

CHAPTER THREE



Construction Project Management CONTENTS

- ❑ **Project and project management**
- + Introduction and definitions
- + Project life cycles
- + Project management processes

Project and Project Management



Introduction and definitions

What is Project ? ‘a **temporary** endeavor undertaken to create a **unique** product or service’ PMBOK’

Generally projects are understood to be parts of the main business of organizations with the following identifying characteristics:

- ✓ **temporary**
- ✓ **Unique product /Services**
- ✓ **Progressive elaboration**
- ✓ **A component of a certain business**

Project and project management



Examples of project includes:

- ✓ Developing a product
- ✓ Effecting a change in structure, staffing, or style of an organization
- ✓ Designing a new transportation vehicle
- ✓ Developing or acquiring a new or modified information system
- ✓ **Construction a building or facility**
- ✓ Implementing a new business procedure process

Project and project management



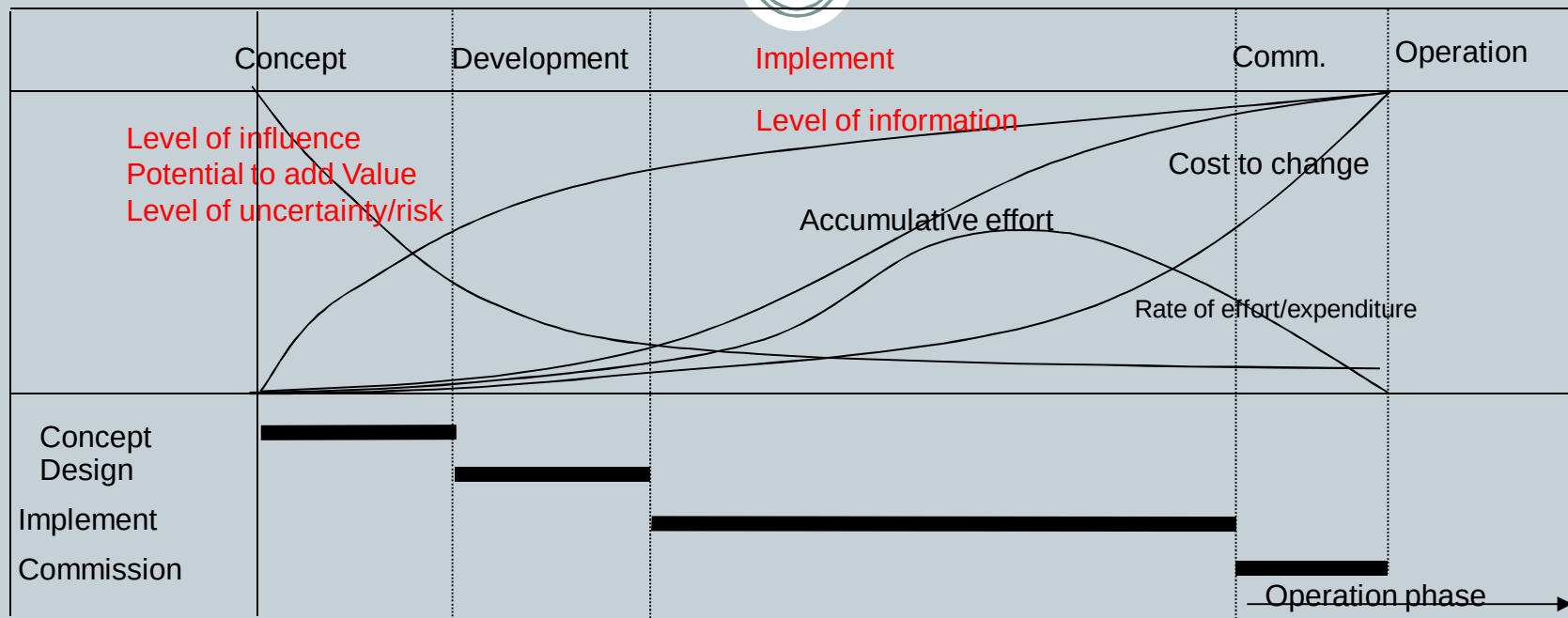
What makes construction projects **UNIQUE?**

- ✓ They deal with geographical differences and natural events in every case and may have a significant effect on the environment
- ✓ Involves many stakeholders
- ✓ Require large amount of materials and physical tools

(project life cycle)

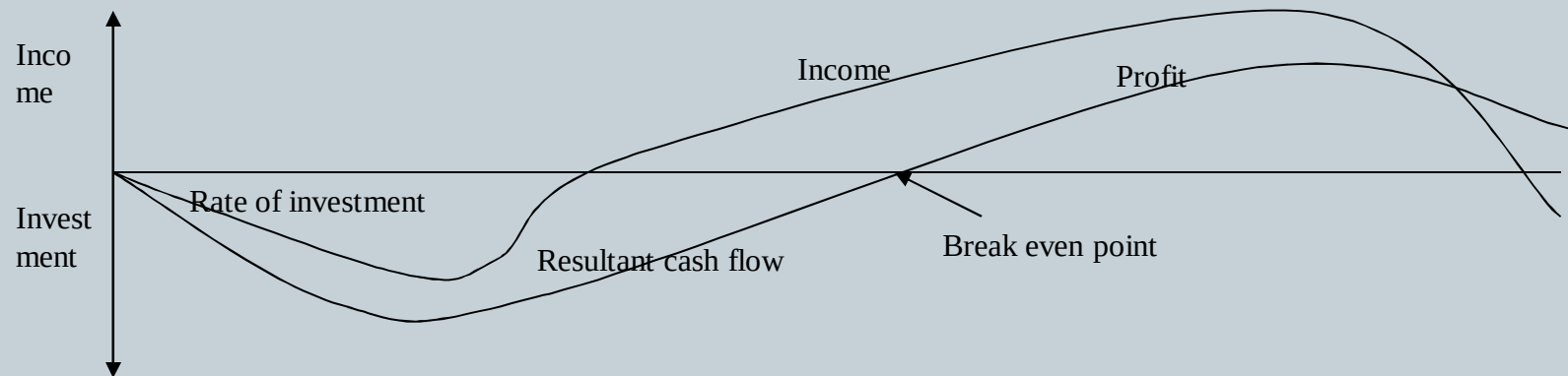
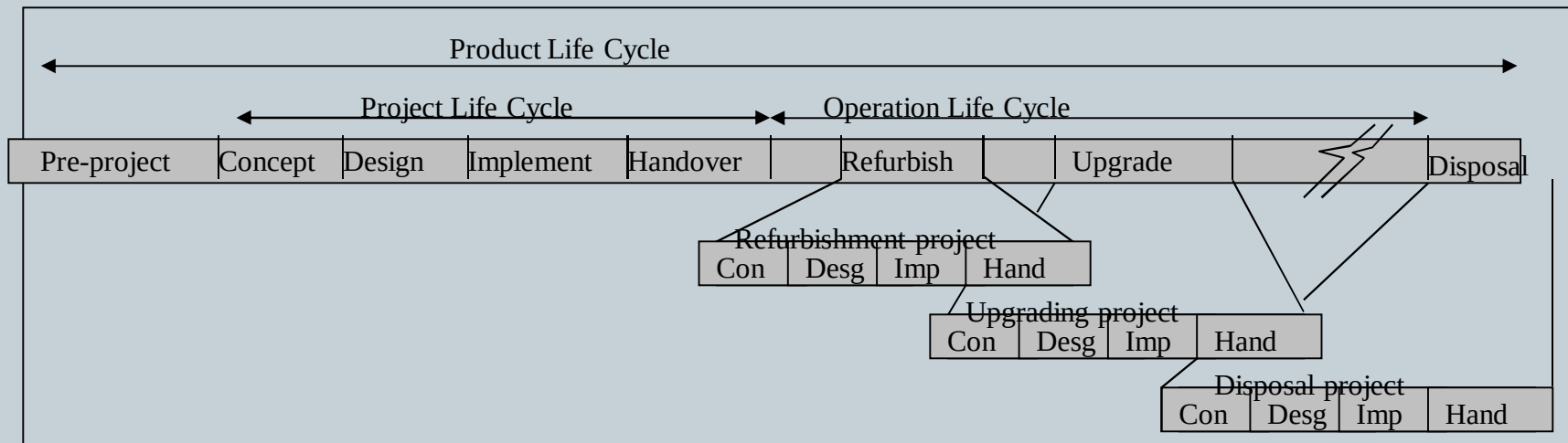
Concept	Development	Implementation	Commission
Input			
Problem or opportunity, project brief, project charter	Approval to go ahead with design and development	Approval to implement project	Commissioning plan, notification of completion
Process			
Feasibility study	Design product, develop detailed programme: WBS, CPM, budget	Solicit tender and award contracts, administer contracts, make the product/solve problem	Start-up and test the product. produce as built drawings, compile knowledge learnt
Major Players			
Client, Economic advisor, Project Manager	Client, Project Manager, Designer	Client, Project Manager, Consultant, Contractor, Suppliers	Client, Project Manager, Consultant
Output			
Feasibility study, Project proposal, Execution strategy	Baseline plan, design drawings and specifications	Completed project output	Project closeout report
Approval			
Go/no go decision	To implement project	Ready to commission	Deliverable accepted

Project Life Cycle: Characteristics



- ✦ Importance of **front end planning**: Level of influence, Potential to Add Value, Level of Uncertainty Vs Level of Information, Cost to change

Project Vs product life cycle



Project Vs product life cycle



- In many projects (particularly construction projects), the **product of the project** long out spans the **project**.
- Very crucial to **Value Engineer** various alternative for **product life cycle costs** rather than the simplistic **project life cycle cost**.
- **Discounted cash flow** (for alternative selections) analysis should focus on **product life cycle**.

Project Management Processes

Processes are sets of interrelated actions and activities that are performed to achieve objectives

- Project Management Processes

- ❖ are common to most project most of the time
- ❖ Involve processes needed for **initiating, planning, executing, monitoring & controlling** and **closure** of projects.

- Product Oriented Processes
 - ï Processes that **specify** and **create** the project's product
 - ï typically defined by the **project life cycle** and **vary by application area**.
 - ï Eg. Geometric design, asphalt design, clearing and grubbing, etc

Efficient integration of these processes is of paramount importance for the **project's success**

1. Links Among Process Groups in a Phase

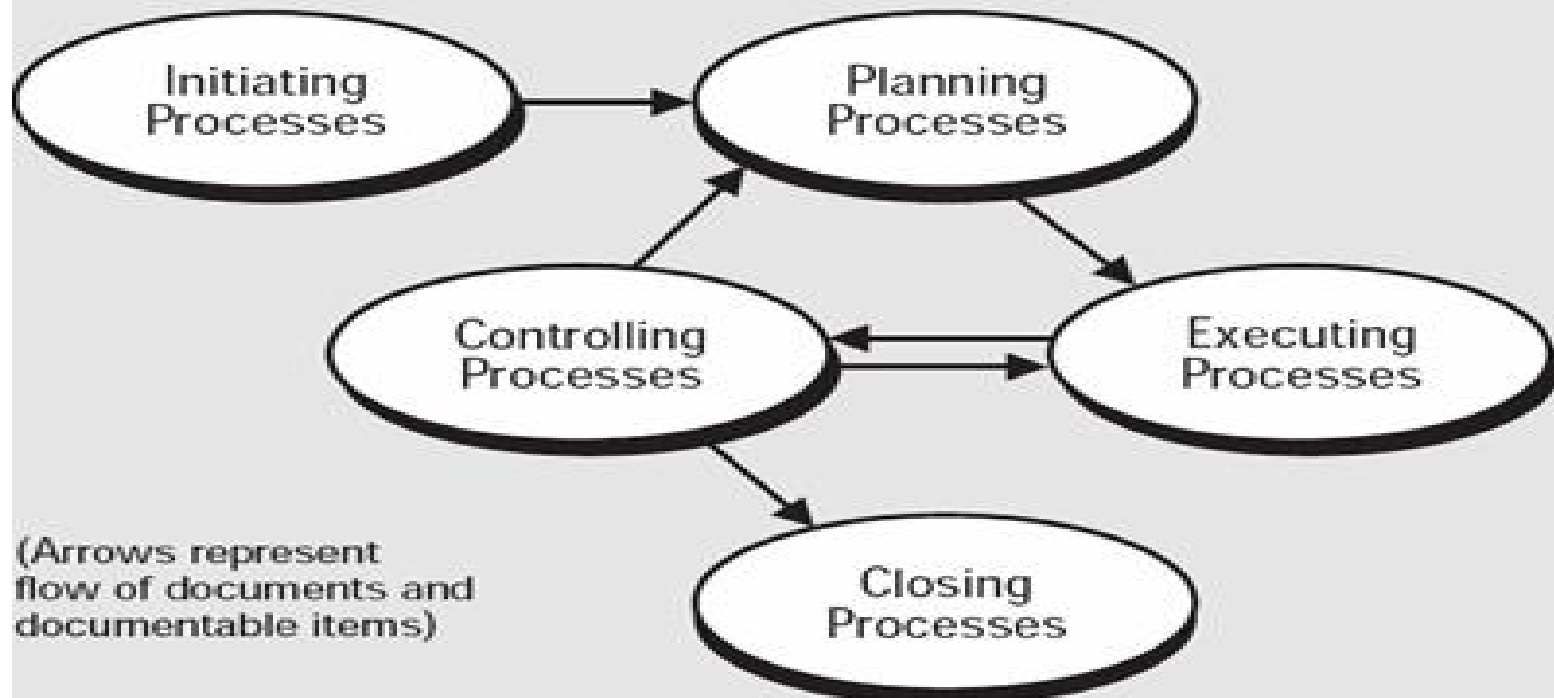
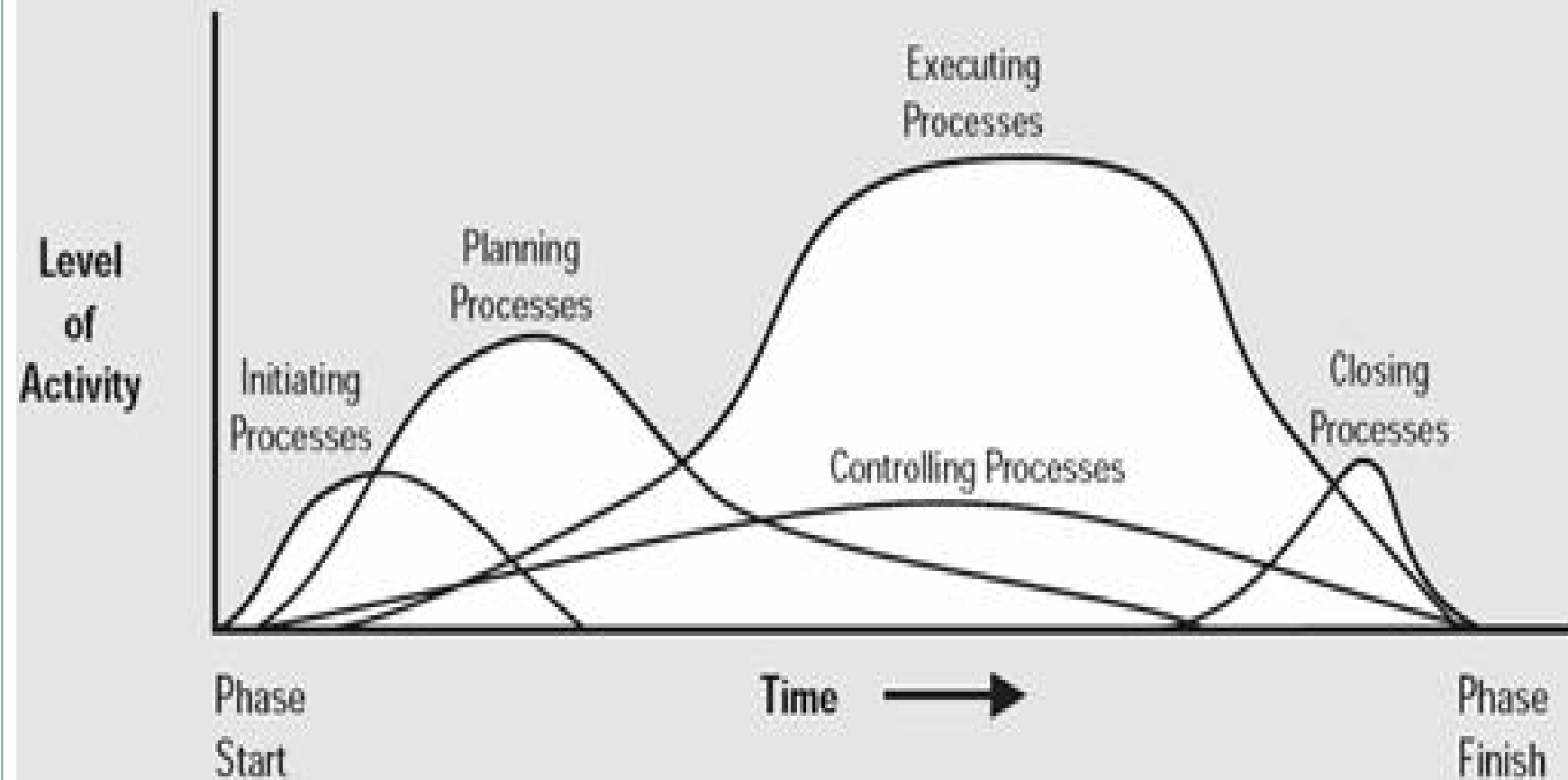
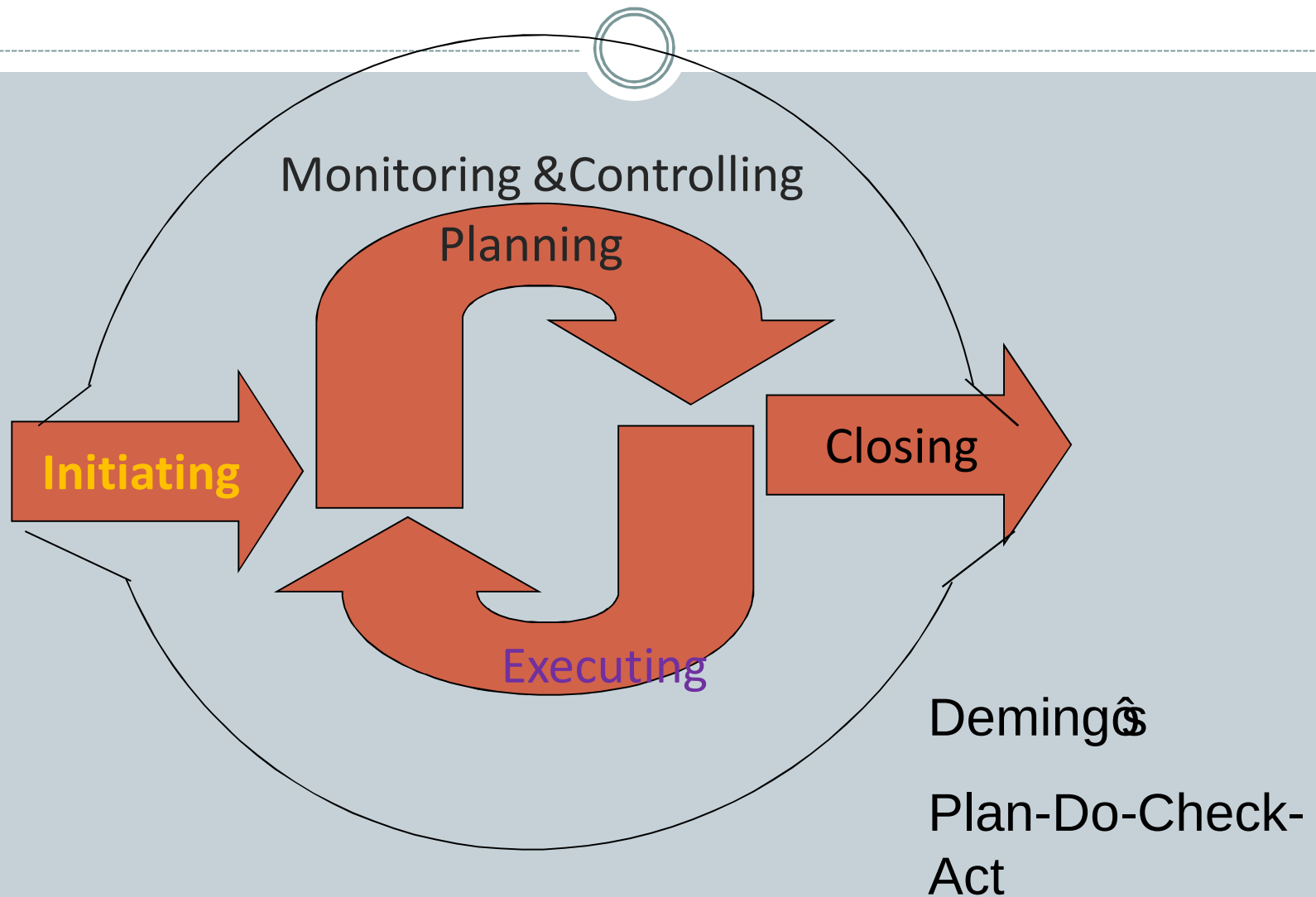


Figure 3-2. Overlap of Process Groups in a Phase



Project Management Processes



Initiating Processes



- Are the processes needed to **define** and **authorize** the project or its phases
- **Developing project charter** and **developing preliminary project scope statement**

Initiating processes



- *Project charter* also called TOR
 - Provided buy client
 - Initiates a project
 - Tight worded document comprising:
 - ✦ Background to the project
 - ✦ Key assumptions
 - ✦ Business needs and other commercial needs
 - ✦ Scope of work
 - ✦ Identify key activities, budgets and milestones
 - ✦ Comment on how the project is to be managed
 - ✦ Etc

Planning processes



- Are processes that **define** and **refine objectives** and plan courses of actions required to attain the objectives
- Processes needed for a systematic way of deciding in advance **what** is to be done and in **what amount**, **how** it is to be done **when** it is to be done and **how much** it costs to achieve objective.
 - **What?** Scope/quality planning
 - **How?** Resource/procurement/communication/risk planning
 - **When?** Time planning
 - **How much?** Cost planning

Final document: Project management plan

Planning processes: Output



- Scope plan: All the works and only the works required to achieve objective and to the quantity required: Build methods, WBS, etc
- Quality plan: quality standards, specifications, manuals, etc to ensure quality
- Time plan: Schedules showing the *time frames* for the execution of each activity in such a way that the project *satisfies the projects constraint of time*
- Resource plan: resources required for the execution of the project in terms of *type, amount, time frame* needed as well as when/how the deployments needs to be done
- Procurement plan: clear indications as to *buy or make* options, *how procurements* are need to be made and when they need to be made
- Communication plan: OBS & RAM
- Risk management plan: All *potential risks* and possible way of *managing them*
- Cost plan: *Cash flow* Vs *Income* reconciled

Executing processes



- Are processes that need to be **executed to achieve** the project requirements
- Most are **product oriented** ones
- The major project management processes include, team acquisition, team coordination, information distribution,

Monitoring and controlling



- Are processes performed to:
 - 'Monitor' project execution,
 - Provide control mechanism to avoid deviations from plan
 - Check if there are any deviations from plan,
 - Evaluate effects of deviation and provide possible courses of actions

Monitoring Resource Performance



Å **Resources and Crews Productivity Monitoring & Evaluation System**

Å Worker's Productivity

Å **Work units produced / Wo-Man hour used**

Å Record's

Å Time keepers' records (Manpower time card)

Å Daily or Weekly Labour productivity report

Å Causes of High and Low Productivity Rate

Å Worker's low moral, poor pre-work preparation, etc

Å Material's Productivity if produced on site

Å **Work units produced / Material Quantity produced**

Å Resources Mobilization Monitoring

Å **Delivered / made available against Planned**

Closing processes



- Are processes that need to be executed to bring the project (or its phase) to **a formal closure**
- Incorporate compiling and handing over of:
 - **As built drawings, operating manuals, lessons learned, etc**
 - **Certification of acceptance**



Introduction to knowledge areas of project management

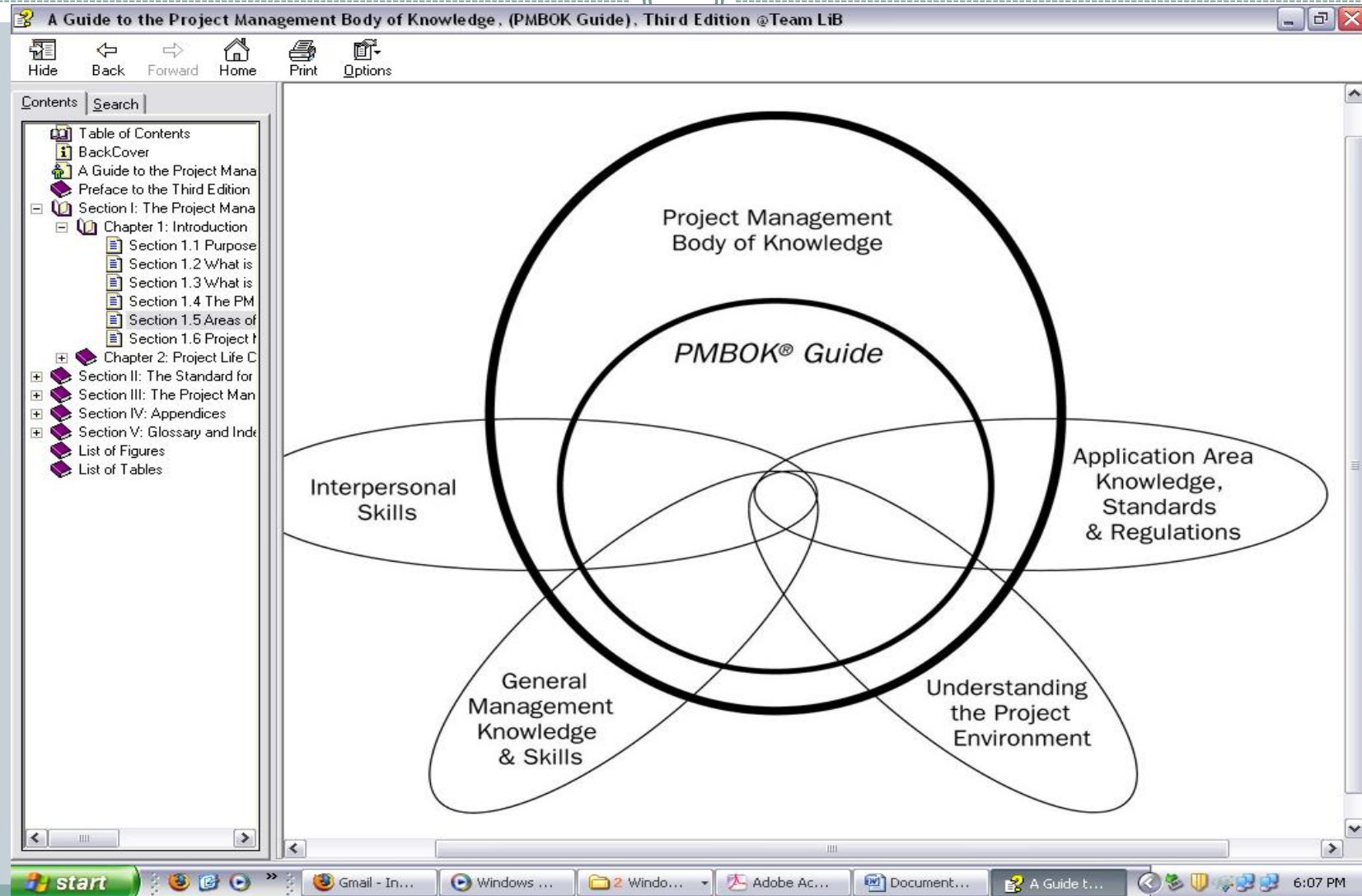
Introduction



MAJOR SKILLS NEEDED TO MANAGE PROJECTS

Construction project works are complex endeavours that demand various **technical, managerial, and other capacities** for their success. To be successful in a project work, the project management team need to setup itself in such a way that they have all the major capacities and competencies necessary to accomplish the work at hand efficiently and effectively.

MAJOR SKILLS NEEDED TO MANAGE PROJECTS



MAJOR SKILLS NEEDED TO MANAGE PROJECTS



1. Project management body of knowledge

Managing construction projects to success demands various project management knowledge, technique, skills etc. In these regard, the project management team needs to develop appropriate capability in terms of such project management competencies throughout the project life cycle as it is appropriate.

MAJOR SKILLS NEEDED TO MANAGE PROJECTS



2. Construction Area Knowledge

- Construction technology
- Construction material and equipment management and **current situation**
- Construction industry practices:
 - Construction (building, road, water works, etc) **codes, standards, norms** and **specifications**
 - Construction contracting (DBBs, DBs, CMs, PPPs,). Lump sum, rated, cost plus, etc. Contracting principles and documents: FIDIC, MoWUD, PPA, ACP,-EDF, etc. Claims, ADRs, etc.
 - Others: Health and safety, environmental, etc

MAJOR SKILLS NEEDED TO MANAGE PROJECTS



3. Understanding the project environment

- + Cultural and social environment
- + International and political environment
- + Physical environment

Managing the situations!!!

MAJOR SKILLS NEEDED TO MANAGE PROJECTS



4. General management skills

- Stakeholders Management
- Change management (in construction context both project change management well as enterprise change management)
- Financial management and accounting
- Strategic planning, tactical planning and operational planning
- Organizational behavior
- Logistics and supply chain management

MAJOR SKILLS NEEDED TO MANAGE PROJECTS



5. Interpersonal skills

- ✚ Effective communication
- ✚ Influencing the organization
- ✚ Leadership
- ✚ Motivation
- ✚ Negotiation and conflict management
- ✚ Problem solving

PROJECT MANAGEMENT BODY OF KNOWLEDGE



- ✦ Project Integration Management
- ✦ Project Scope Management
- ✦ Project Time Management
- ✦ Project Cost Management
- ✦ Project Quality Management
- ✦ Project Human Resource Management
- ✦ Project Communications Management
- ✦ Project Risk Management
- ✦ Project Procurement Management
- ✦ Project Safety Management
- ✦ Project Environmental Management
- ✦ Project Financial Management
- ✦ Project Claim Management

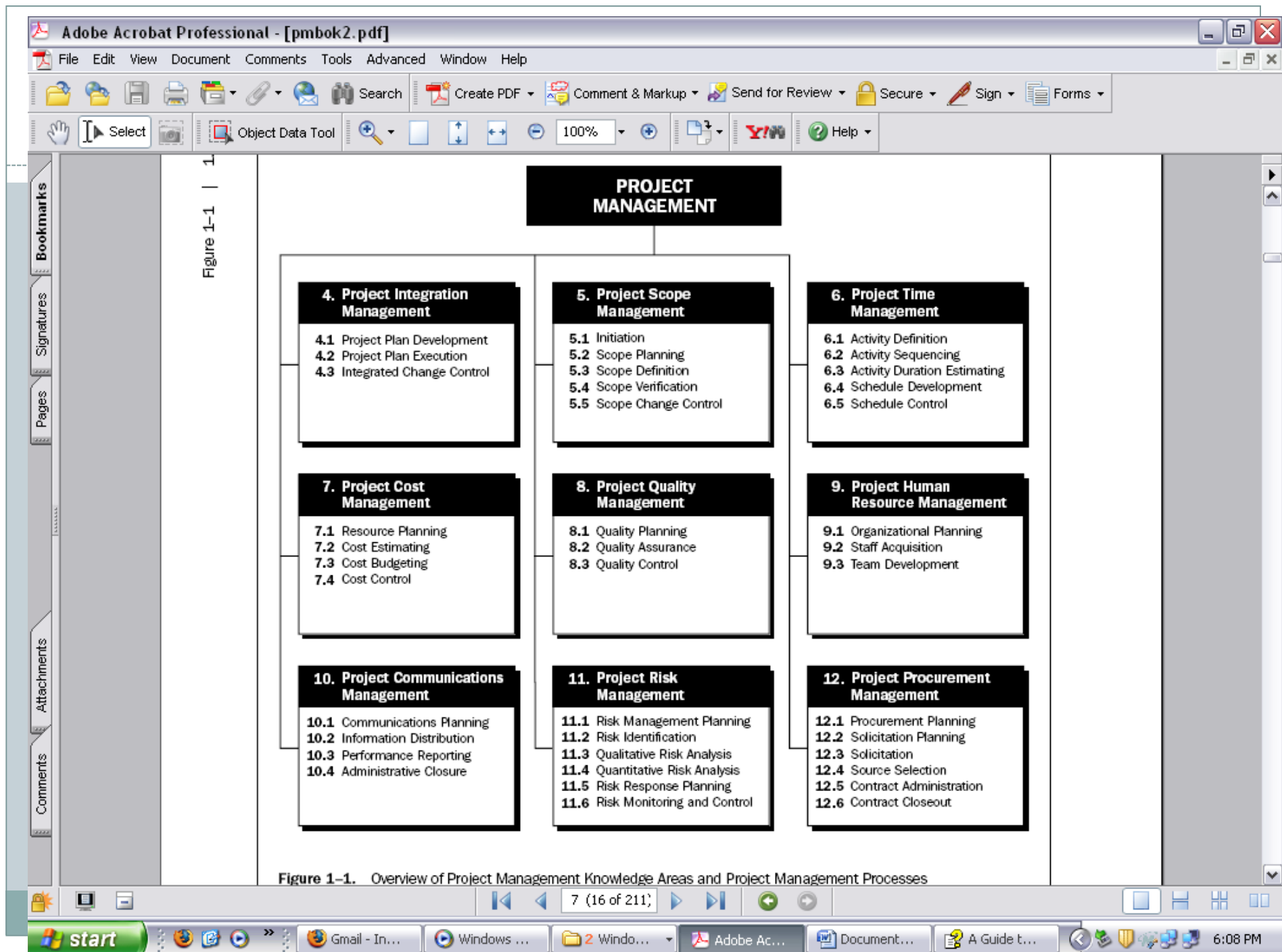
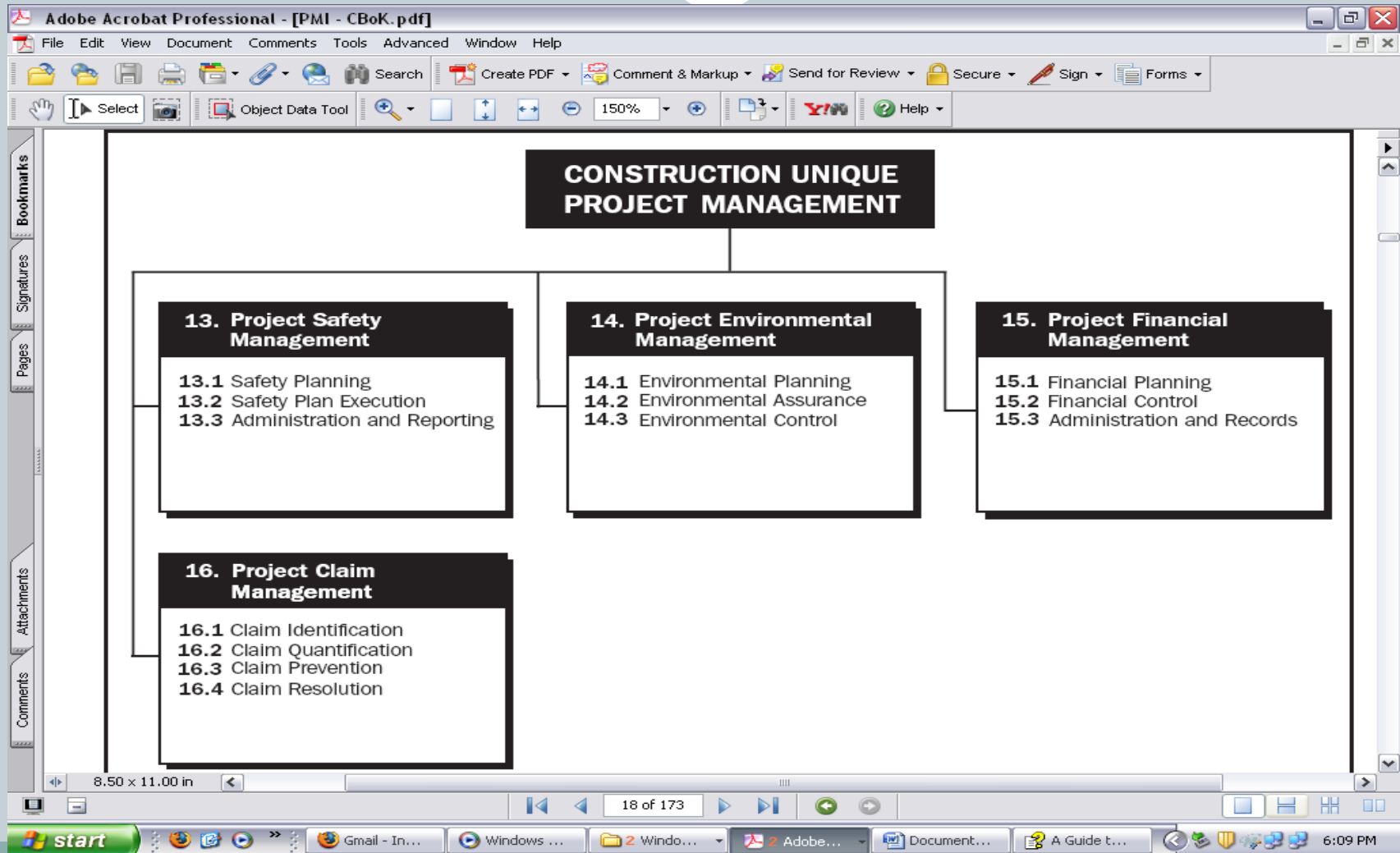


Figure 1–2. Overview of Construction Unique Project Management Knowledge Areas and Project Management Processes





PROJECT INTEGRATION MANAGEMENT

Project Integration Management



✚ Describes the **processes** and **activities** that integrate the various **elements** of **project management**, which are identified, defined, combined, unified and coordinated within the **Project Management Process Groups**.

Project Integration Management

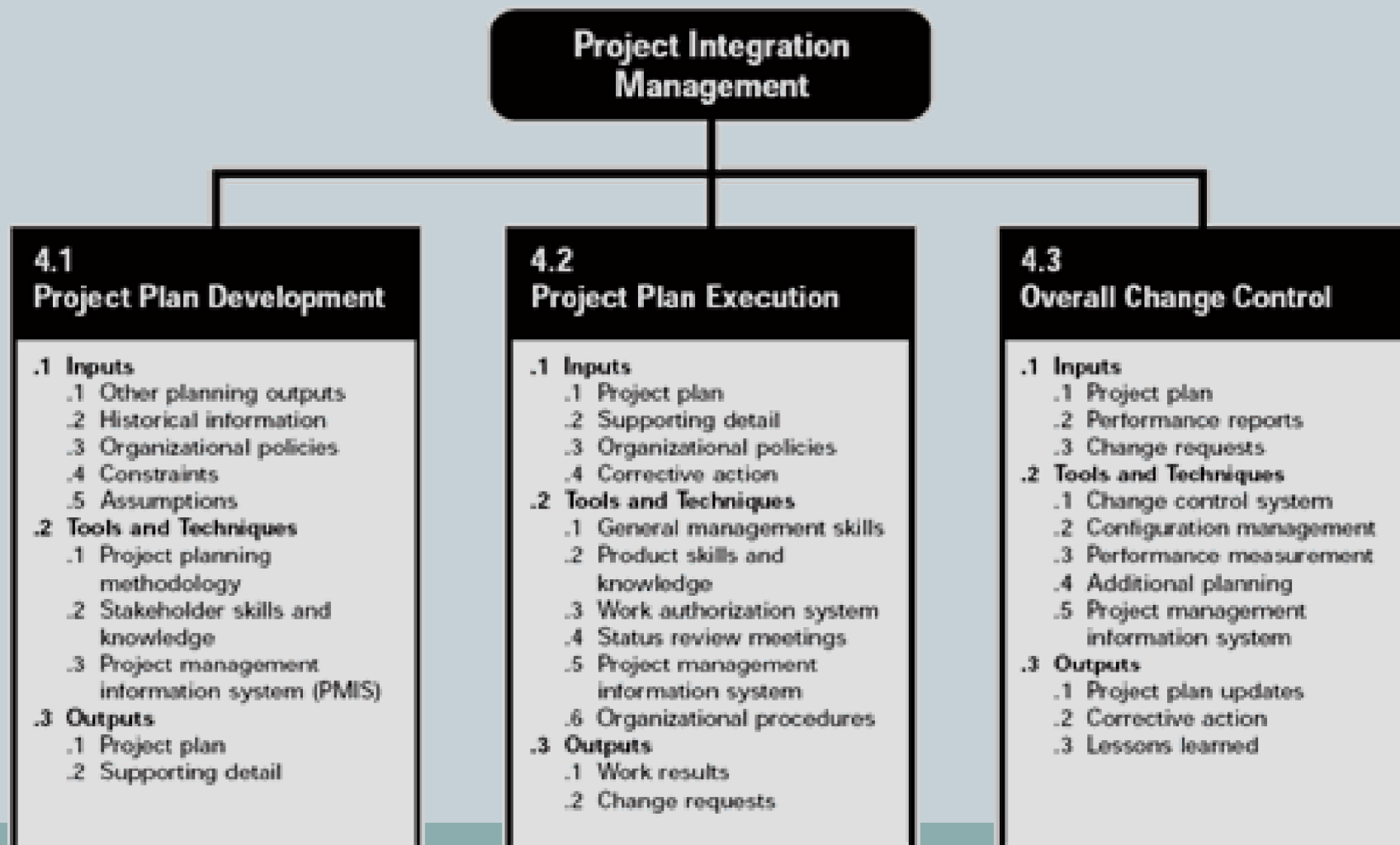


✓ The process in integration management includes:

- ✚ **Project plan development** –taking the results of the other planning processes and putting them into a **consistent, coherent** document.
- ✚ **Project plan execution**-carrying out the project plan by performing the activities included therein.
- ✚ **Overall change control**-coordinating changes across the entire project.

Project Integration Management

Figure 4-1. Project Integration Management Overview





Project Scope Management

Project Scope Management



+ What?

- + Process required to ensure that the project includes *all the work required* to complete the project successfully

+ How?

- + Scope planning
- + Scope definition
- + Scope verification
- + Scope control

Scope Planning

✚ Process of **creating** the project scope management plan that enable to **define**, **verify**, and **control** the project scope.

Scope definition



- ✚ **What?** Process of developing **detailed project scope statement** that enable to guide the project work.
- ✚ **How?** Determines **execution strategy** and conducts **product analysis** to create **WBS** and **build method**.

Build Method



+ Outlines how the product will be assembled or implemented.

+ *Drawings, Specifications and Statements of Work.*

Work Breakdown Structure (WBS)

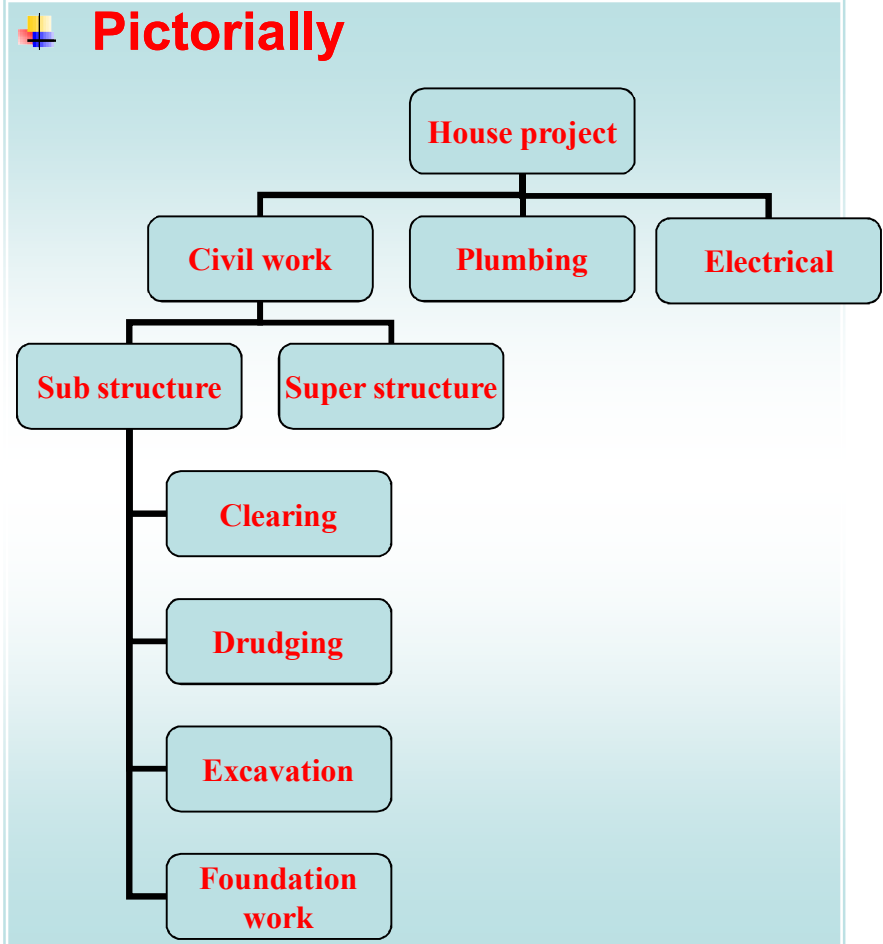


- ✚ **What?** a deliverable-oriented hierarchical decomposition of the works to be executed by the project team to accomplish the project objectives and create the project deliverables.
- ✚ **How?** via **systematic decomposition** of the overall job into smaller chunks which are **easily manageable**.

Formats of WBS

✚ Text Indention

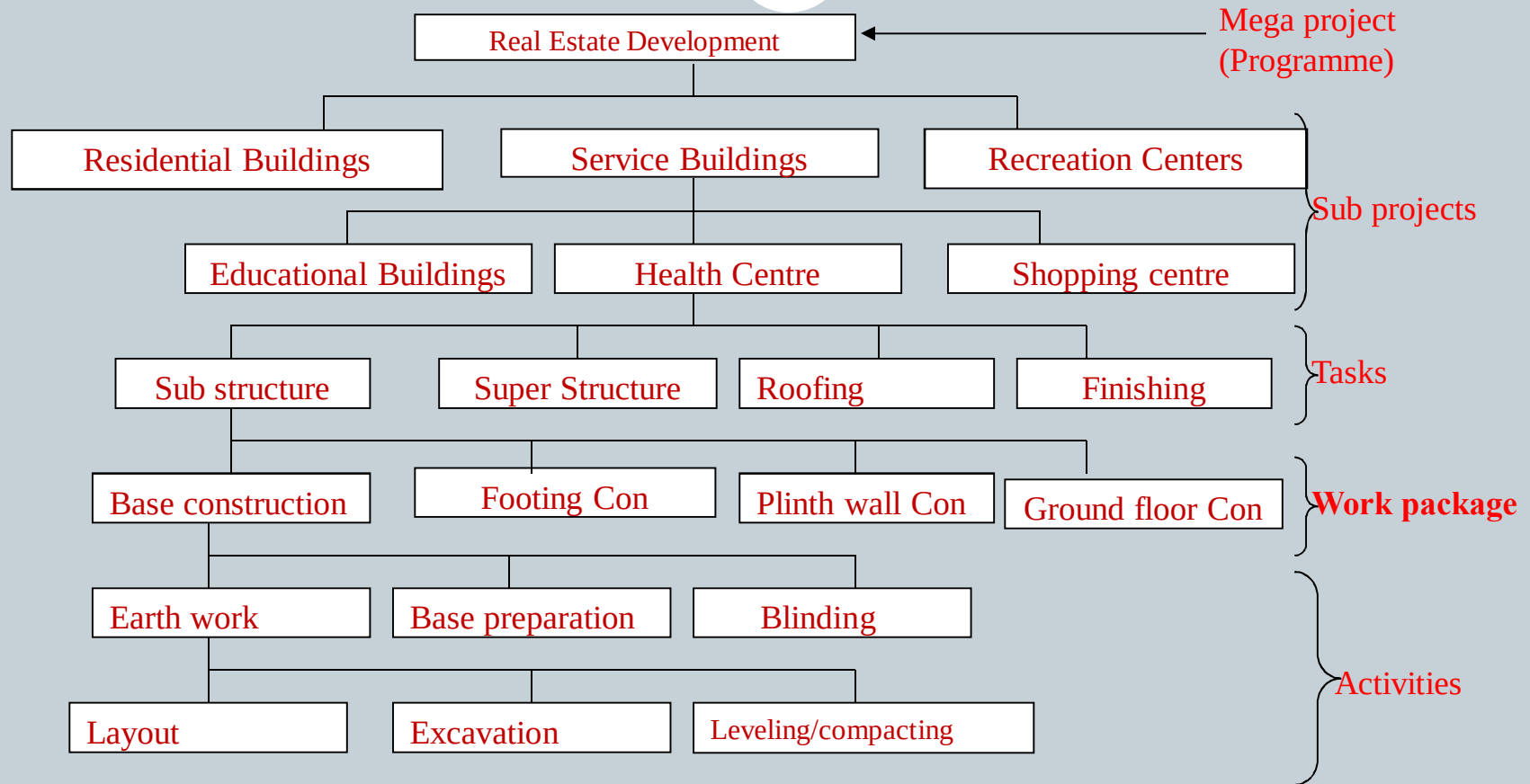
- ✚ A house project
 - ✚ Civil work
 - ✚ Sub structure
 - ✚ Clearing
 - ✚ Drudging
 - ✚ Excavation
 - ✚ Rebar fixing
 - ✚ Concert casting
 - ✚ Super structure
 - ✚ Plumbing
 - ✚ Electrical



WBS: Level of Divisions



- ❑ To the level that **estimates and forecasts** about the resources required, durations and activity relationships are **realistically estimated for each activity**;
- ✚ **Sub-project level**: Sub projects are derived by dividing a large project, usually termed *a program*, into independent large-volume mini projects.
- ✚ **Task level**: A task is an identifiable and deliverable major work which can be performed without major interference from other tasks.
- ✚ **Work package level**: A work package contains a sizeable, identifiable, measurable, constable and controllable package of work.
- ✚ **Activity level**: An activity is a sub division of a work package and is defined as a work which has a definite start and end and consumes resources.
- ✚ **Operations level**. Operations are sub-divisions of activities and generally are comprised of particular types and a fixed group of resources associated with it.



Scope verification



✚ Process of formally accepting the project deliverables.

✚ **Consultant supervision**

Scope control



- ✚ Process that is concerned with influencing those factors that could have resulted in scope change and containing its impacts.
- ✚ All the scope controlling processes conducted by the performing organization.



Project Time Management

Time management



✚ **What?** all the processes that need to be adopted to ensure the timely completion of the project.

✚ **How?**

- ✚ Activity Definition
- ✚ Activity Sequencing
- ✚ Activity Duration Estimating
- ✚ Schedule Development
- ✚ Schedule Control

Activity definition



✚ What? the processes of determining the specific activities that need to be executed to achieve objectives.

✚ How?

✚ WBS

Activity sequencing



- + What? processes of determining the job logic.
- + How?

+ S-S

+ F-S

+ F-F

+ S-F

Activity duration estimation



✚ **What?** Determination of duration of time that an activity's execution takes.

✚ **How?**

$$D_{ij} = \frac{A_{ij}}{P_{ij} N_{ij}}$$

✚ One Time Estimate

$$Te = \frac{To + 4 Tm + Tp}{6}$$

✚ Three Time Estimate

✚ Trapezoidal Estimate (takes **learning curve** into consideration)

Schedule development



✚ **What?** establish the start and finish time of each and every activity and the overall project

✚ **How?**

- ✚ The Bar Charts

- ✚ Line of Balance Chart

- ✚ The Networking Schedule Technique

 - ✚ The Critical Path Method (CPM),

 - ✚ The Performance Evaluation & Review Technique (PERT)

 - ✚ Critical Chain Method



Project Cost Management

- Cost estimation
- *Income Forecast/cash flow*
- *Cost control*

F
O
C
U
S



Project cost management



✚ What? all the processes needed in **planning**, **estimating**, **budgeting** and **controlling** of costs so that the project is finished within budget

✚ Objective:

- ✚ Product of the **project making a profit**,
 - ✚ The **project financing itself** through the project life cycle
- How?
- ✚ Cost estimation
 - ✚ Income Forecast/cash flow
 - ✚ Cost control

Cost estimation



- ✚ The processes of determining **cost of doing a project and the outflow** profile.
- ✚ *It combines:*
 - ✚ Scope of work
 - ✚ Resource/procurement rates and deployment
 - ✚ Time schedules

Cost estimation



Types: Based on the quality of information available and the effort put into compiling the estimate

- ✚ **Conceptual Estimates**

- ✚ is a rough estimating technique which depends on rough scope of work. Conceptual estimates usually used to **filter projects** that may deserve further investigation.

- ✚ **Feasibility Estimates/Preliminary Estimate/ Comparative Estimate**

- ✚ Project Estimate made along with the feasibility study. It generally is expected to produce +/- 10% accuracy.

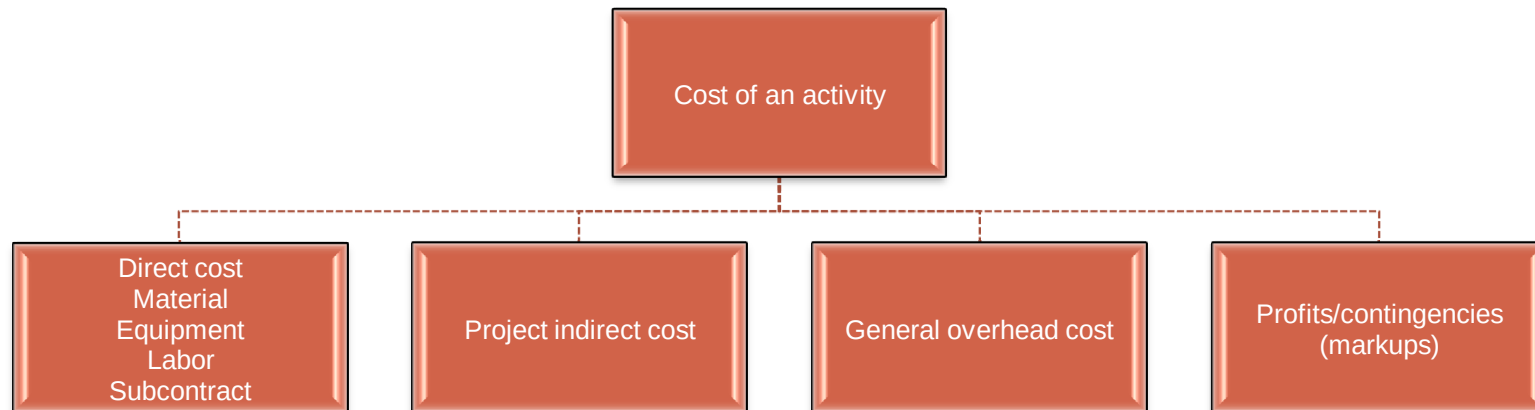
- ✚ **Definitive Estimates/Detailed Estimate/ Project Control Estimate/Quotation or Tender**

- ✚ is the estimate that will be conducted after having the design and Planning information.

Cost estimation

Definitive estimates

- Generally, such estimates are rolled up after having costing of each activity that comprise the project's work plus *contingencies*.



- Help to determine the cost of each activity fairly easily by adding the all the costs. By loading this to the schedule of the project, the project manager will have a *cost-loaded diagram*.

Cost estimation



A cost-loaded diagram provides various advantages for the project manager.

- ✚ Provides an easy start point for the preparation of the cash-flow diagram which is the fundamental tool for budgeting;
- ✚ Helps reduce amount of subjectivity in pay requests during execution of the project. Pay requests to each activity executed [or its percentage] can be tailored to the amount allocated for;
- ✚ Helps to identify and rectify problems arising by *front-end loading* and incorrect billing by contractors. As each activity is priced and the cost shown, the tender evaluators can easily recognize whether the early activities are overly priced or not;

Facilitates decisions whether to *crash* or not;

Income Forecast/cash flow



Example-cash flow

No	Item description	Duration	Amount	1	2	3	4	5	6
				50	50				
1	Excavation to Waste	2	100,000						
					130	130			
2	Capping Layer	2	260,000						
						100	100		
3	Sub-base Course (25cm)	2	200,000						
							200	200	
4	Base-Course (20cm)	2	400,000						
									150
5	Prime Coat	1	150,000						
	Total		1110,000	50	180	230,000	300,000	200,000	150,000
	Cumulative		0.00	50,000	50,180	280,180	580,180	780,180	930,180

Income forecast

Cash inflow



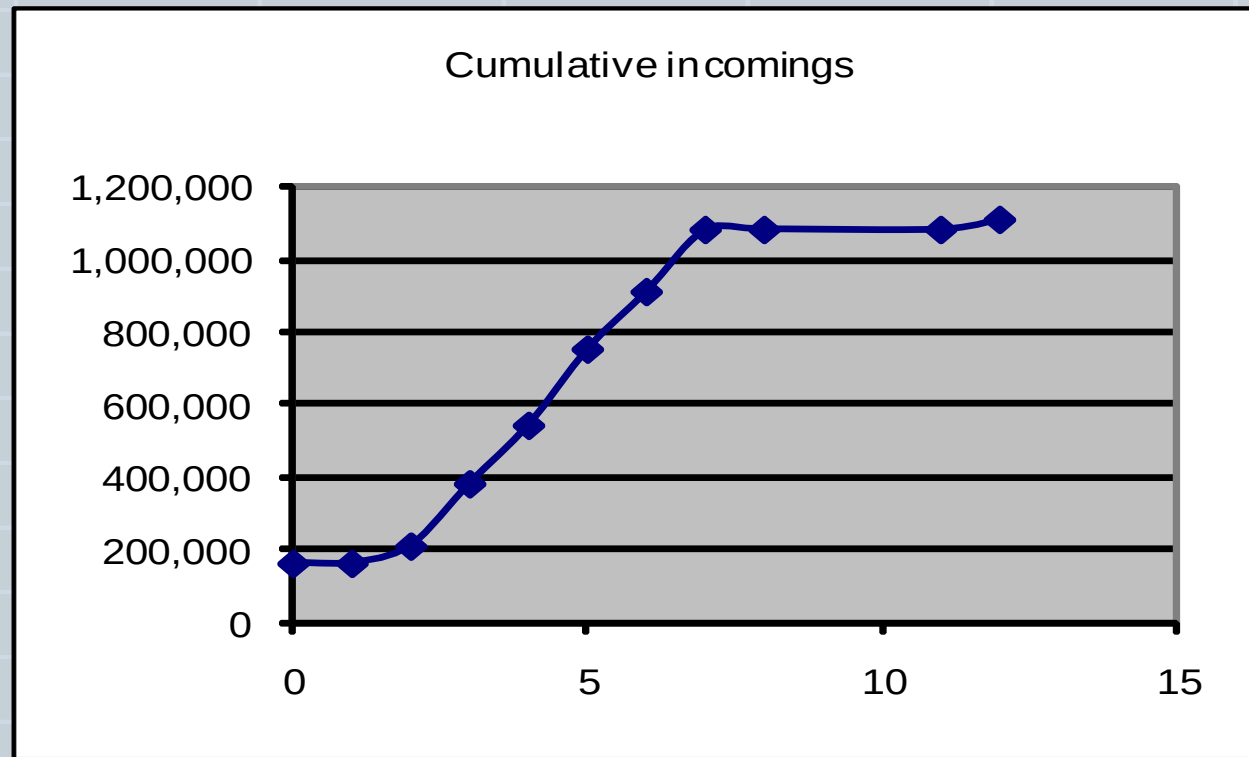
Cash Inflow

	t=0	M1	M2	M3	M4	M5	M6	M7		M11	M12
Work done by measurement		50,000	180,000	230,000	300,000	200,000	150,000				
Recoveries towards advance payment @ 25.3%				58,199	75,912	32,389					
Retention @ 5% of gross invoice		2,500	9,000	11,500	15,000	10,000	7,500				
Payment due		47,500	171,000	160,301	209,088	157,611	142,500				
Cash received (one month delay)			47,500	171,000	160,301	209,088	157,611	142,500			
Release of retention								27,750			27,750
Total Incomings	166,500	0	47,500	171,000	160,301	209,088	157,611	170,250			27,750
Cumulative incomings	166,500	166,500	214,000	385,000	545,301	754,389	912,000	1082,250	1082,250	1082,250	1110,000

Cash Outflow

Work done by measurement		50,000	180,000	230,000	300,000	200,000	150,000				
Total cost (reduce 15% for markup)		42,500	153,000	195,500	255,000	170,000	127,500				
Material @ 50%		21,250	76,500	97,750	127,500	85,000	63,750				
Labor @ 15%		6,375	22,950	29,325	38,250	25,500	19,125				
Equipment and Plant cost @ 20%		8,500	30,600	39,100	51,000	34,000	25,500				
Site overheads @ 15%		6,375	22,950	29,325	38,250	25,500	19,125				
Material payment (one month delay)			21,250	76,500	97,750	127,500	85,000	63,750			
Labor Payment (no delay)		6,375	22,950	29,325	38,250	25,500	19,125				
Equipment and Plant payment (one month delay)			8,500	30,600	39,100	51,000	34,000	25,500			
Site Overhead cost payment (no delay)		6,375	22,950	29,325	38,250	25,500	19,125				
Expenses due		12,750	75,650	165,750	213,350	229,500	157,250	89,250			
Reducing Mobilization cost @10% from production cost and bringing it upfront	94,350	11,475	68,085	149,175	192,015	206,550	141,525	80,325			
Payment towards Insurance		400	400	400	400	400	400				
Outgoing Total	94,350	11,875	68,485	149,575	192,415	206,950	141,925	80,325			
Cumulative Outgoings		106,225	174,710	324,285	516,700	723,650	865,575	945,900	945,900	945,900	945,900
Month	0	1	2	3	4	5	6	7	8	11	12
Cumulative cash flows	166,500	60,275	39,290	60,715	28,601	30,739	46,425	136,350	136,350	136,350	164,100

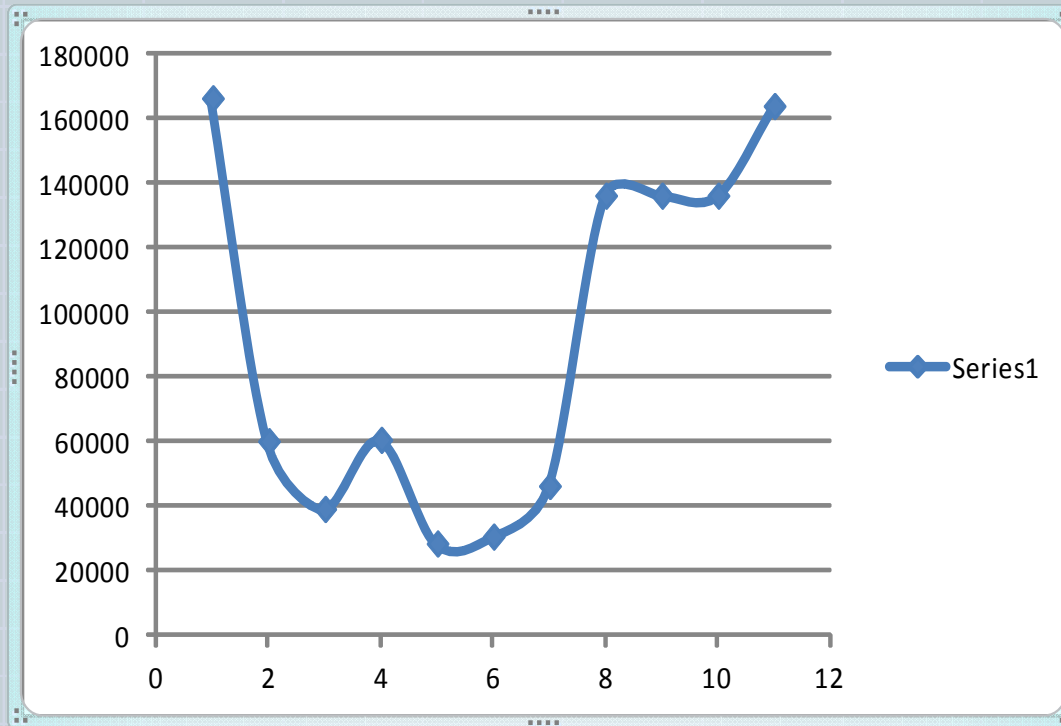
cash flow(incomings)



cash flow(cumulative)



Month	0	1	2	3	4	5	6	7	8	11	12
Cumulativ	166500	60275	39290	60715	28600.91	30739.06	46425	136350	136350	136350	164100



COST CONTROL



✚ **Cost control:** includes all the processes that are needed to account for and influence factors that could lead to **cost change, monitoring cost performance to detect potential drafts, manage cost changes when they occur, etc.**

✚ Such processes are normally effected through **tracking costs to check expenditures, evaluating and forecasting potential changes and effects, and reporting them.**

COST CONTROL



- ✚ The EVA technique is an important tool in **evaluating** and **forecasting**.
- ✚ Earned Value analysis is a method of **performance measurement**.
- ✚ **Earned Value** is a program management technique that uses ñwork in progressò to indicate what will happen to work in the future.
- ✚ However, the output is only as good as the input data and the appropriate tracking of costs and changes.

COST CONTROL(EVA)



+Description of Earned Value Management Terms

+Three quantities form the basis for cost performance measurement using Earned Value Management are:

- + Budgeted Cost of Work Scheduled (BCWS) or Planned Value (PV),

- + Budgeted Cost of Work Performed (BCWP) or Earned Value (EV) and

- + Actual Cost of Work Performed (ACWP) or Actual Cost (AC) .

+Budgeted Cost of Work Scheduled (BCWS) or Planned Value (PV)

The sum of budgets for all work packages scheduled to be accomplished within a given time period.

+Budgeted Cost of Work Performed (BCWP) or Earned Value (EV)

The sum of budgets for completed work packages and completed portions of open work packages.

COST CONTROL(EVA)



✚ **Description of Earned Value Management Terms**

✚ **Actual Cost of Work Performed (ACWP) or Actual Cost (AC)**

The actual cost incurred in accomplishing the work performed within a given time period. For equitable comparison, ACWP is only recorded for the work performed to date against tasks for which a BCWP is also reported.

✚ From these three quantities we can determine our total program budget as well as make a determination of **Schedule and Cost Performance** and provide an estimated cost of the project at its completion.

COST CONTROL(EVA)



Additional terms are defined to record cost and schedule performance and program budget:

Performance Measurement Baseline (PMB) ï The sum of all work packages Budgeted Cost of Work Scheduled (BCWS) for each time period, calculated for the total program duration. The PMB forms the time-phased budget plan against which project performance is measured.

Budget At Completion (BAC) ï The sum of all the budgets allocated to a program.

Schedule Variance (SV) ï The difference between the work actually performed (**BCWP**) and the work scheduled (**BCWS**).

COST CONTROL(EVA)



Additional terms are defined to record cost and schedule performance and program budget:

Cost Variance (CV) is The difference between the planned cost of work performed (**BCWP**) and actual cost incurred for the work (**ACWP**).

Cost Performance Index (CPI) is The ratio of cost of work performed (**BCWP**) to actual cost (**ACWP**). CPI of 1.0 implies that the actual cost matches to the estimated cost. CPI greater than 1.0 indicates work is accomplished for less cost than what was planned or budgeted. CPI less than 1.0 indicates the project is facing cost overrun.

COST CONTROL(EVA)



Additional terms are defined to record cost and schedule performance and program budget:

Schedule Performance Index (SPI) i The ratio of work accomplished (BCWP) versus work planned (BCWS), for a specific time period. SPI indicates the rate at which the project is progressing.

Estimate At Completion (EAC) i It is a forecast of most likely total project costs based on project performance and risk quantification. At the start of the project BAC and EAC will be equal. EAC will vary from BAC only when actual costs (ACWP) vary from the planned costs (BCWP).

COST CONTROL(EVA)



Additional terms are defined to record cost and schedule performance and program budget:

Estimate At Completion (EAC)-

Most common forecasting techniques are some variations of:

1.EAC = Actual to date plus a new estimate for all remaining work.

This approach is most often used when past performance shows that the original estimating assumptions were fundamentally flawed, or they are no longer relevant to a change in conditions.

2.EAC = Actual to date plus remaining budget. This approach is most often used when current variances are seen as atypical and the project management team expectations are that similar variances will not occur in the future.

COST CONTROL(EVA)



Additional terms are defined to record cost and schedule performance and program budget:

Estimate At Completion (EAC)-

Most common forecasting techniques are some variations of:

3.EAC = Actual to date plus the remaining budget modified by a performance factor, often the cumulative cost performance index (CPI). This approach is most often used when current variances are seen as typical of future variances.

4.EAC = Budget At Completion (BAC) modified by a performance factor, cumulative cost performance index (CPI). This approach is most often used when no variances from BAC have occurred.

COST CONTROL(EVA)

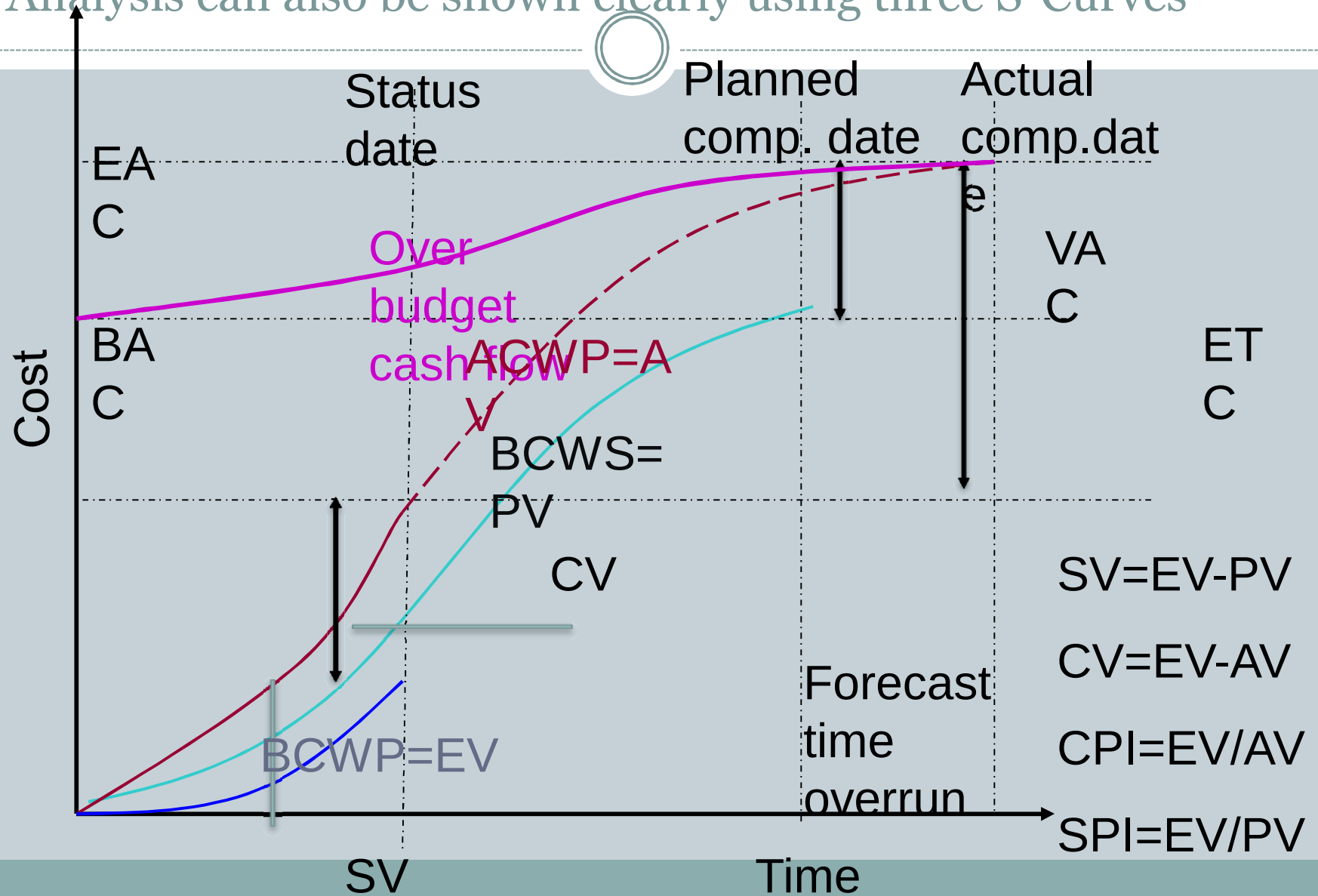


Additional terms are defined to record cost and schedule performance and program budget:

Estimate To Complete (ETC) i The difference between Estimate At Completion (EAC) and the **Actual Cost (AC)**. This is the estimated additional cost to complete the project from any given time.

Variance At Completion (VAC) i The difference between Budget At Completion and Estimate At Completion (EAC). This is the dollar value by which the project will be over or under budget.

The expression used for computations based on EV Analysis can also be shown clearly using three S-Curves





Project Quality Management

Quality



Definition

- ✚ Quality can be defined as meeting the legal, aesthetic and functional requirements of a project.
- ✚ Requirements may be simple or complex, or they may be stated in terms of the end result required or as a detailed description of what is to be done.
- ✚ But, expressed, quality is obtained if the stated requirements are adequate, and if the completed project conforms to the requirements.

Quality



- ✚ In the construction industry, quality can be defined as **meeting the requirements** of the designer, constructor and regulatory agencies as well as the owner. According to an ASCE(American Society of Civil Engineers) study, quality can be characterized as follows.
1. Meeting the requirements of the owner as to **functional adequacy; completion on time and within budget; lifecycle costs; and operation and maintenance.**
 2. Meeting the requirements of the design professional as to provision of **well-defined scope of work; budget to assemble and use a qualified, trained and experienced staff; budget to obtain adequate field information prior to design; provisions for timely decisions by owner and design professional; and contract to perform necessary work at a fair fee with adequate time allowance.**

Quality



3. Meeting the requirements of the constructor as to provision of **contract plans, specifications, and other documents** prepared in sufficient detail to permit the constructor to prepare priced proposal or competitive bid; timely decisions by the owner and design professional on authorization and processing of change orders; fair and timely interpretation of contract requirements from field design and inspection staff; and contract for performance of work on a reasonable schedule which permits a reasonable profit.
4. Meeting the requirements of regulatory agencies (the public) as to **public safety and health; environmental considerations; protection of public property including utilities; and conformance with applicable laws, regulations, codes and policies.**

Quality



Introduction to Quality Management

Project quality management is the process of determining **quality policies, standards, objectives, responsibilities**, etc so that the project fulfils the purpose it is undertaken for.

processes in quality management

Quality planning

- ✚ The process where quality standards that suite the project are identified and ways of fulfilling them is depicted.
- ✚ In the case of construction, such a process usually is presented in the form of **technical specifications, drawings, manuals, etc** that are compiled with through analysis of the projects purpose.

Quality



Processes in quality management

Quality assurance

- ✚ is the process of applying the quality criteria set out in the planning phase and ensure that the project employs all the processes needed to meet requirements.
- ✚ Its major purpose is to ensure that the project and its product satisfy the purpose it is undertaken.

Quality



Processes in Quality Management

✚ *Quality control:*

- ✚ is a process of monitoring executions and products in order to determine if they satisfy relevant quality standards, and if they don't see into the causes of the deviations and their effects.
- ✚ The common practice in construction is that, project supervisors inspect projects as a quality control mechanism while performing organizations (contractors) are said to make sure that what they do satisfies quality requirements-hence perform quality assurance.

COST OF QUALITY



✚ Cost incurred to ensure quality requirement and evaluate that the quality requirement are being met (**Cost of Conformance**) and any other cost incurred as a result of poor quality being produced (**Cost of Non-Conformance**).

COST OF QUALITY



Cost of Conformance

- ✚ Cost incurred to ensure complete compliance of products and services to the quality requirements of customers by ensuring that the products are produced defect free in the very first place. This includes **prevention and appraisal costs**.

Cost of Non-Conformance

- ✚ Cost incurred to correct the defective product produced as a result of poor quality. This includes **internal and external failure costs**.
- ✚ **Cost of Quality = Prevention + Appraisal + Failure Costs**

Quality Cost Models :

A) Prevention Appraisal Failure (P-A-F) Model

- 1. Prevention Costs***
- 2. Appraisal Costs***
- 3. Failure Costs***
- ***Internal Failure Costs***
- ***External Failure Costs***

B) Cost of Conformance – Cost of Non Conformance (COC - CONC) Model

- 1. Cost of Conformance***
- 2. Cost of Non Conformance***

PREVENTION COSTS



+ Prevention costs are the costs for activities to keep defects from occurring in the first place.



+ **These include**



TRAINING



CUSTOMER SURVEYS



PROCESS QUALITY DESIGN



PRODUCT QUALITY DESIGN



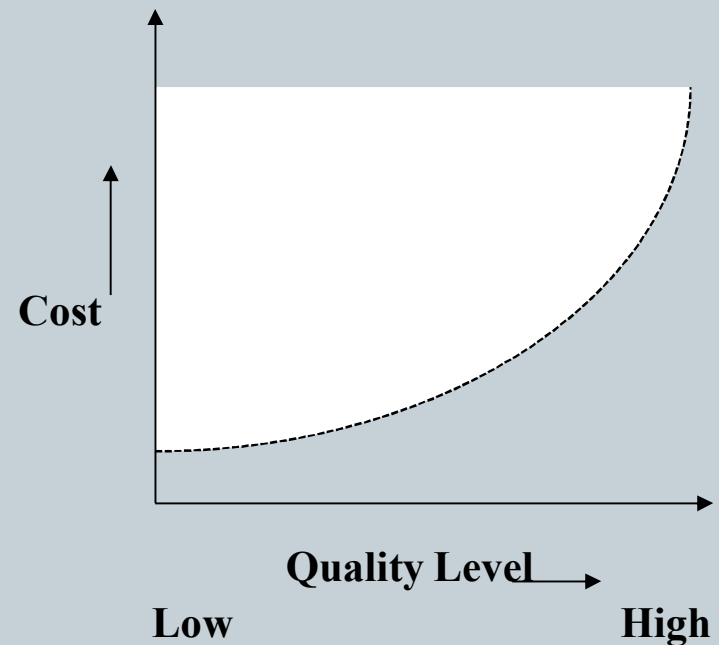
SERVICE QUALITY DESIGN



QUALITY SYSTEMS AUDITS



SUPPLIER REVIEWS / RATINGS



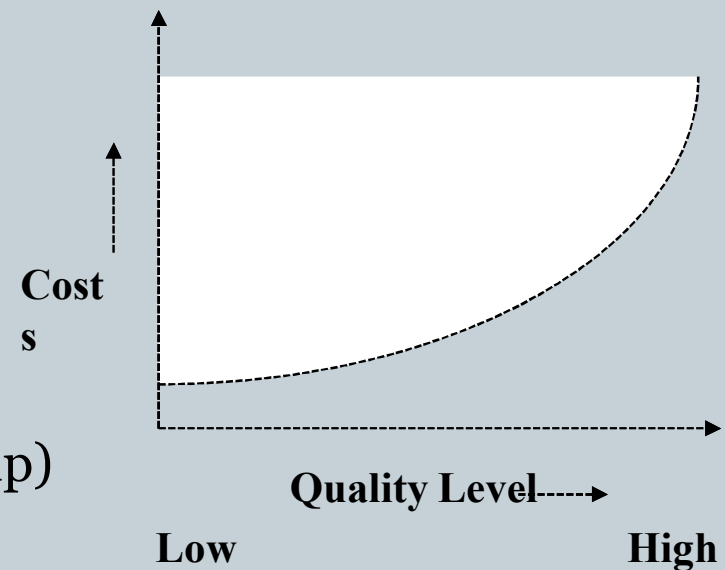
APPRAISAL COSTS



- Appraisal Costs represent expenses for maintaining company quality levels by means of formal evaluations of product quality

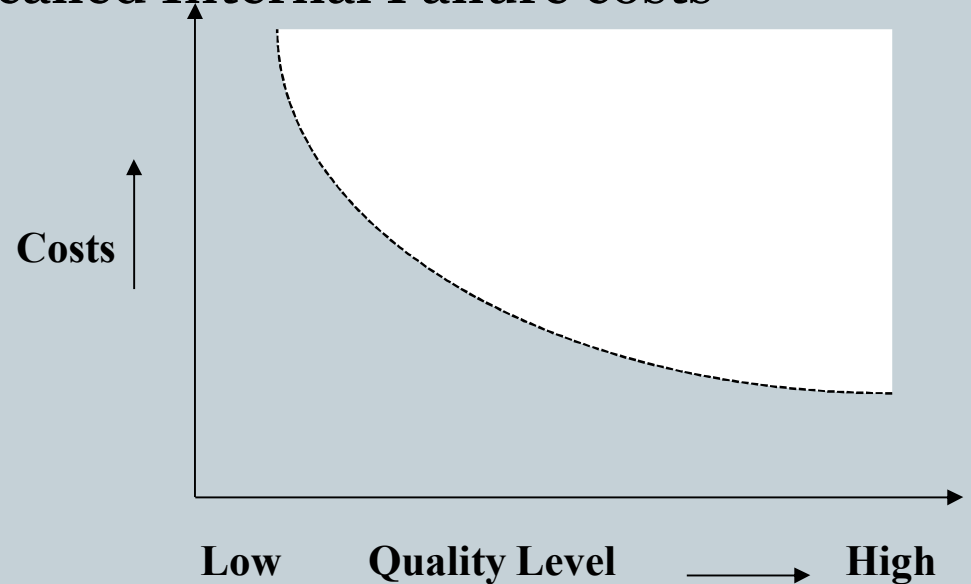
These include

- + INSPECTIONS (Incoming, Planned, Set-up)
- + TESTS
- + TEST EQUIPMENT MAINTENANCE
- + INSPECTION AND TEST REPORTING
- + QUALITY SYSTEM EXPENSE REVIEW
- + PROCESS CONTROL MEASUREMENT
- + SERVICE EVALUATIONS
- + OTHER QUALITY EVALUATIONS / AUDITS



INTERNAL FAILURE COSTS

- Failure costs that arise before the company supplies its product to the customer are called Internal Failure costs



These include

- SCRAP
- RE's: (Rework, Repair, Reinspect, Retest, Redo)
- DESIGN CHANGES
- EXCESS INVENTORY
- DISPOSITION COSTS
- PURCHASED MATERIAL REPLACEMENT

EXTERNAL FAILURE COSTS



+ Failure costs that arise after your company supplies the product to the customer

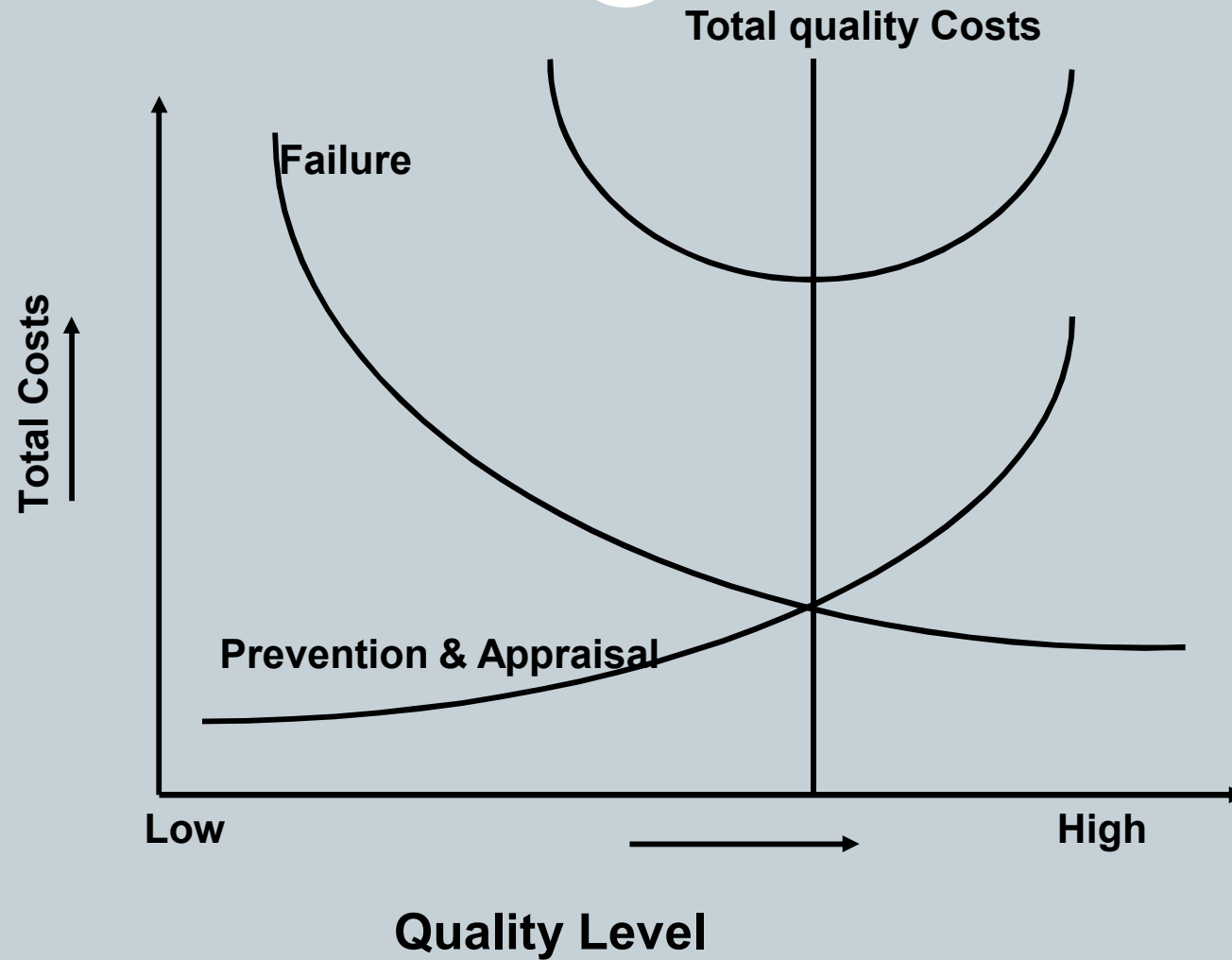
+ **These include**

+ RETURNS

+ PENALTIES

+ WARRANTY WORK

QUALITY COSTS





Project Resource management

Resource Management

Major resources in construction: **Material**,
Labor (HR), **Equipment**

Level of Mechanization

Å Low (labor Intensive)

Å Used in light constructions

- + Low rise buildings
- + Small structures in road constructions
- + Small irrigation projects, etc

Å Very useful in creating job opportunities

Å High (Machine intensive)

Å Used in heavy constructions like

- + High rise buildings
- + Road projects
- + Hydropower projects
- + Mining projects
- + Mechanized irrigations, etc

Å Help achieve high quality efficient execution of tasks

Resource Management: Procedure



- + Resource Estimation and Selection
- + Resource Scheduling & Checking Resource Availability
- + Resource Deployment
- + Resource Utilization
- + Resource Demobilization

Resource Management



+ Resource estimation and selection

- + Scope of work
- + Productivity of resource
- + Optimum combination of resources
- + Duration and time period work needs to be executed

Resource Management: Procedure



+ Resource scheduling & checking resource availability

A clear time table needs to be set up to determine when certain resource is needed on site and for how long. These, indeed is highly dependent of the **work schedule** and **time constraint of both the activities and the resources.**

Resource Management: Procedure



+ Resource scheduling & checking resource availability: Depends on:

- + Activity and resource schedule constraints
- + Availability should take into consideration
 - In house and possibility of sourcing in (lease, rent)
- + Commitments (industry wide and firm commitments)
- + Off times
 - Maintenance, upgrading, etc for equipments
 - Sick, holiday, annual, etc leaves for human resource
 - Low production times for materials

Resource Management: Procedure



+ Resource deployment

- Most, particularly machineries demand **lead time** if to be purchased.
- Options of **just in case stocking** and **just in time delivery** needs to be compared.

Resource Management: Procedure



Resource utilization

- ✦ Down time of work resources
 - Resources at their most productive works
 - Right combination of dependent resources
 - Appropriate maintenance schemes
 - Proper inventory
 - Motivational and leadership traits
- ✦ Waste of materials
- ✦ Company wide resource trade-off for portfolios of projects

Resource demobilization



PROJECT COMMUNICATION MANAGEMENT

PROJECT COMMUNICATION MANAGEMENT



- + Communication entails the **formal** or **informal** way of interacting with people.
- + In a project environment, it incorporates timely and appropriate generation, collection, distribution, storage, retrieval and ultimate disposition of project information to the appropriate recipients. ➔ Processes!

PROJECT COMMUNICATION MANAGEMENT



Advantage of proper communication

Indeed it is through proper communication that project managers/team leaders give:

- ✚ Direction to project teams
- ✚ Hold meetings with and pass decisions with various stakeholders
- ✚ Report performance and possible courses of actions
- ✚ Relay information and ideas to project participants, public etc.
- ✚ Etc



Project Risk Management

Focus

- ✚ Risk in construction projects
- ✚ Risk management processes

Risk Management



- ✚ Risk management is process of selecting ways of **identifying, analyzing** and **responding** to risks.
- ✚ It is concerned with risk **management plan, risk monitoring and controlling**, and **responding** to risks when they occur.
- ✚ It decides how to approach, plan and execute risk management activities for the various risks involved in delivery of a certain project.

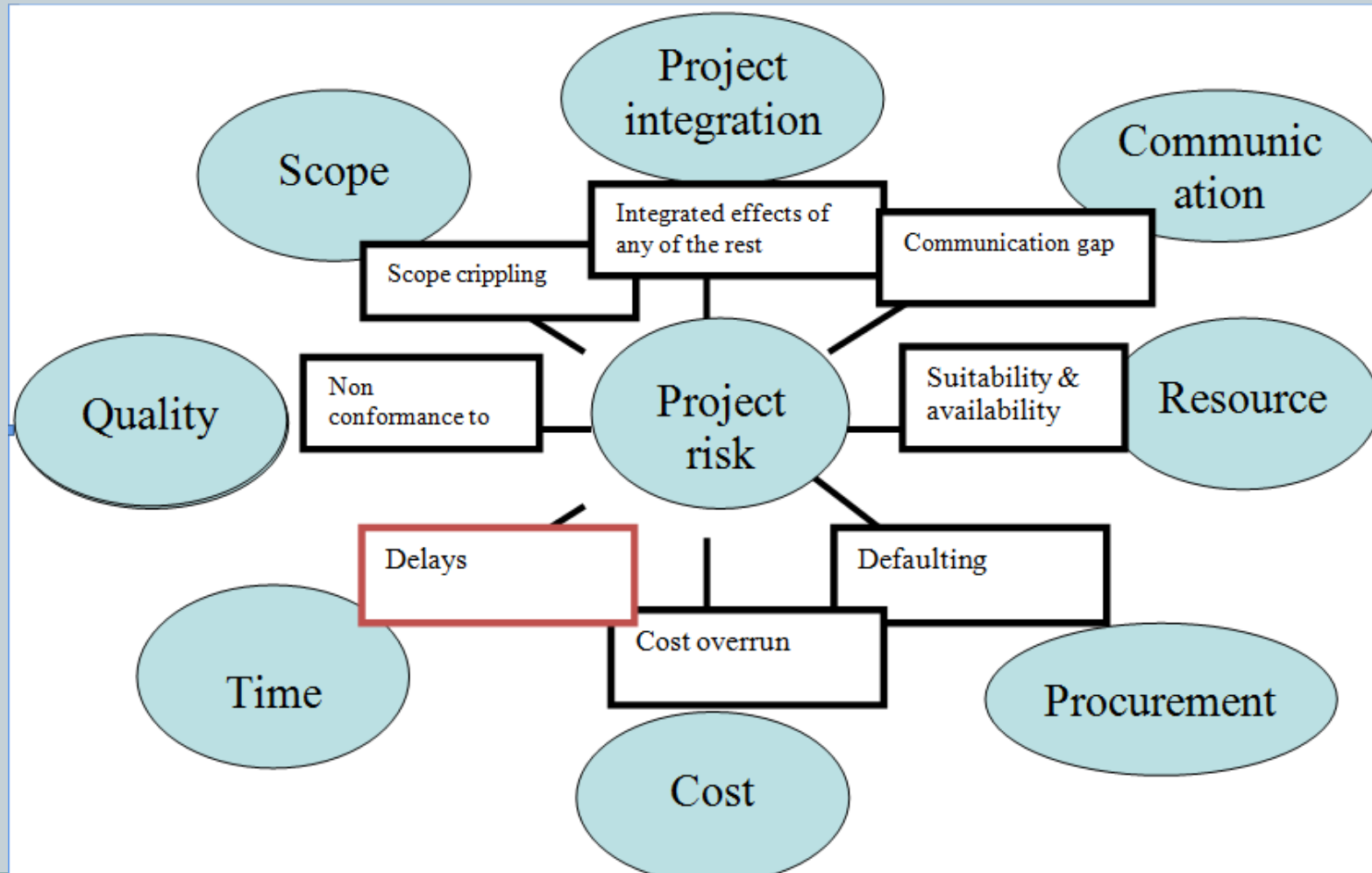
Risks in construction



Construction project risks are related:

- ✦ To the nature of the production processes,
- ✦ Products themselves,
- ✦ Time it takes to produce, etc
- ✦ Construction projects are said to be risky businesses, generally the nature of construction works entail susceptibility to *changing situations* such as *weather conditions change, subsurface conditions change*, etc while the long duration of project works is susceptible to *market [price] changes*, as well as change in demand of the facility delivered.

Major project risks




```
graph TD; RM[Risk management] --- IO[Identify objective]; RM --- IR[Identify risk]; RM --- QR[Quantify risk]; RM --- RR[Respond to risk]; RM --- CR[Controlling risk]; RR --- O[Options<br/>1. Avoid<br/>2. Transfer<br/>3. Mitigate<br/>4. accept];
```

Risk management

Identify objective

Identify risk

Quantify risk

Respond to risk

Controlling risk

Options

1. Avoid
2. Transfer
3. Mitigate
4. accept

Procedures in Risk Management

Project Procurement Management



AGENDA OF THE CLASS

PROJECT PROCUREMENT MANAGEMENT

- ✚ PROCESSES IN PROCUREMENT MANAGEMENT
- ✚ MAJOR FORMS OF BID
- ✚ MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT
- ✚ COMMON FORMS OF CONTRACTS IN CONSTRUCTION
- ✚ PROJECT DELIVERY SYSTEM

Introduction



- ✚ Project procurement management includes the process required to acquire **goods**, **services** and **works** from outside the performing organizations.
- ✚ Processes in procurement involve those processes needed to determine **what is to be procured** via through to those processes **contract administration** and **closure**.

Procurement Management process

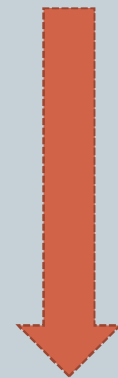
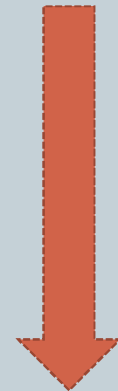


Activity		Steps	
#	Description	Inputs	Procedural milestone (control point)
1	Establish what is to be procured	Prepare broad scope of work for procurement	
		Estimate financial value of proposed procurement	
			Obtain permission to start with the procurement process
2	Decide on procurement strategies	Establish contract and pricing strategy	
		Establish targeting strategy	
		Establish procurement procedure	
			Obtain approval for procurement strategies that are to be adopted
3	Solicit tender offers*	Prepare procurement documents	
			Obtain approval for procurement documents
			Confirm that budgets are in place
		Invite contractors to submit tender offers or expressions of interest	
		Receive tender offers or expressions of interest	
		Evaluate expressions of interests	
		Prepare evaluation report on short listing process	
		Invite tender offers from shortlist	Confirm shortlist

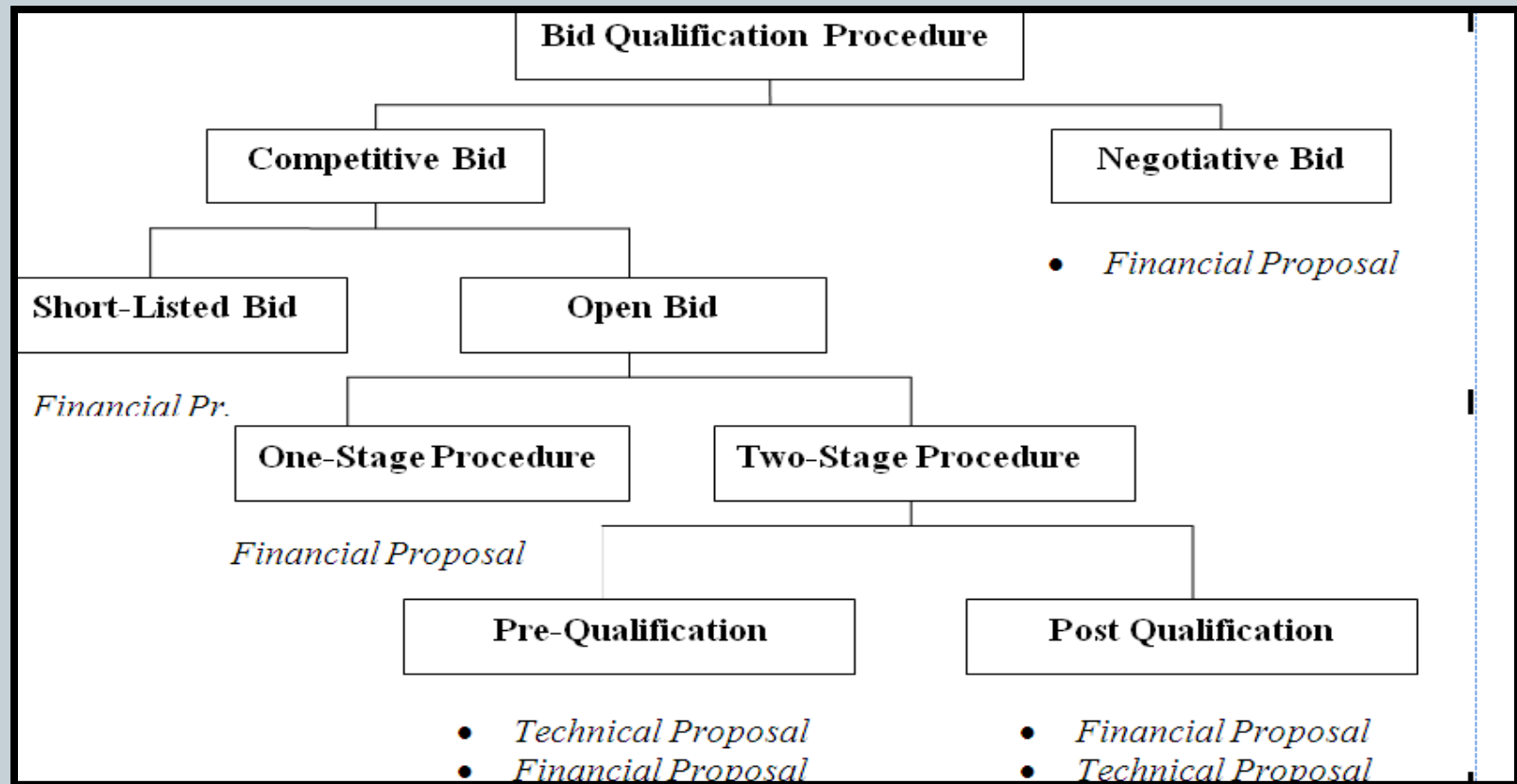


Procurement Management process

4	Evaluate tender offers*	Open and record tender offers received	
		Determine whether or not tenders offers are complete	
		Determine whether or not tender offers are responsive	
		Evaluate tender submissions	
		Perform a risk analysis	
		Prepare a tender evaluation report	
			Confirm recommendation contained in the tender evaluation report
5	Award Contract	Notify successful <u>tenderer</u> and unsuccessful <u>tenderers</u> of outcome	
		Compile contract document	
			Formally accept tender offer
		Capture contract award data	
6	Administer contracts and confirm compliance with requirements	Administer contract in accordance with the terms and provisions of the contract	
		Ensure compliance with requirements	
			Capture contract completion / termination data



Major Form of Bid



Object: qualification and selection process in order to arrive at best advantage to the client in both price and efficiency!

Major Form of Bid



- ✚ *Negotiated Bid*: this is a bid arrangement where a client **invites**, **negotiates** and **enters** a contract agreement with only a single contractor. The type of bidding process is selected:
 - In need of specialized service of a contractor,
 - In case of conflict of interest between the client and contractor. Say, if the client is the major shareholder of the contractor.

Major Form of Bid



- ✚ **Competitive Bid:** In a competitive bid arrangement equip-potential and competent contractors are invited to provide their best offer to the bid.
- ✚ Contract is awarded to the most responsive bidder based on a bid evaluation process to be carried out consequently.
- ✚ **Short-listed Bid:** A bid arrangement where the client directly selects two or more contractors who are technically fit to the project based on their past performance record.
- ✚ **Open Bid:** Any contractor qualifying the minimum requirement in the invitation to bid and wishing to participate is allowed to compete in the tender.

Major Form of Bid

- In the single-staged bid, contractors will be required to submit only a single document upon which bid evaluation would be conducted and the least and most responsive bidder will be selected for contract award.
- A two staged procedure requires submittal of two separate documents that comprise technical and financial proposal. The evaluation process to take place in the two-staged process will be either the pre-qualification or post-qualification.

Major Form of Bid



- **Prequalification process:** Assessment and evaluation of the technical proposal of contractors is made prior to opening the financial offers.
- ✚ Eligibility and registration by authorized body,
- ✚ Past and relevant experience to the work,
- ✚ Capability to the work in terms of key staff, equipment, and methodology proposed,
- ✚ Financial position,
- ✚ Safety and Health management improvised so far.
- **Post qualification Process:** Technical evaluation of contractors will be performed after opening of the financial offer.

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



- i) **Invitation to Bid:** this is an announcement or a call of bidders to participate in the bid. It contains a short brief description of the project and forward information to bidders such that they can eventually reach a decision on whether to purchase the full bid document and participate in the bid.
- ☐ The invitation to bid shall contain, as a minimum:
 - + The name and address of the Client,
 - + A brief description of the project (type, size and location) including desired time for completion,
 - + The means and conditions for obtaining the bid documents and the place from which they may be obtained,
 - + The place and deadline for the submission of bids,
 - + The place and time for opening of bids,

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



ii) *Instruction to Bidders*: This is a separate document in the tender to furnish instruction to bidders on the preparation and submission of the bids. Although it may repeat some of the information in the invitation to bid, the instructions are mostly concerned with the following:

Instructions about filling out the bid form,

- Bid due date,
- Location to deliver the bid,
- Examination and evaluation of bids
- Method of awarding the contract
- Bid security information,
- Conditions to become non-responsive to the bid

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



iii) *Bid Form*: The bid form is the document upon which the bidder submits its offer such as **financial, technical and legal requirements** of the bid. The form is usually prepared by the designers with blanks left to be filled out by the bidder. This makes the bids more easily comparable. Items may include some or all of the following:

- ☐ Name of Contractor,
- ☐ Unit prices for the bill of quantities,
- ☐ Basic price index
- ☐ Tender sum both in numbers and in words,
- ☐ Technical information such as key staff to be deployed, equipments to be availed, past experiences, etc

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



- Legal status of the company : proprietorship, corporation, partnership,
- Financial status of the company
- Key subcontractors
- Time required for the job by the contractor,
- Signature, title and date.

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



iv) Addenda: After the documents are issued but before the bids are due, changes often need to be made.

Contractual Information:

These are documents included in the tender document to furnish bidders with full and detailed information of the project for application after winning the contract. The bidder should utilize such information to provide a fair and reasonable offer to the bidding document. This section of the document comprises:

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



- i) *Agreement Form*: It serves the purpose of presenting a condensation of the **contract elements, stating the work to be done and the price to be paid and providing suitable places for signature and seal of the parties**. The following provisions are common to most agreement forms:
- Identification and full address of the signing parties,
 - short description of the project and the work,
 - Date of commencement and signature,
 - Completion time of the project,
 - The contract price,
 - Enumeration of contract documents constituting the entire agreement.

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



ii) *Standard or General Conditions of Contract:*

The purpose of the general conditions is to establish the legal responsibilities, authority and rights of all parties involved in the project in normal procedure of the work, in case of disputes, hazards etc.

- FIDIC Conditions of Contract,
- The Standard Conditions of Contract by the Ministry of Works and Urban Development, 1994 etc.

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT

iii) *Particular or Special Conditions of Contract:*

Having similar performance with that of the general conditions, however more specific and relevant to a particular project.

It is a supplementary and modified section of the general conditions of contract.

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



iv) *Technical Specifications & Methods of Measurement:* These are written descriptions of the quality of the project. They detail the materials, equipment and workmanship to be incorporated into the project.

V. Activity Schedule / Bill of Quantities

Records the contractor's prices for providing supplies / services / engineering and construction works which are described elsewhere in a specification within the Scope of Work section of the contract.

MAJOR COMPONENTS OF THE PROCUREMENT DOCUMENT



v) *Drawings*: These are intended to describe the size and dimensional requirements of the project. Many professionals are involved in developing drawings. These include the architectural, structural, sanitary, mechanical, electrical, topographic survey, land profile, and detailing.

vi) *Appendix to Construction Agreement*: Comprises tabulated and narrative information of the project such as amount and liquidated damages, interest rates, completion time, amounts of bond and insurances, defects liability period, retention, progress payments, advance payment, etc. Some of this information might be left blank to be filled by the contractor or might be readily provided by the client.

Common forms of contracts in construction



A. **Fixed price contract.**

- ✓ In this type of contract, the parties agree on a **pre-determined price** to execute the contract. This pre-determined amount can only be altered by changes to the contract. There two variations of these forms of contract:

i. **Lump sum contract.**

- ✓ In this form of contract, the parties agree on the total amount of money required to complete the contract. Thus, as a general practice, the contractor doesn't have to show the specific breakdown of costs and match it to the specific work executed.

ii. **Unit price contract**

- ✓ In this form of agreement, the parties agree on the unit price of each and every item to be executed. Though the contractor is asked to come up with the total sum of the project work, in this form of arrangement, it is the unit price of the items specified that governs the project work, i.e, if there is some kind of discrepancy between the total sum and unit price multiplied by amount of work to be done, the latter takes precedence.

Common forms of contracts in construction



B. Cost-Plus Contracts

- ✓ In cost-plus arrangement, the contractor will be paid for the costs incurred for the execution of the project plus an agreed amount of profit margin.

Cost plus percentage of cost

- This type of contract fixes percentage of the cost of construction for the profits and risks to be due to the contractor. However, there is one big problem in this arrangement, contractors often try to exploit the arrangement via different means such as over staffing the project, not assigning the most competent resource, forging invoices etc. As a measure of partial counteracting of this problem, clients usually demand other variations of the cost plus contract.
- **Cost i Plus fixed fee**
- In the arrangement, the parties agree on the cost the contractor may incur to execute the job plus a fixed fee to cover for the contractor's staffing costs, overheads, profits etc.

Common forms of contracts in construction



- **Cost-Plus fixed fee with guaranteed maximum price.**
- The arrangement is meant to prevent the project cost escalating above a certain maximum price. In the arrangement, the contractor will be reimbursed for the costs incurred, plus given an agreed amount of fixed fee to cover for its other expenses and profits. But in this arrangement, unlike the previous one, the agreement puts a cap to the maximum price the project can possibly escalate to.
- **Cost-Plus Sliding Scale Fee Contract:**
- A form of cost-plus contract that acts in the nature of a compromise between the percentage of cost fee and a fixed fee. It is one in which the fee is established in accordance with a sliding scale arrangement.

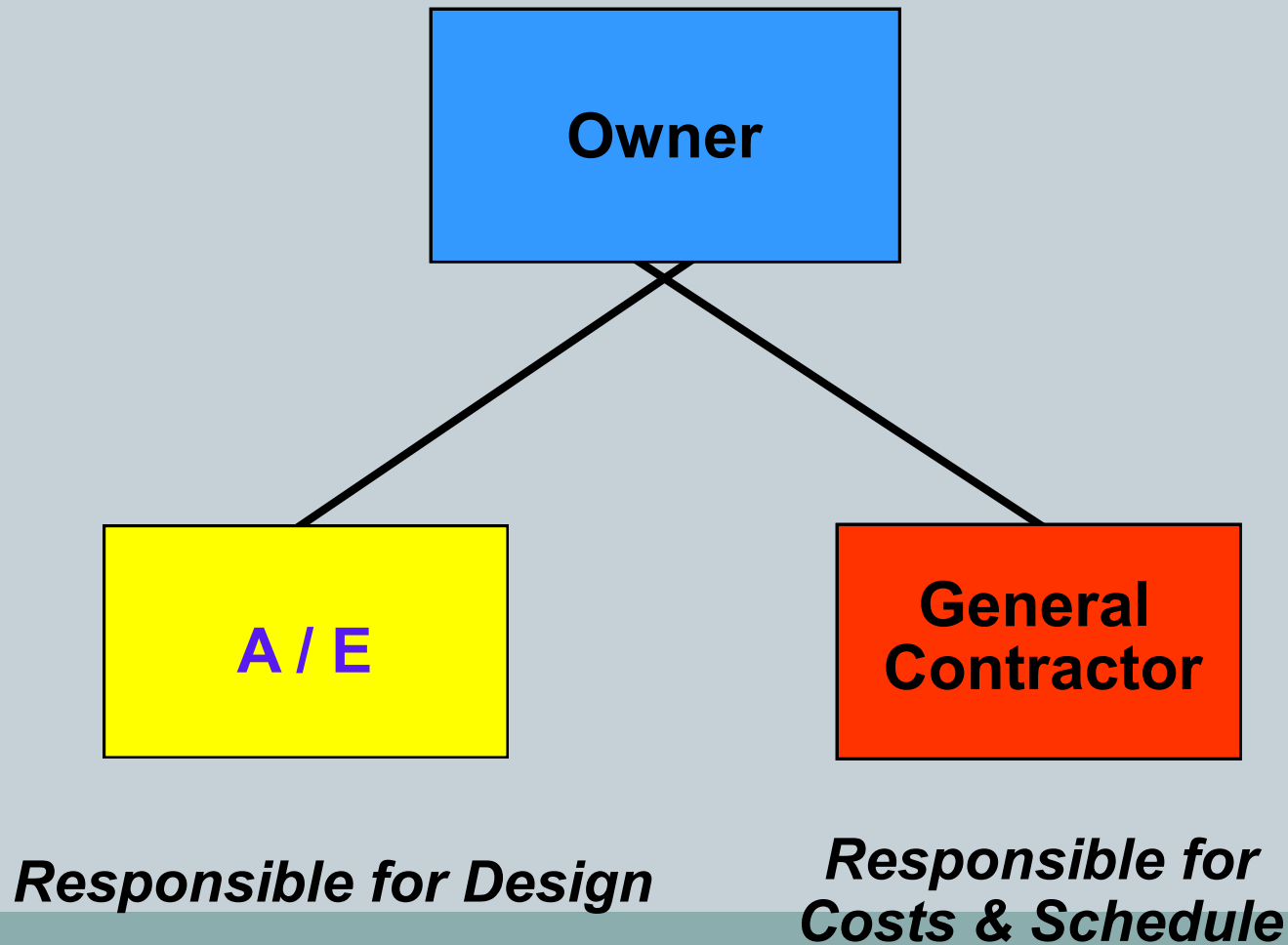
Project Delivery Systems



- Procurement and Contract Delivery system is the way Project Owners together with Project Regulators and Financiers determine the assignment of responsibilities to Project Stakeholders along the Construction Process. Procurement and Contract Delivery system is often determined during the Basic Planning phase of Construction Project.
- Methods of project delivery system
 - Force Account,
 - Design Bid Build (DBB),
 - Design Build (DB) or Turnkey,
 - Finance / Build Operate System (BOT),
 - Construction/Facility Management Consultancy

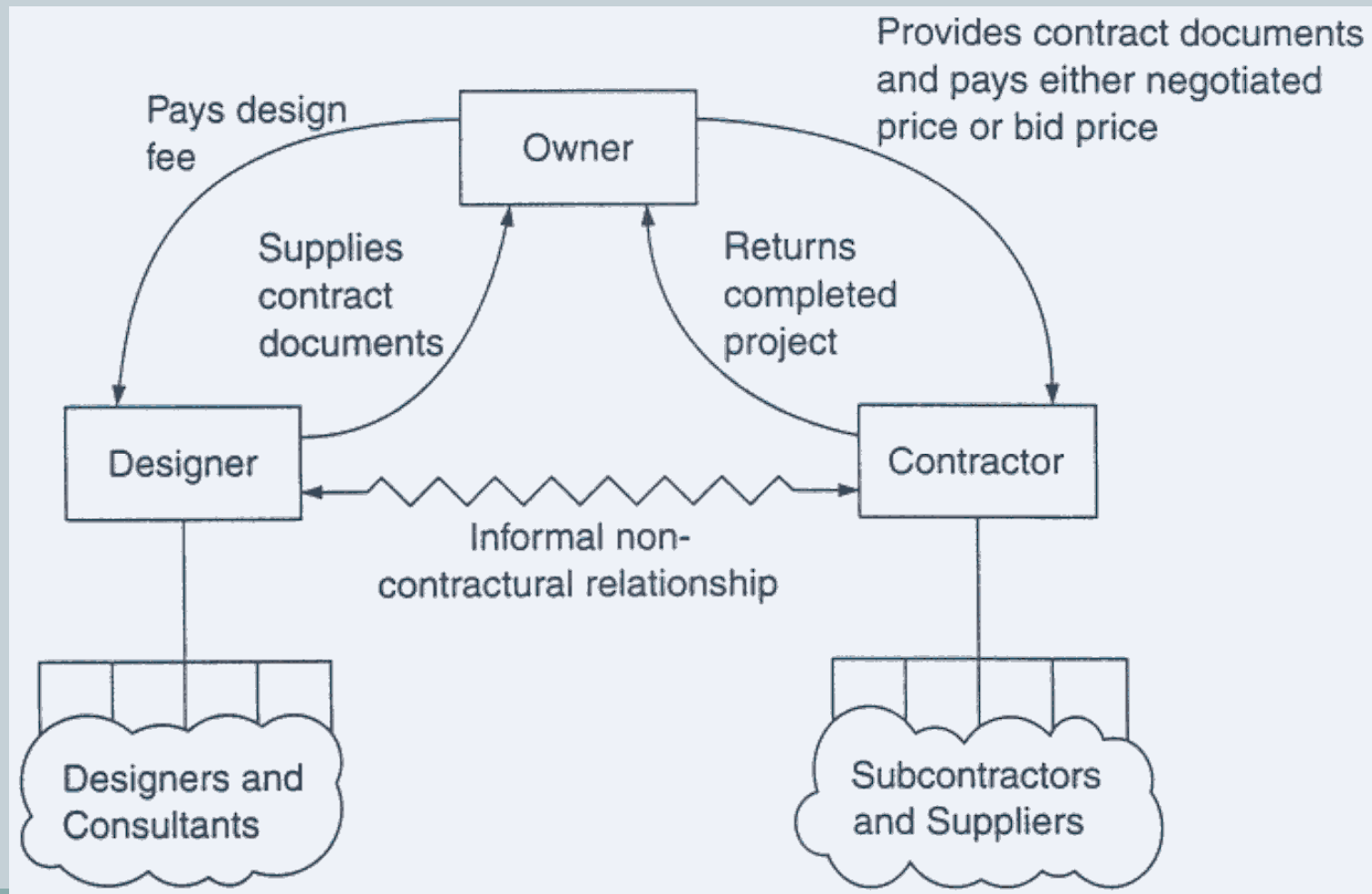
Design-Bid-Build

(Two Separate Contracts for Design & Construction)



Design bid build

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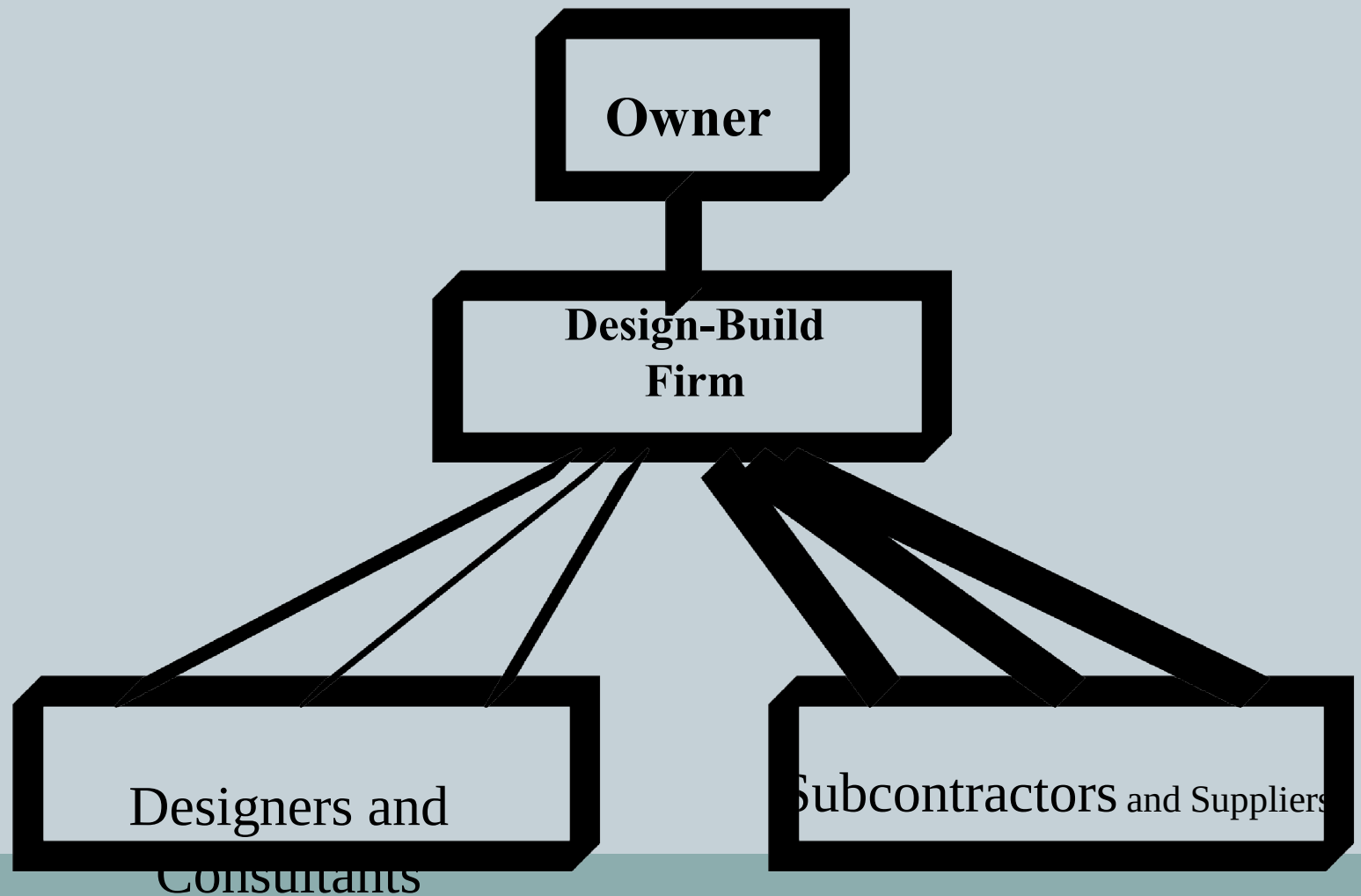
Project Delivery Systems



Design-Build (DB)

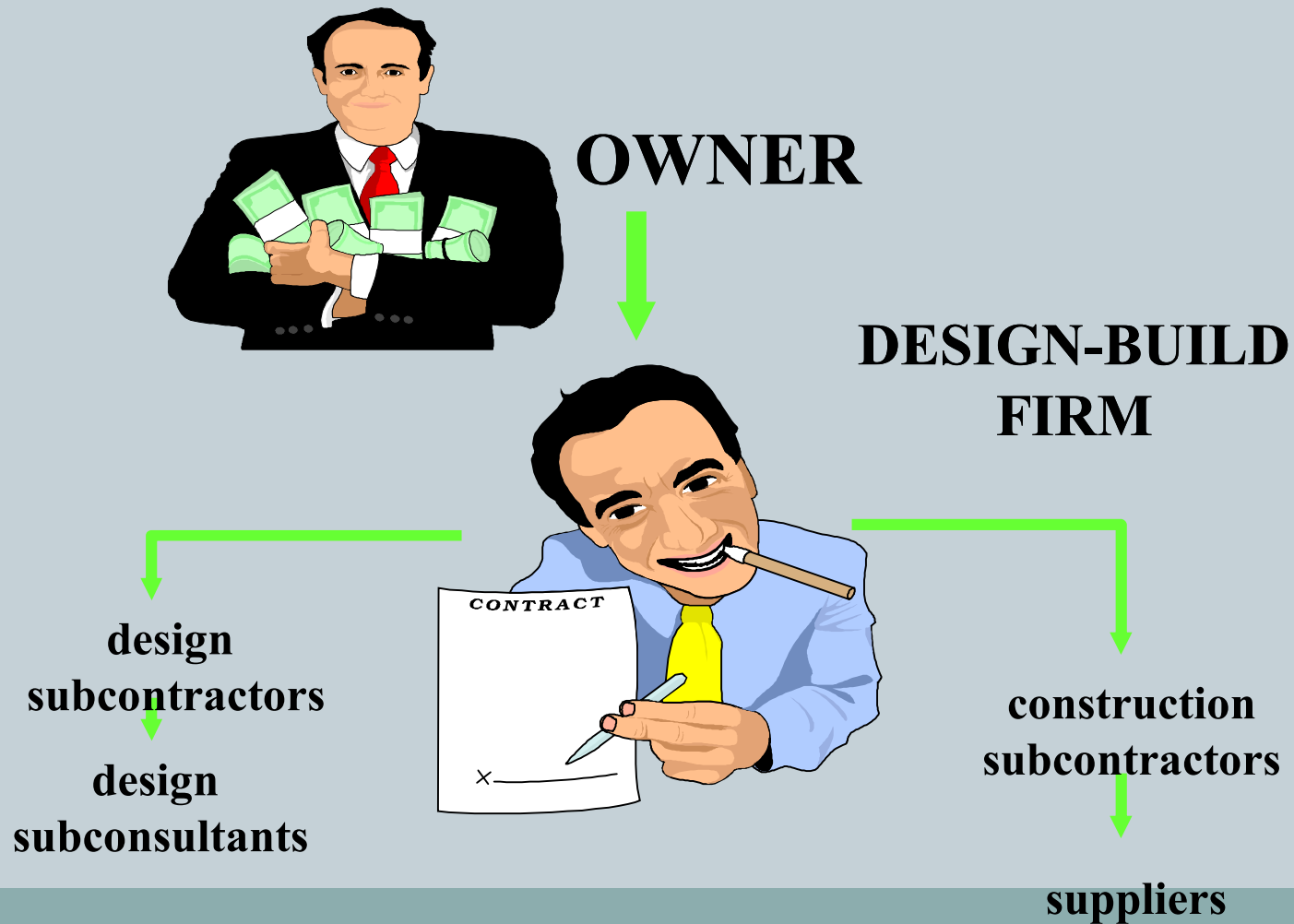
The design-build method of project delivery is one way that reduces the number of contractual relationships that the client has to go into and the associated inefficiencies. In this method, the owner contracts with a single firm, which provides both the design and construction services.

Design-Build (Turnkey)



Design-Build

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Project Delivery Systems



Finance/Build Operate Transfer (BOT)

Build - Operate - Transfer is a form of procurement and contract delivery system that promotes Public Private Partnership (PPP) in which a private company is contracted to finance, design, construct, and operate for a certain period (usually 10 years) and transfer.



PROJECT CLAIM MANAGEMENT

PROJECT SAFETY MANAGEMENT

PROJECT ENVIRONMENTAL MANAGEMENT

PROJECT FINANCIAL MANAGEMENT



PROJECT CLAIM MANAGEMENT

Project Claim Management



Introduction to Claim management process

- ✓ Claim Identification
- ✓ Claim quantification
- ✓ Claim prevention
- ✓ Claim resolution

claim

- ✓ “Is a demand for something due or believed to be due”, usually the results of an action or direction.
- ✓ In construction “something” is usually additional compensation for work claimed to be extra to the contract or an extension of time for completion or both.

•

Project Claim Management

Claim identification



The identification of a claim starts with sufficient knowledge of the scope and contract terms to be aware when some activity appears to be a change in scope or terms requiring a contract adjustment. Proper identification involves not only an interpretation of what the contract requires but also a documented description of the activity viewed as extra to that required by the contract.

Claim quantification

Once an activity has been reviewed and a decision made that it is worthy of pursuing as a claim, the next step is to quantify it in terms of additional compensation or a time extension to the contract completion or other milestone date.

- + Quantity measurement
- + Cost estimation
- + Contract law procedures
- + Schedule analysis, are the main techniques for quantifying claims.

Project Claim Management



Claim prevention

- ✓ Clarity of language
- ✓ Schedule
- ✓ Constructability review
- ✓ Request for information (RFI) procedure
- ✓ Prequalification process
- ✓ Dispute review board ETC are some of the techniques for claim prevention.

Claim resolution

- ✓ Negotiation
- ✓ ADR
- ✓ Litigation
- ✓ Estimated Cost of resolution are some of claim resolution techniques.



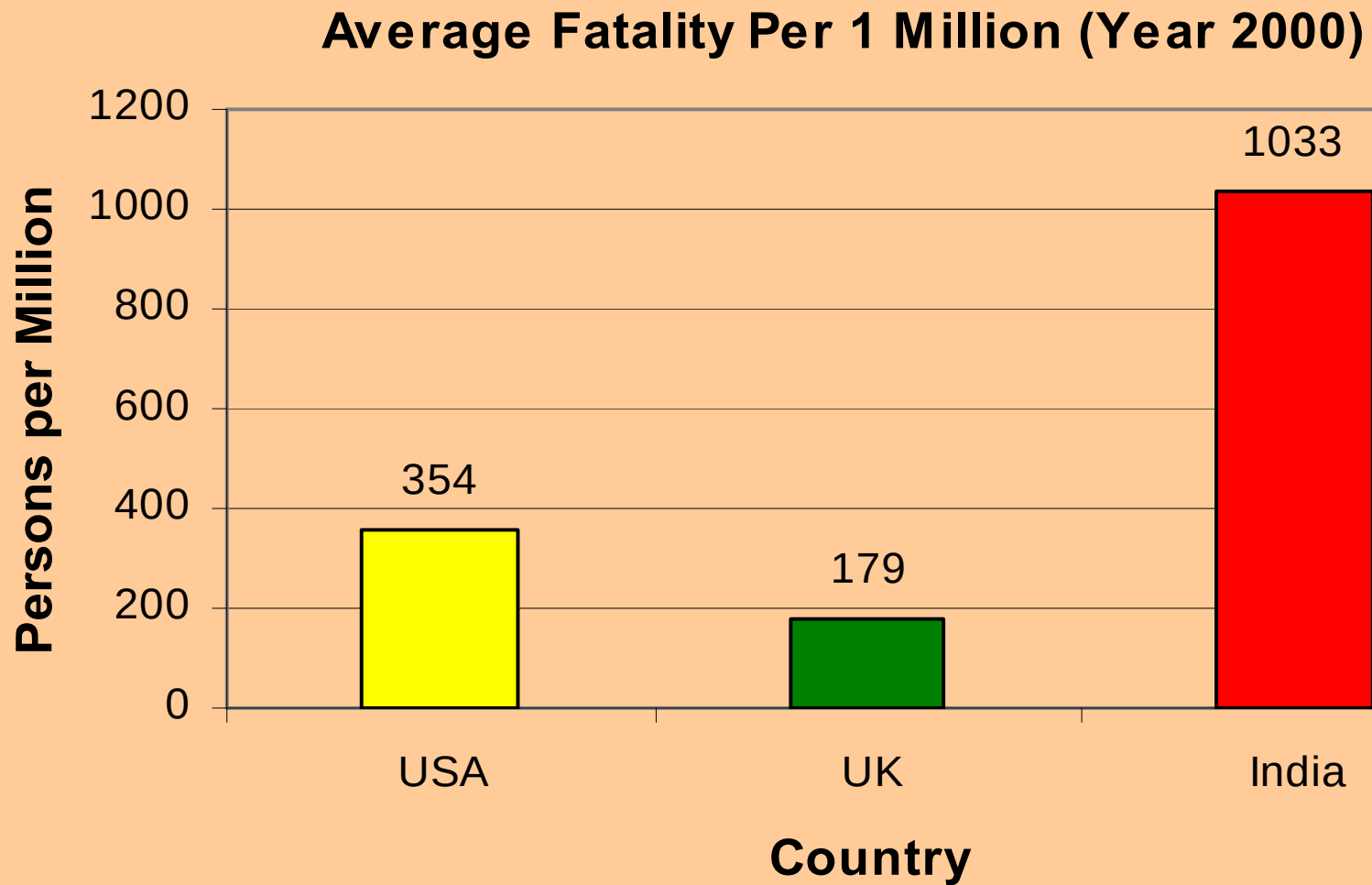
Project safety management

INTRODUCTION



- ✚ Construction industry, in general, is comparatively less organized and involves participation of major percentage of unskilled labor as compared to other industrial sectors.
- ✚ This makes it more vulnerable to accidents.
- ✚ Accidents are generally unavoidable in construction projects but the number and gravity of accidents can be reduced considerably if proper safety measures are taken beforehand.

Average Fatality Rate



Causes of Accidents



✖ Causes of Accidents-According to their types

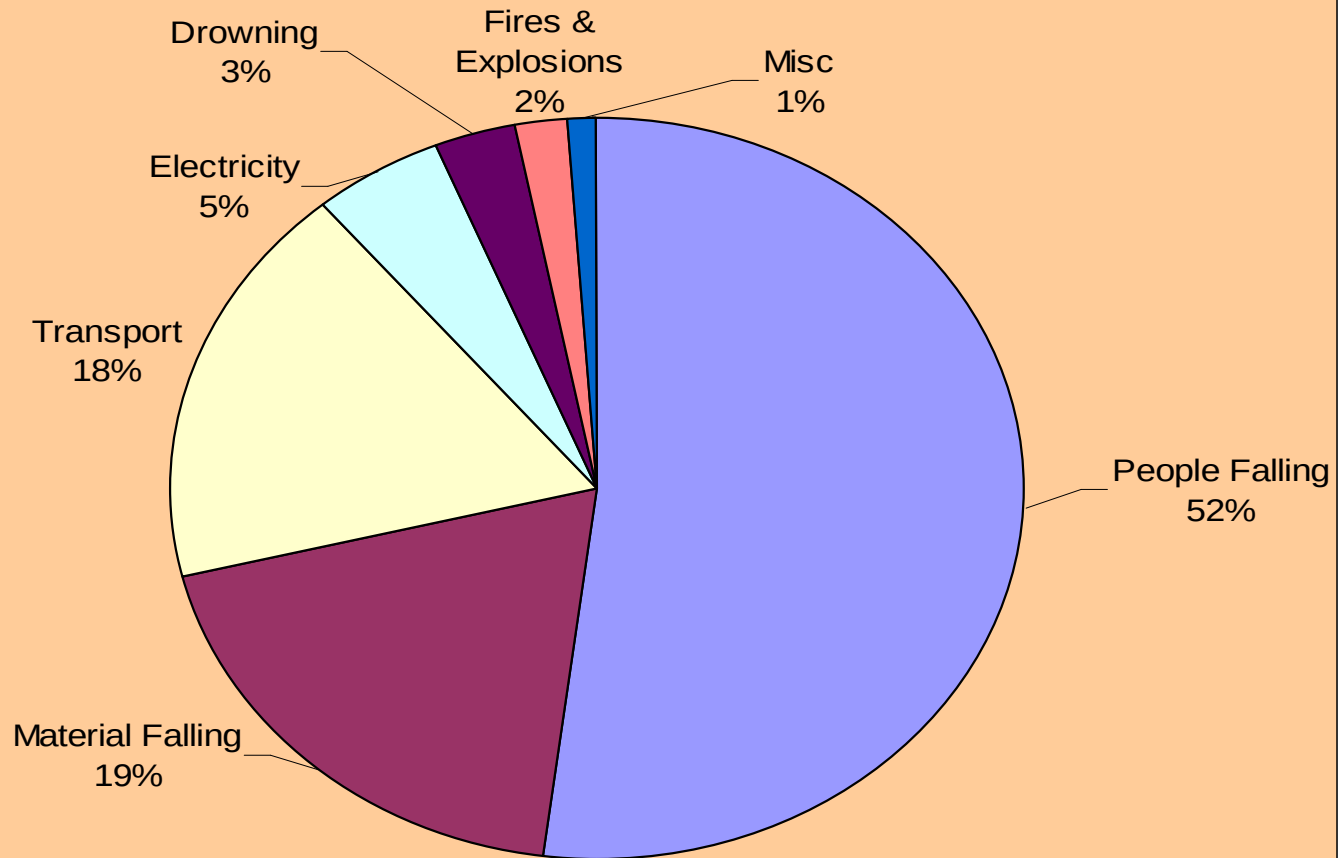
- + Falls
- + Stepping on or striking against objects
- + Lifting and carrying-over exertion
- + Machinery
- + Electricity
- + Transport
- + Fires and explosions

Causes of Accidents- According to their origin



- **Planning, Organization**
 - Defects in technical planning
 - Assignment of work to incompetent contractors
 - Insufficient or defective supervision of work
 - Improper designs or their faulty implementation
 - Lack of cooperation between different trades
- **Management & Conduct of Work**
 - Inadequate preparation of work
 - Unskilled or untrained workers

Construction Fatality



Distribution of Major Causes of Accidents in Construction Industry

Classification of Accidents



✗ Physical Causes

- + Tools and Equipments
- + Materials
- + Environment

✗ Physiological Causes

- + Poor Senses
- + Fatigue
- + Poor Health
- + Intoxication

✗ Psychological Causes

- + Mental tension
- + Fear
- + Carelessness

Process Prone to Accidents



Some of the processes prone to accidents are:

- + Excavation
- + Scaffolding/Working at Height
- + Shaft work
- + False work
- + Erection of Structural Framework
- + Tunneling
- + Use of Cranes
- + Transportation & Mobile Plants
- + Sewer Works
- + Demolition
- + Road works in hilly terrain

Occupational Health Hazards



✗ What are they?

- + Occupational health hazards (OHH) are those hazards which are inherent with the specific occupation
 - + There are some jobs in which the risk of the hazards is more and inborn
- ## ✗ It is mandatory to list the possible occupational health hazards whenever a job specification is prepared
- ## ✗ OSHA (Occupational Safety and Health Administration) has laid down the possible OHH with most kinds of the jobs and also their safety measures
- ## ✗ Since construction industry too has a high risk of accidents, it is important to know the types of OHH

Occupational Health Hazards: Types

✗ Physical Health Hazard

- + Noise
- + Vibration
- + Working Environment
- + Ionizing Radiation
- + Air Pressure Variation
- + Ergonomics

✗ Chemical Health Hazard

- + Solids
- + Liquids
- + Vapors, Aerosols & Gases

✗ Biological Health Hazard

- + Bacteria, Fungi
- + Parasites

Hazard Control Measures

- The measures to be taken against the hazards can be classified into two groups:
 - **Proactive measures**- Actions to be taken in advance, precautionary measures and its implementation
 - ✦ Safety training
 - ✦ Safety program
 - ✦ Inspection and checklist
 - ✦ Personal protective equipments (PPE)
 - **Reactive measures**- Actions to be taken after accident occurs
 - ✦ Medical aid
 - ✦ Accident reporting and analysis

Proactive Measures: SAFETY TRAINING & PROGRAM



- ✗ Training aims at preventing and minimising the accidents
- ✗ Education to the workers is provided
- ✗ Safety measures committee is formulated
- ✗ Charts, posters and show films on the need to follow safety measures should be displayed
- ✗ The careless workers should be discontinued after sufficient warnings
- ✗ First-Aid training to at least one worker in a team
- ✗ Proper medical checkups of the workers before employment and also periodically

Proactive Measures: INSPECTION & CHECKLIST

- ✗ This is very important aspect in proactive measures
- ✗ Checklists for various items of work at each stage are to be prepared and accordingly inspection is to be carried out. eg: extract from checklist for roofing works is shown

Roofing			
1	Except where roof battens, provide adequate handholds and foot holds, crawling boards or crawling ladders are used to work on roof slopes of more than 10 degrees	Do you propose action?	
		No	Yes
		Priority	
2	Sufficient guard rails and toe boards or other forms of edge protection are provided to prevent a worker or materials falling more than 2 m from sloping or flat roofs	Remarks_____	

Reactive Measures: MEDICAL AID

- First-Aid should be given to injured person as soon as possible
- He then should be immediately moved to nearest hospital in case of severe injury
- A separate vehicle for this purpose is to be maintained when the number of workers is sufficiently large
- Medical Insurance should be provided for those workers working in hazard susceptible zones

Reactive Measures: ACCIDENT REPORTING & ANALYSIS

- Analysis is done by the concerned engineer and he should submit the report of analysis in standard format with the details like cause of accident, responsibility, etc. A sample preliminary report is shown below

Injury Report- Preliminary

Name of Work: _____

No.-

Name of Contractor: _____

Date:

Particulars of accident:

1 Name of the person injured:

2 Sex

3 Age

4 Department/Project Div/Section:

5 Date & time of accident:

6 Cause(s) of accident:

7 Fatal/Serious/Minor:

Signature

Safety Engineer

Signature with Designation
Reporting Officer

Copy to:

1 Medical officer (5 copies)

3 Contractor

2. Project Safety Engineer

4. Engineer-In-charge

Personal Protective Equipment

- Personal Protective Equipments (PPE) plays a vital role in safety
- Depending on the activities involved, PPE is chosen. Eg as far as masks are concerned there are different types of masks are available but the right choice depends on the activity for which it is to be selected
- Generally there are numerous PPE available out of which prominent PPEs are discussed

Personal Protective Equipment

HEAD PROTECTION

- Falling objects, overhead loads and sharp projections are to be found everywhere on construction sites
- Safety helmets protect the head effectively against most of the hazards
- Everybody should wear a helmet whenever on site and particularly working in an area where overhead work is going on (Hard-Hat area). This area should be clearly marked with safety signs
- Safety helmets have adjustable plastic or terylene head-harness



Personal Protective Equipment

HEARING PROTECTION

- ✗ The noise level in some areas on construction sites are often above the level which causes sensory hearing loss to workers in the vicinity
- ✗ The common form of protection in industry is ear defender consisting of a head band and cup
- ✗ There are several types of head bands depending upon helmet attachment
- ✗ Helmet muffs and ear plugs can also be used. The reduction in noise level
 - + Ear muffs: 25 %
 - + Foam expanding ear plugs: 50%
 - + Combination: 75%



PVC Earplugs

Foam Earplugs

Personal Protective Equipment

EYE PROTECTION

- The chances of eye accidents are there in jobs like breaking, cutting, drilling, chipping, dry grinding, welding etc
- While working on these jobs, goggles, safety glasses or shields are the only practical solutions
- Wearing of eyewear is readily accepted, as danger from flying particles and dust are obvious to most construction workers
- Goggles, face shields and spectacles can also be used against impact, chemicals, molten metal and gas hazards



Personal Protective Equipment

- ✗ On construction sites such as rock crushing, sand blasting, asbestos insulation/dismantling, welding / cutting paint spraying, blasting etc. harmful dust, mist or gas may be present
- ✗ Whenever there is a presence of toxic substances, respirator must be worn
- ✗ The correct type will depend upon the hazards and the work conditions
- ✗ There are 3 types of face masks:
 - + Air borne particles
 - + Gases and fumes
 - + Both
- ✗ The simplest mask is disposable paper type against nuisance dust



Personal Protective Equipment

BODY PROTECTION



- Skin is extremely vulnerable to all types of hazards in works like painting, welding, sewer works, demolition works, etc. leading to different types of skin diseases
- Full sleeved shirts and trousers provide good protection against many of the hazards
- In case of ionizing radiation use of shielding layers inside the cloths is necessary



Personal Protective Equipment

HAND & FOOT PROTECTION

- ✗ Hands are most important as most of the work is done by hands. They are susceptible to wounds, abrasion, fractures, strains, and also are subjected to environmental variations
- ✗ Protective gloves solve the purpose of preventing any hazards to hands
- ✗ Foot injuries can be:
 - + Due to crushing
 - + Due to penetration
- ✗ Safety footwear are of types like:
 - + Leather shoes- climbing jobs
 - + Normal shoes- heavy duty work
 - + Rubber safety Wellington shoes- corrosive substances, chemicals and water (with steel toes)



Personal Protective Equipment

SAFETY BELTS & HARNESS

- ✗ Major accidents in construction are due to falls from heights where the provision of safe working platforms are impracticable
- ✗ Wearing of a safety belt or harness and line or lanyard attached to a reliable strong point above the working position will serve the purpose of safety
- ✗ Full harness is preferable to a safety belt
- ✗ Sometimes safety harness is supplemented by use of safety nets
- ✗ A safety harness and lanyard must
 - + limit the fall to a drop not more than 2 m
 - + Be strong enough to support the weight
 - + Be attached to strong structure through firm anchorage
- ✗ In case where rescue operations may arise (underground sewer works) chest or body harnesses is compulsory for the workers



Personal Protective Equipment

HIGH VISIBILITY

- ✗ High visibility of the workers and equipments in construction sites is vital
- ✗ This has many advantages like:
 - ✚ Preventing accidents
 - ✚ Spotting or location accident victim
 - ✚ Clear identification/separation of the work and equipment
- ✗ The high visibility clothing maintain a contrast
- ✗ They should be of vibrant colors with reflective stripes
- ✗ All the types of PPE discussed so far are available with high visibility
- ✗ Some of the disadvantages of PPE:
 - ✚ Wearing PPE may involve discomfort to the user and slow down the work and reduce efficiency
 - ✚ PPE is costly

But as human life is precious, use of PPE should be mandatory

Accident costs



- ✗ Every accident brings with it losses in the form of sacrifice of human life, loss of materials or equipment, injuries to workers etc.
- ✗ In turn accidents also lead to compensation cost
- ✗ Thus accidents increase the cost of construction and decrease the margin of profit to contractors
- ✗ They are broadly classified as
 - + Tangible or Direct Cost:- The cost which can be easily ascertained or evaluated
 - + Intangible or Indirect Cost:- The cost which cannot be easily evaluated

Accident cost: Direct Cost



✗ Direct cost includes

- + Temporary or permanent injury to worker
- + Cost of man-hours for the work destroyed
- + Loss of equipment
- + Loss of material

✗ It is possible to cover some of the direct costs through an insurance policy. If the workers are insured then in case of accident compensation to be given is covered by the insurance company

✗ The value of other losses can be suitably computed using quantity analysis

Accident cost: Indirect Cost

- ✗ It is not possible to cover the indirect costs through an insurance company. Sometimes they sum up to four times that of the direct cost
- ✗ Indirect costs include:
 - + Transportation: Includes cost of emergency transportation of injured person
 - + Wages paid to injured workers for time not worked
 - + Cost incurred due to delays which resulted from accident
 - + Cost of overtime necessitated by accident
 - + Loss of efficiency of crew
 - + Cost of education for replacement worker

Accident cost: Indirect Cost

- Cost of cleanup, repair and/or replacement
- Cost for rescheduling: Includes time spent by supervisors, Engineers and foreman to review schedules and the resultant costs of adjusting to the new schedule
- Cost for safety personnel & clerical personnel in case of accidents: Typing, investigation, forwarding forms, etc.
- Cost of legal assistance
- Loss of reputation

Cost of Safety Program

- ✗ The cost of administering a construction safety and health program usually amounts to 2.5% of direct labor cost
- ✗ These costs include:
 - + Salaries for safety, medical and clerical personnel
 - + Safety meetings
 - + Inspection of tools and equipments
 - + PPE
 - + Health programs such as respirator fit tests
 - + Miscellaneous supplies and equipments
- ✗ The net savings to be expected from introducing effective safety program is 4 % of direct labor cost



PROJECT ENVIRNMENT MANAGEMENT



- Project environmental management includes the processes required to ensure that the impact of the project execution to the surrounding environment will remain within the limits stated in legal permits.
- It is related with identifying the environmental characteristics surrounding the construction site and the potential impacts the construction may bring to the environment;
- planning the approach towards avoiding environmental impacts and achieving environmental conservation (and improvement if possible);
- auditing the plan and
- controlling the results; and inspecting environmental condition.

ENVIRONMENTAL PLANNING



Inputs

- .1 Scope Statement*
- .2 Contract environmental provisions*
- .3 Standards and regulations*
- .4 Permits*
- .5 Environmental policy*
- .6 Site and neighborhood environmental characteristics*
- .7 Project execution characteristics*
- .8 Historical information*
- .9 Other process outputs*

Tools & Techniques

- .1 Risk planning process tools and techniques*
- .2 Alternative selection*
- .3 Benchmarking*
- .4 Flowcharting*
- .5 Stakeholder analysis*

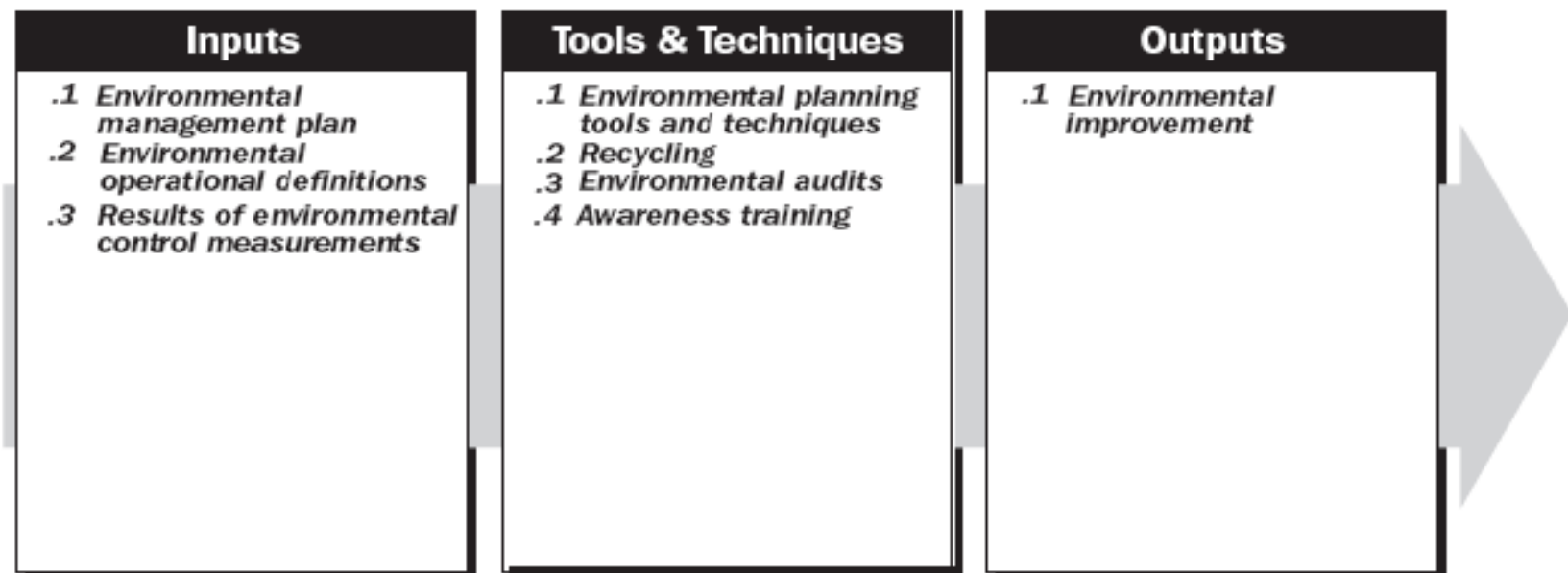
Outputs

- .1 Environmental management plan*
- .2 Scope updates*
- .3 Inputs to other processes*
- .4 Environmental operational definitions*
- .5 Checklists*



ENVIRONMENTAL ASSURANCE

Environmental assurance is all the planned and systematic activities implemented within the environmental system to provide confidence that the project will satisfy the relevant environmental standards. It should be performed throughout the project. Assurance should be provided to all stakeholders, as environment conservation is a matter of global interest.



ENVIRONMENTAL CONTROL



Inputs

- .1 Environmental impacts of work results*
- .2 Environmental management plan*
- .3 Environmental operational definitions*
- .4 Checklists*
- .5 Stakeholders feedback*

Tools & Techniques

- .1 Quality control tools and techniques*
- .2 Risk control processes and techniques*

Outputs

- .1 Environmental improvement*
- .2 Acceptance decisions*
- .3 Rework/remedial action*
- .4 Completed checklists*
- .5 Process adjustments*





PROJECT FINANCIAL MANAGEMENT



FM is the planning for, acquiring and Utilizing of funds in order to maximize the efficiency and value of the firm.

➤ It involves

- Forecasting & Planning
- Major investment and financing decisions
- Coordination and Control
- Risk Management

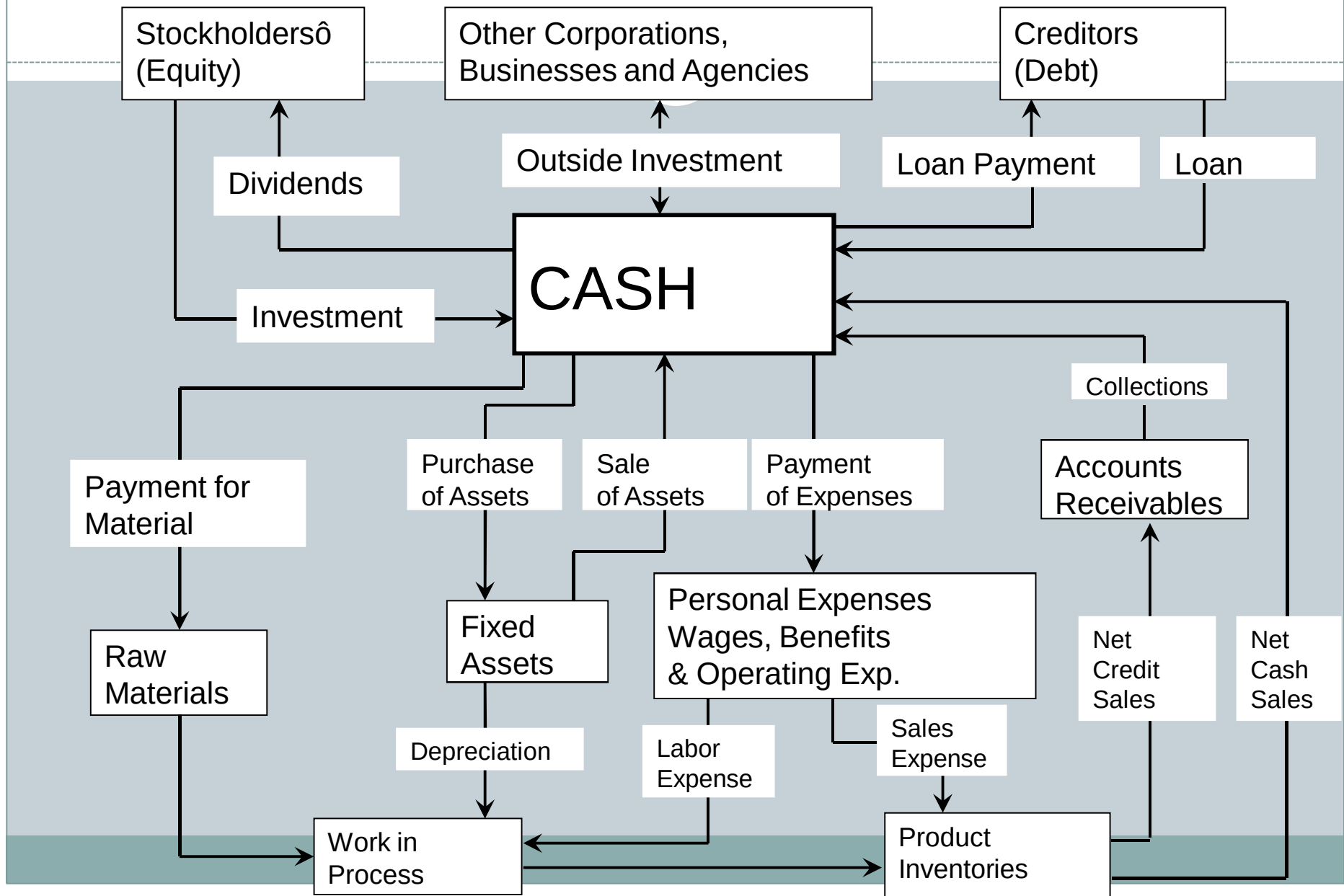


- The term finance can be defined as the management of the flows of money or its equivalent through an organization, whether it is a *for* or *not-for* profit firms, corporation or non-corporate business, or government agency.

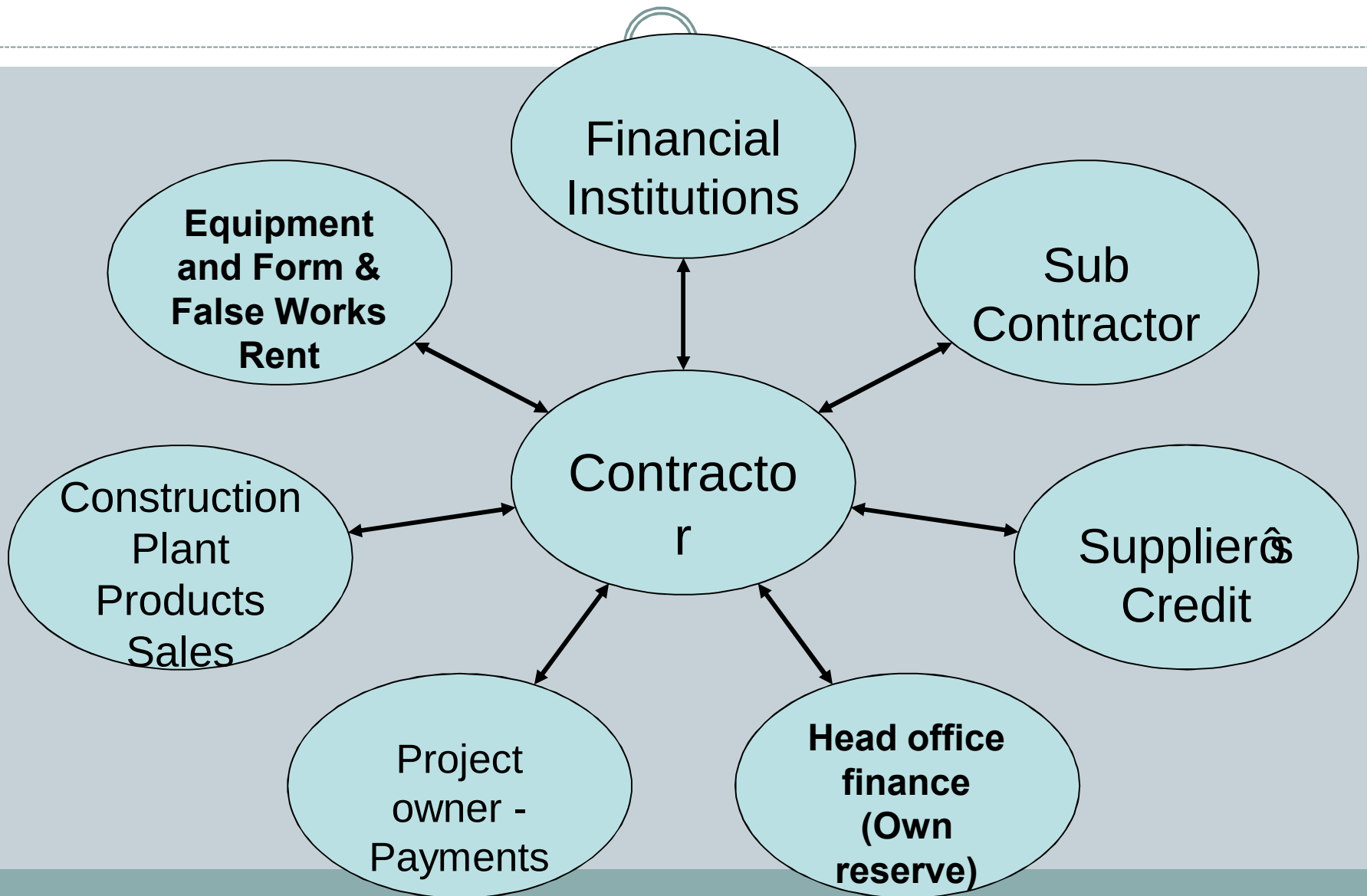
Finance concerns itself with the actual flow of money as well as any claims against money.

- The flow of fund is a continuous process

Cash Flow in a Firm



CASH FLOW OF CONTACTORS TOWARDS PROJECT PARTICIPANTS



GOALS OF FINANCIAL MANAGEMENT



❑ Profit Maximization:

- It is vague
- It leaves consideration of timing and duration undefined
- It overlooks future aspects

❑ Wealth Maximization:

- Avoid high level of risk
- Pay consistent dividend
- Seek growth in Sales
- Maintain market Price of Stocks

FUNCTION OF FINANCIAL MANAGEMENT



- ❑ Liquidity functions
 - ❑ Forecasting Cash flow
 - ❑ Raising Funds
 - ❑ Managing the flow internal funds
- ❑ Profitability functions
 - ❑ Cost Control
 - ❑ Pricing
 - ❑ Forecasting profits
 - ❑ Profit-risk analysis
- ❑ Managing assets