hospitals)
 - As an investment for direct enjoyment (e.g., housing)

Characteristics of the Construction Industry II

- The demand for the product is:
 - Determined differently for different types of products
 - Largely dependent on governmental policy
 - Largely dependent on economy cycles
- Unique Industry:
 - Incorporates small remodeling to giant international, multibillion-dollar contractors.
 - Highly competitive.
 - Low profit margins.

Characteristics of the Construction Industry III

- Many parties are involved in the process:
 - Owner
 - Architect
 - Contractor
 - Subcontractors
 - Materials and equipment suppliers
 - Regulatory agencies
 - etc....
- The price determination is a discrete process for each project and for each piece of work subcontracted (bidding or negotiations)

Characteristics of the Construction Industry IV

- Human resources: Growing shortage of skilled workers due to:
 - 4D Industry Perception (dull, dirty, demanding, and dangerous)
 - Aging workforce
 - Absence of apparent technology
 - Requirement to travel

Characteristics of the Construction Industry V

- Safety:
 - Construction accounted for 19.5% of all workplace fatalities in 2000 in the United States (about 5% of the total U.S. workforce)
- Quality control:
 - In this competitive age, if you do not provide quality services, someone else will

Construction Projects Categories I

- Industrial, heavy engineering and infrastructure, commercial buildings, residential
- Industrial
 - Examples: automobile plants, petroleum refineries, petrochemical plants, steel mills, nuclear plants ...etc)
 - Dominated by very large engineering and construction firms
 - The most technical projects of the construction projects
 - Few design firms and constructors are qualified to undertake them
 - Privately funded

Construction Projects Categories II

- Heavy Engineering and infrastructure
 - Examples (airports, bridges, dams, tunnels, highways, water treatment and distribution, urban rapid transit systems ...etc)
 - Activities in this category are primarily the domain of civil engineers, but other engineering disciplines have roles
 - Equipment intensive and characterized by fleets of large earth movers, heavy trucks, etc)
 - Working with massive quantities of basic materials (earth, rock, concrete, steel, pipe)
 - Many of those projects are publicly funded
 - Projects tend to be long in duration

Construction Projects Categories III

- **Commercial Building**
 - Examples (Mosques, churches, government buildings, hospitals, shopping malls, small retail stores, warehouses...etc)
 - Labor and materials intensive
 - Interact closely with people
 - Private economy finances these structures, with some exceptions
 - Design coordinated by architects, who work with engineering specialists (structural, mechanical, electrical)

Construction Projects Categories IV

- **Residential**
 - Examples (single-family homes, apartments, condominiums, town houses)
 - Largely financed by private investment
 - Large number of contractors and subcontractors
 - High rate of business failure if demand falls
 - Low capital and labor intensive
 - Design is done by architects, drafting people, builders, or the home owner (USA)

Construction Projects Categories V

- In terms of owner, construction projects are either Public or Private Projects.
 - A private party can award a contract in any way they choose to anyone they choose.
 - Private party can make one contract or multiple
 - Public party is limited by laws and regulations
 - Public party commonly awards bids by competitive bidding.

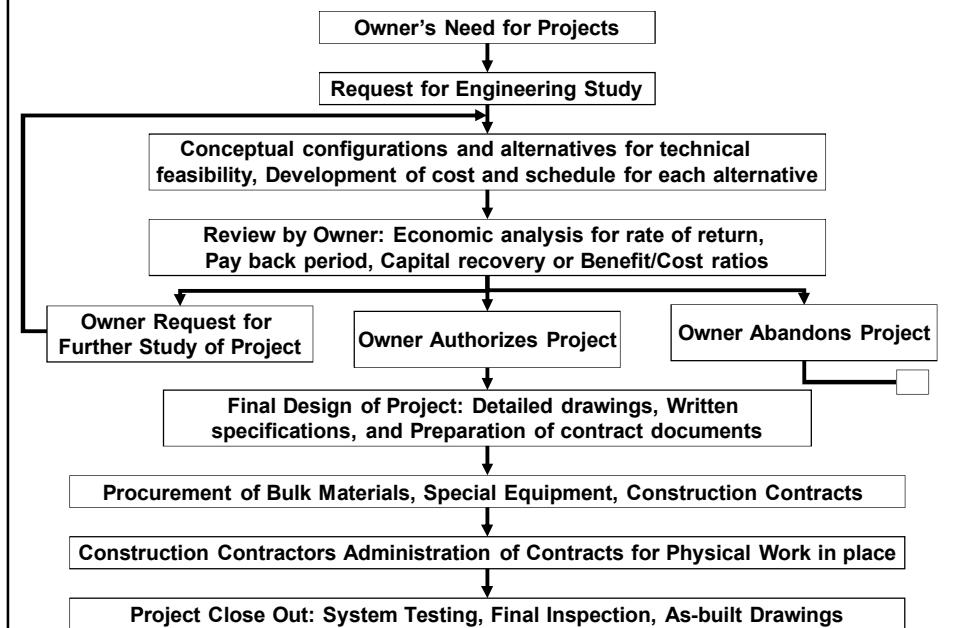
Construction Contractors

- Construction contractors: Companies and individuals engaged in the business of construction
 - They operate under a contract arrangement with the owner
- Construction contractors
 - General contractors: engage in a wide range of construction activities and execute most major construction projects
 - Specialty contractors: limit their activities to one or more construction specialties

Phases of a Project

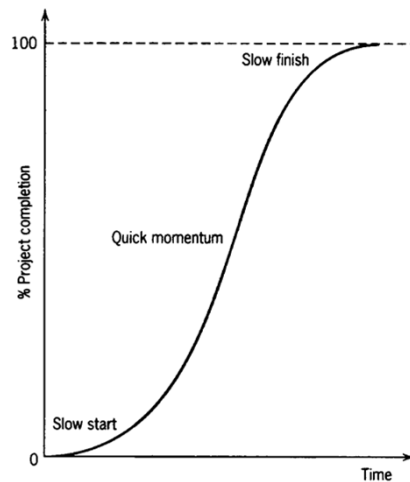
- Business Planning
- Conceptual Design
- Detailed Design
- Procurement
- Construction
- Testing, Start-up & Implementation
- Operations & Utilization
- Decommissioning

Phases of a Project II



The Project Life Cycle

- Slow-rapid-slow progress
- Minimal effort is required at the beginning but increasing effort in the early stages of the life cycle will improve the chances of project success

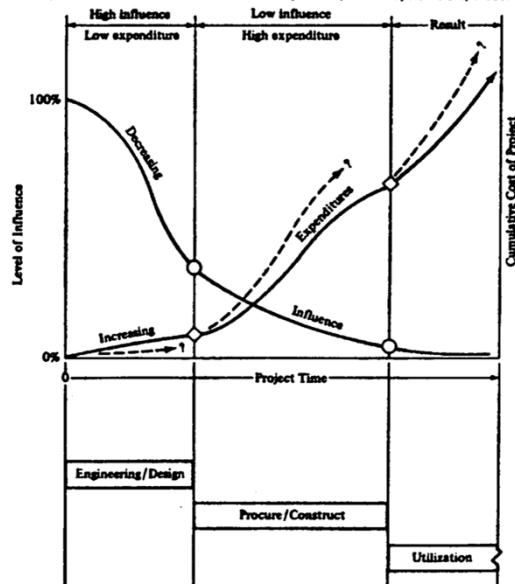


Phases of a Project III

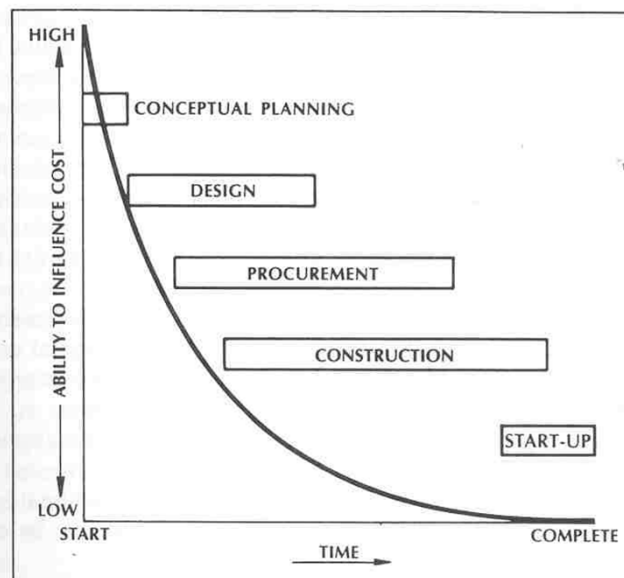
- The cost of each phase depends on specifics, but usually the majority of the budget is spent during the production phase
- Most of the budget is committed during the design phase before the actual work takes place
- Pressures to start the “real-work” may lead to high cost due to commitment of resources without adequate planning

The Level of Influence Concept

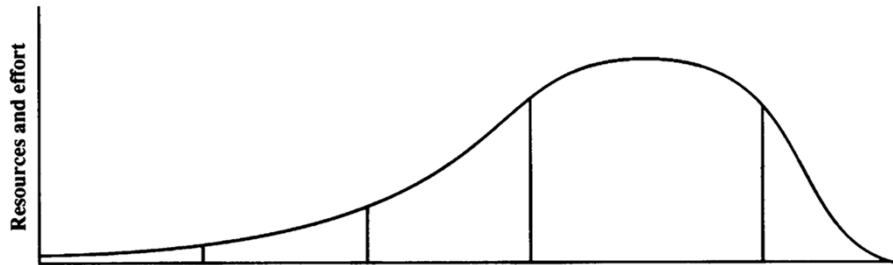
Level of influence on project costs. (From Boyd C. Paulson, Jr., "Designing to Reduce Construction Costs," *Journal of the Construction Division, ASCE*, vol. 102, no. CO4, December 1976, p. 588.)



The Level of Influence Concept



Life Cycle Strategic and Tactical Issues



Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
<i>Conceptual design</i>	<i>Advanced development</i>	<i>Detailed design</i>	<i>Production</i>	<i>Termination</i>
<ul style="list-style-type: none"> • Goals • Scope • Baseline • Requirements • Feasibility • Desirability 	<ul style="list-style-type: none"> • Plan • Budget • Schedule • Bid proposal • Management commitment 	<ul style="list-style-type: none"> • Responsibility definition • Team • Organizational structure • Detailed plan • Kickoff 	<ul style="list-style-type: none"> • Manage • Measure • Control • Update and replan • Problem solving 	<ul style="list-style-type: none"> • Closeout • Document • Suggest improvements • Transit • Reassign • Dissolve team

Project Management

- “The art of *DIRECTING* and *COORDINATING* human and material *RESOURCES* throughout the life of a project by using modern management techniques to achieve *PREDETERMINED OBJECTIVES* of scope, quality, time, and cost, and participants’ satisfaction.”

Project Management Institute

Construction Management

- Construction Management: the act of managing the construction process
- The construction manager manages the basic resources of construction
 - Workers and subcontractors
 - Equipment and construction plant
 - Materials
 - Money (income, expenditure, and cash flows)
 - Time

Construction Management II

Construction Management Triangle



Construction Management III

Managing Trade-Offs: The Primary Task of Construction Management

