

# **GE404 Engineering Management**

## **Topic1. INTRODUCTION**

# GE404 Course Description

- Introduction for project management objectives.
- Project Participants and Project Life Cycle.
- Planning Engineering projects.
- Scheduling using activity-on-node and precedence methods.
- Resource leveling and allocation.
- Project time-cost trade-off.
- Updating construction schedules.
- Project time and cost control.
- Contractual and organizational approaches including definition of organizational responsibilities of project participants.

# GE404 Course Learning Objectives

***Students completing this course successfully will be able to:***

- a) Using bar chart technique to formulate a complete plan for a project.
- b) Apply activity-on-node network, and precedence diagram to schedule a project.
- c) Level and allocate project resources.
- d) Shorten project duration.
- e) Monitor an engineering project for purpose of time and cost control.
- f) Use computer software for preparing project schedules
- g) Understand principles of project organization and contractual relationships including definition of professional responsibilities of project participants.

# GE404 Course Topics Covered

- 1) Introduction for management of engineering projects.
- 2) Project Participants and Project Life Cycle
- 3) Project time planning
  - a) Planning with bar chart.
- 4) Network model
  - a) Activity-on-node
  - b) precedence diagramming.
  - c) Time-scaled network.
- 5) Resource leveling and allocation.
- 6) Time-cost trade-off.
- 7) Financial Management: Cashflow Forecasting
- 8) Time and cost control.
- 9) Contractual and organizational approaches.

# GE404 Textbook(s) and/or Other Required Material

- 1) Project Management with CPM, PERT, and Precedence Diagramming, 3rd Edition, by Moder J., Phillips, C., and Davis, E.
- 2) Construction Planning and Scheduling (4th Edition) by Jimmie W. Hinze, February 28, 2011
- 3) Course lectures are also found on the following website:  
<http://faculty.ksu.edu.sa/algahtani> & **LMS** (**Blackboard**)

# GE404 Grade Distribution

<b>Mid-term Exams</b>	<b>40 %</b>
<b>Assignments and Quizzes</b>	<b>10 %</b>
<b>Final Examination</b>	<b>50 %</b>

# What is a Project?

- “A Project is a temporary endeavor undertaken to create a unique product or service or result.” (PMI)
- “A Combination of human and non-human resources pooled together to achieve a specific purpose and deliverables.”

# What is a Project?

- “A Project is a one-shot, time-limited, goal-directed, major undertaking requiring the commitment of varied skills and resources.”  
PMI
- “A Combination of human and non-human resources pooled together to achieve a specific purpose.”



# Project Characteristics

- **Temporary** (start, end, project team)
- **Unique** (Product, Service or Result)
- **Completed** (objectives, acceptance & Satisfaction)
- **Progressive Elaboration**
- **Project variables and parameters** (nature, size, budget, resources, complexity)
- **Project Categories** (small, medium, large)
  - Source (PMI, 2004)

# Project Examples

## ❑ Construction projects of various types:

- Residential projects such as villas and town houses.
- Building projects (non residential) such as retail stores, malls, and hospitals.
- Heavy engineering projects such as dams, tunnels, and bridges.
- Industrial projects such as power plants and refineries.

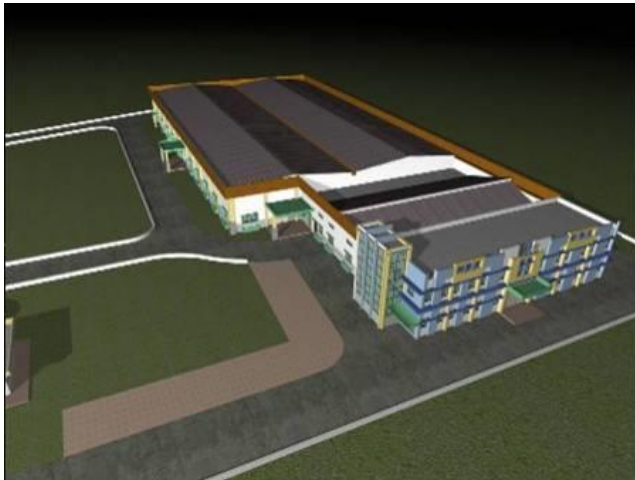
## ❑ Engineering Projects:

*Product Development, Manufacturing, |construction, Design Engineering, Industrial Engineering, technology, production,* or any other field that employs personnel who perform an engineering function.

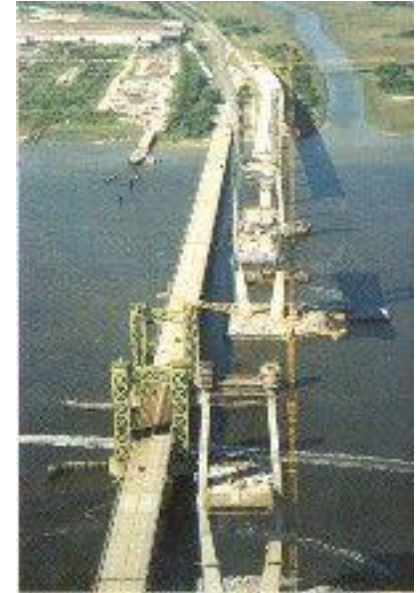
## ❑ Research and development projects such as the Stealth fighter plan.

## ❑ Software Development projects such as the university registration computer program.

# Examples of Projects



# Examples of Projects





# Examples of Projects

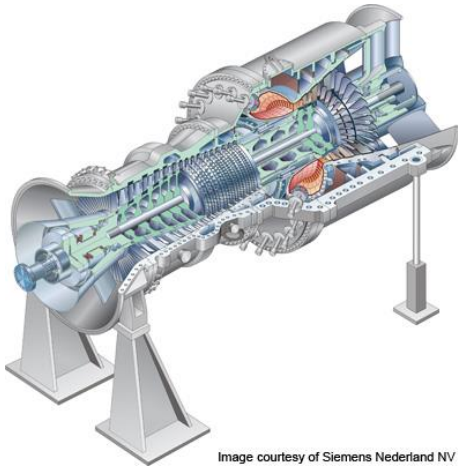
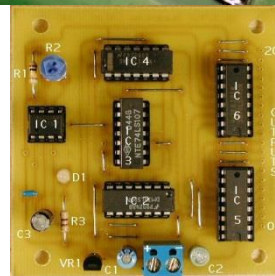
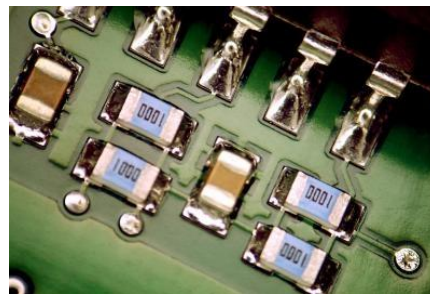
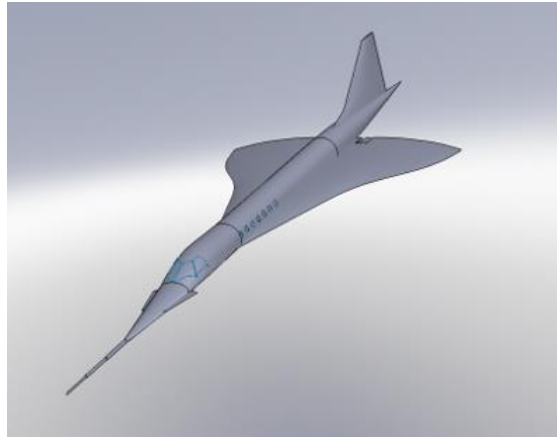


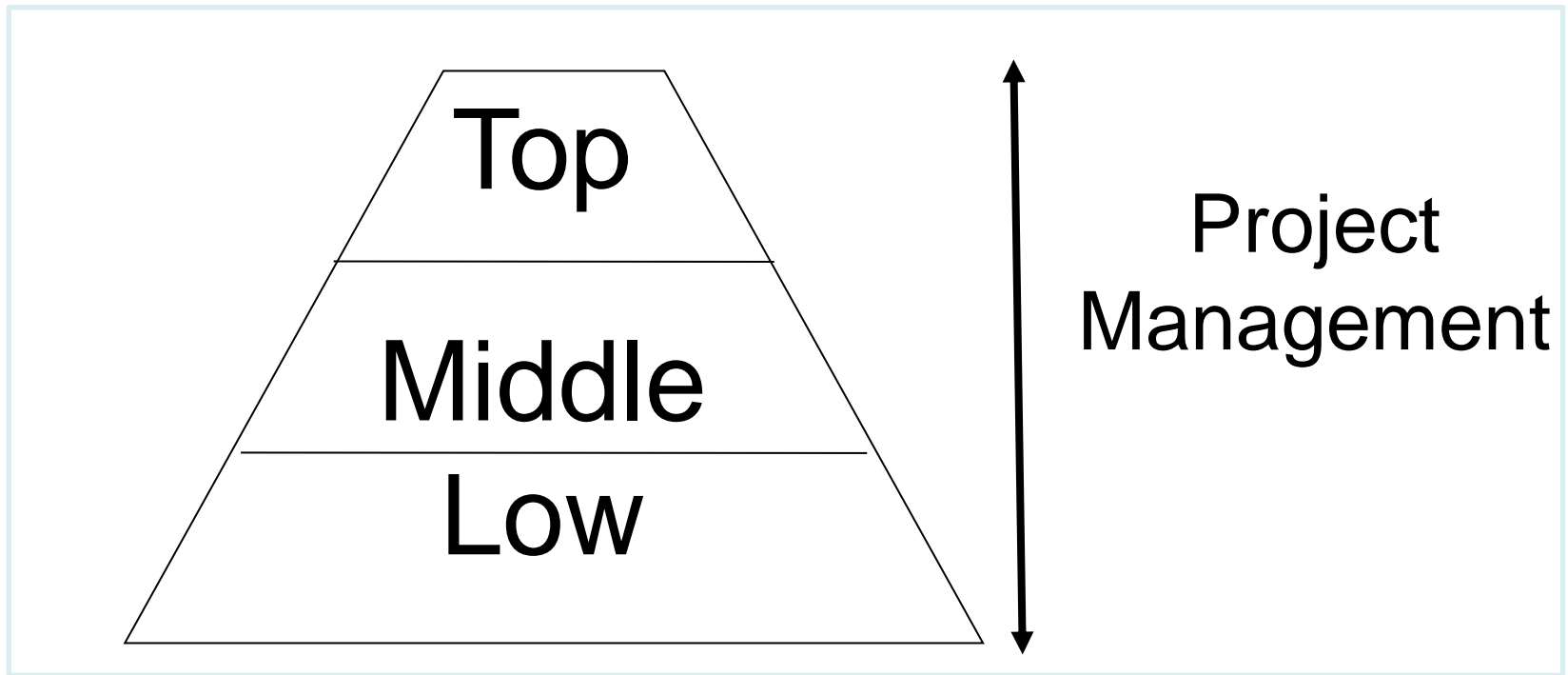
Image courtesy of Siemens Nederland NV



# What is Management?

- **Management** is a process concerned with attainment of objectives. It includes planning, organizing, directing, and controlling, i.e., the management functions.

# Levels of Management

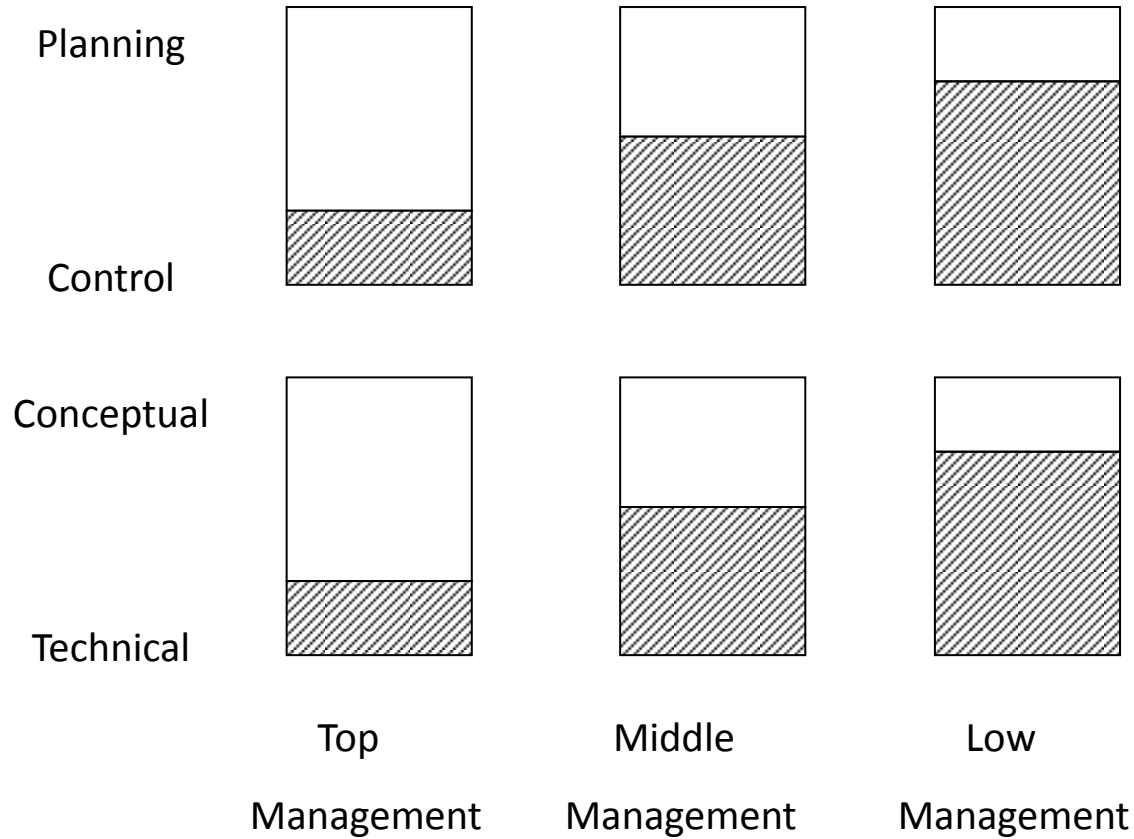


# Levels of Management

- Although the work of management involves the specified functions regardless of level, their purpose, nature, and relative importance vary at the different levels, the required skills (conceptual *vs.* technical) tend to vary as well.



# Levels of Management



# What is Project Management?

- Project Management involves the coordination of group activity wherein the manager plans, organizes, staffs, directs, and controls to achieve an objective with constraints on time, cost, and performance of the end product.

# What is Project Management?

- **Project Management** is defined as the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. (PMI,2004)

# What is Project Management?

- **Project Management** is process of applying the management functions in the context of a project.
- **Project Management** is optimizing the use of resources to meet the project objectives.

# Project Management Functions

- Planning
  - What are we aiming for and why?
- Organizing
  - What's involved and why?
- Motivation
  - What motivates people to do their best work?
- Directing
  - Who decides what and when?
- Control
  - Who judges results and by what standards?

# Planning

- **What are we aiming for and why?**
  - Develop project objectives, goals, and strategies.
  - Develop project work breakdown structure.
  - Develop precedence diagrams to establish logical relationship of project activities and milestones.
  - Develop time-based schedule for the project based on the time precedence diagram.
  - Plan for the resource support of the project.

# Organizing

- **What is involved and why?**

- Establish organizational structure for the team.
- Identify and assign project roles to members of the project team.
- Define project management policies, procedures, and techniques.
- Prepare project management charter and other delegation instruments.
- Establish standards for authority, responsibility and accountability of the project team.

# Motivation

- **What motivates people to do their best work?**
  - Determine project team member needs.
  - Assess factors that motivate people to do their best work.
  - Provide appropriate counseling and mentoring as required.
  - Establish rewards program for project team members.
  - Conduct initial study of impact of motivation on productivity.



# Directing

- **Who decides what and when?**
  - Establish “limits” of authority for decision making for the allocation of project resources.
  - Develop leadership style.
  - Enhance interpersonal skills.
  - Prepare plan for increasing participative management techniques in managing the project team.
  - Develop consensus decision making techniques for the project team.

# Control

- **Who judges results and by what standards?**
  - Establish cost, schedule, and technique performance standards for project.
  - Prepare plans for means to evaluate project progress.
  - Establish a project management information system for the project.
  - Prepare project review strategy.
  - Evaluate project progress.

# Project Management main Function Activities

## **Planning**

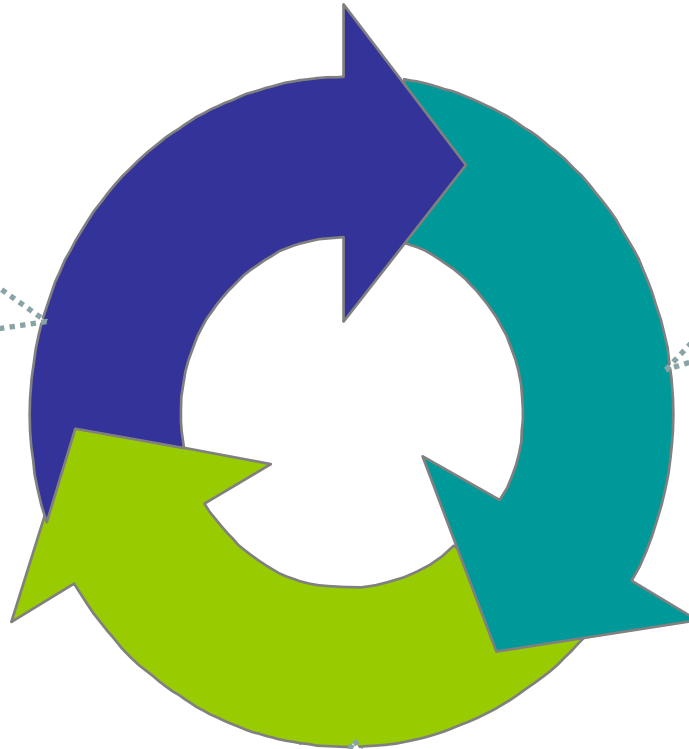
- ☑ Objectives
- ☑ Resources
- ☑ Work break-down schedule
- ☑ Organization

## **Scheduling**

- ☑ Project activities
- ☑ Start & end times
- ☑ Network

## **Controlling**

- ☑ Monitor, compare, revise, action



# Project Management main Function Activities

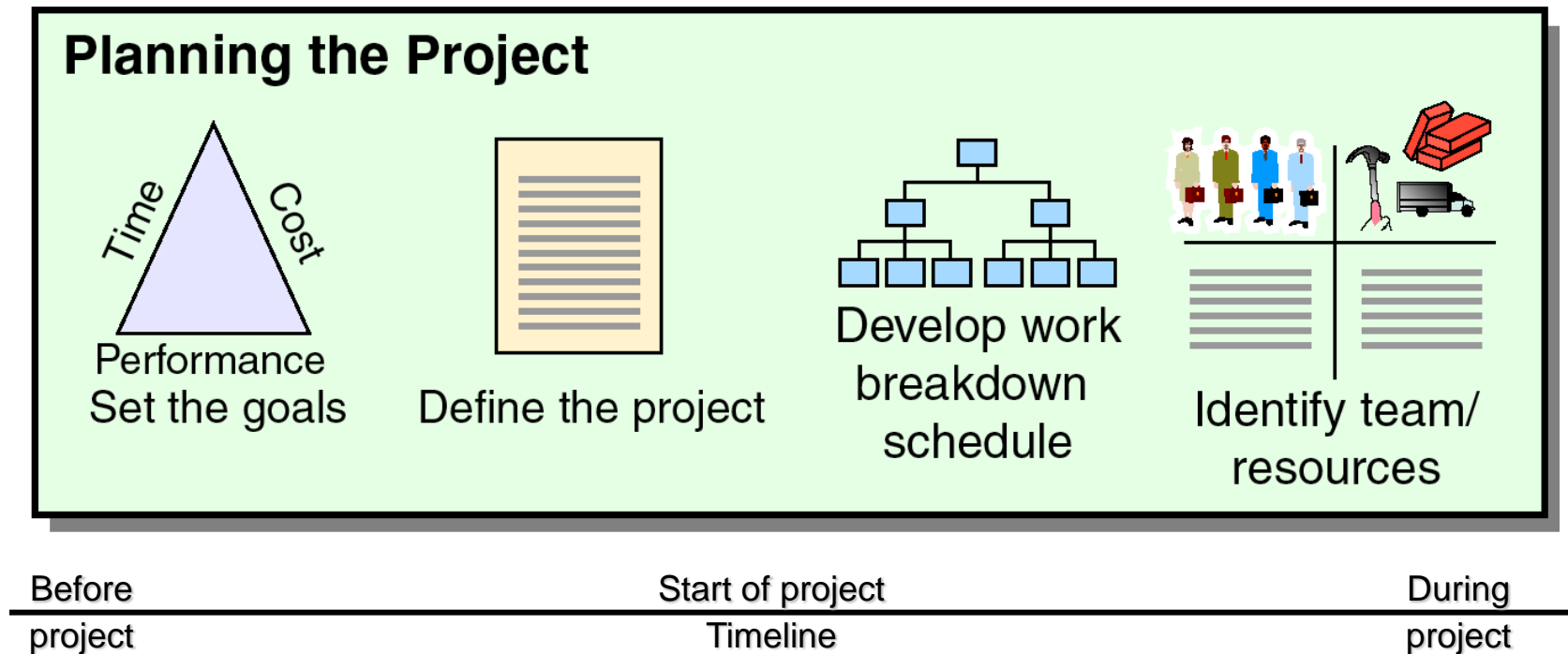


Figure 3.1 (from Heizer/Render –Operation Management)

# Project Management main Function Activities

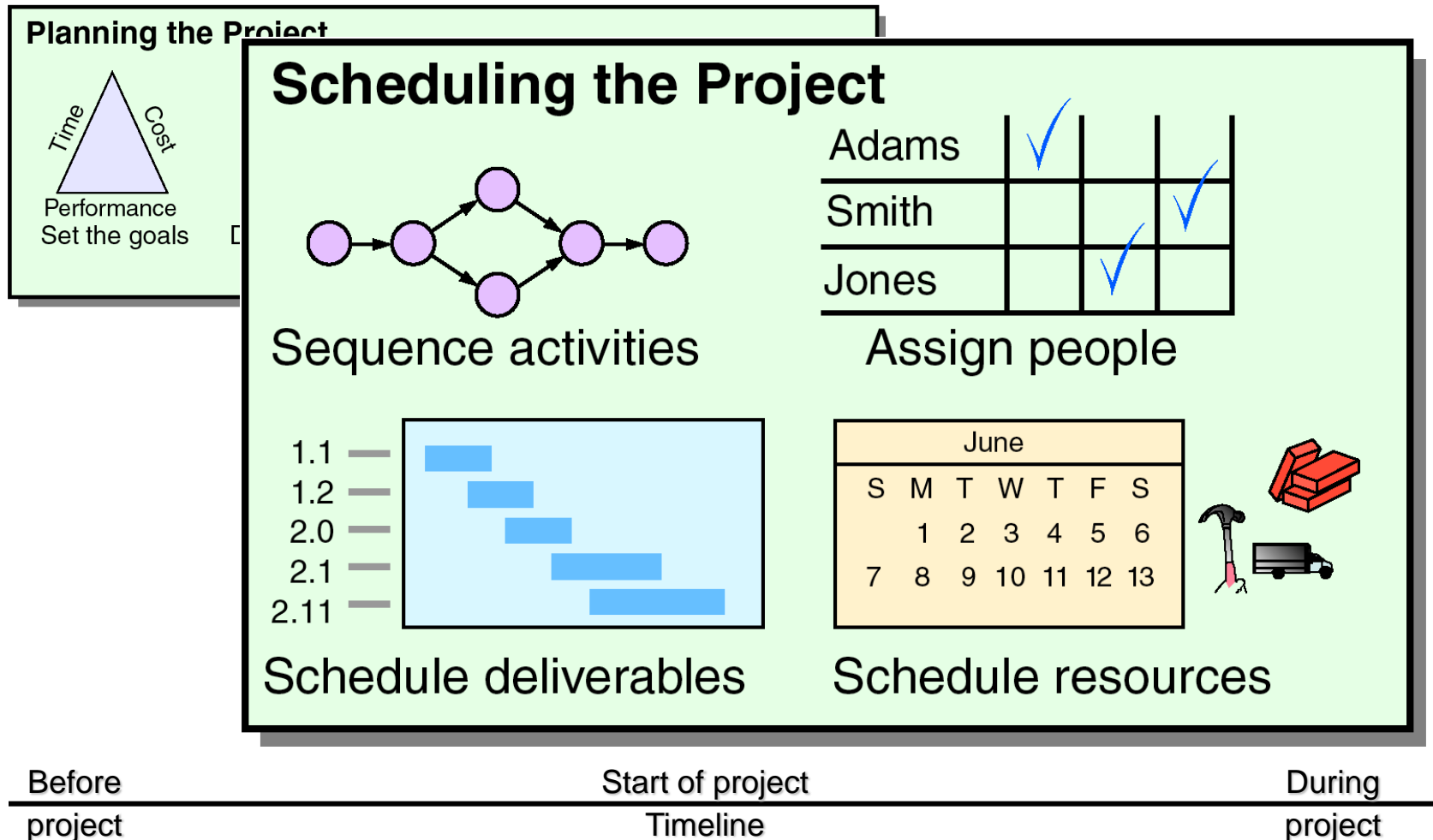


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# Project Management main Function Activities

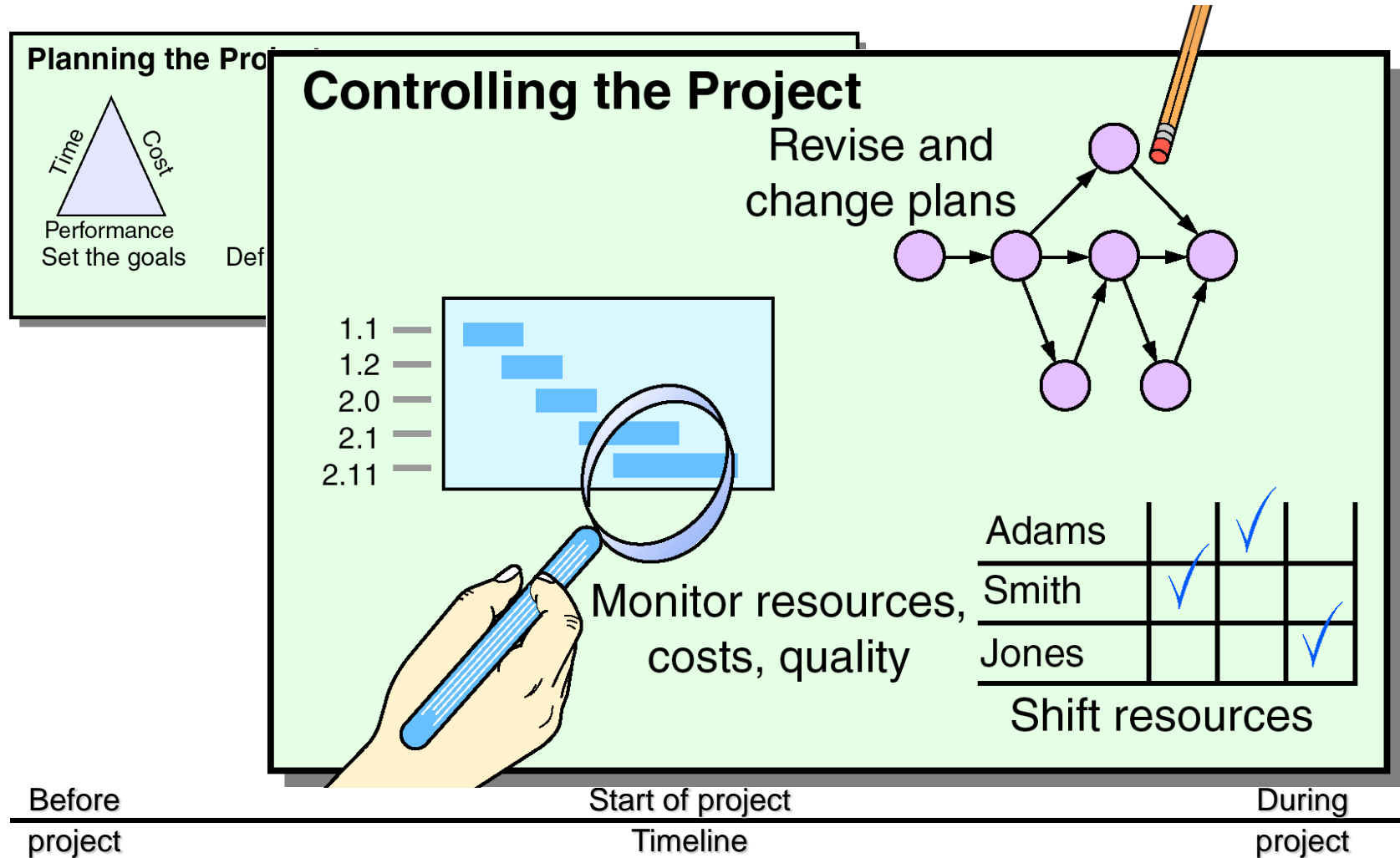


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# Project Management main Function Activities

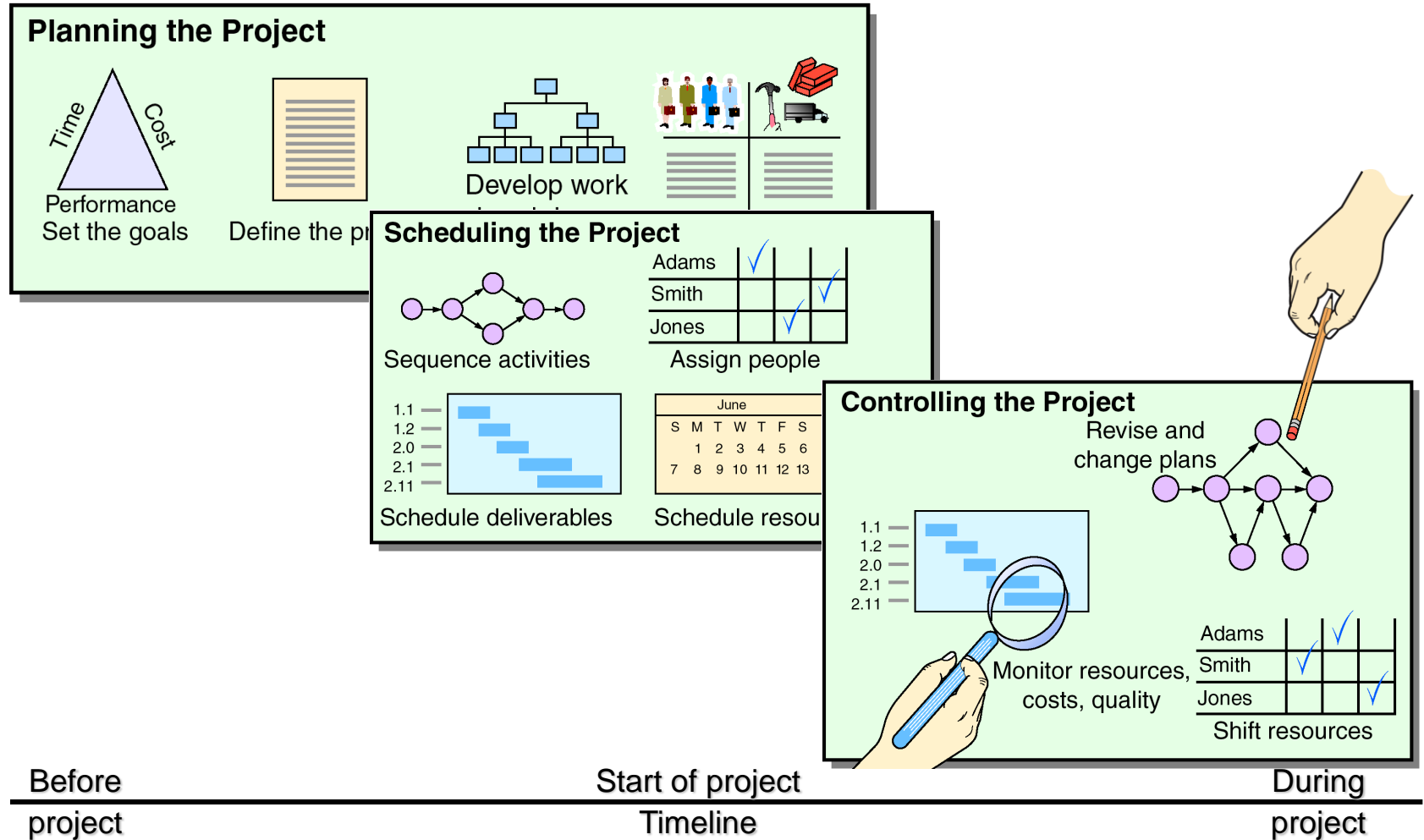


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# Project Management main Function Activities

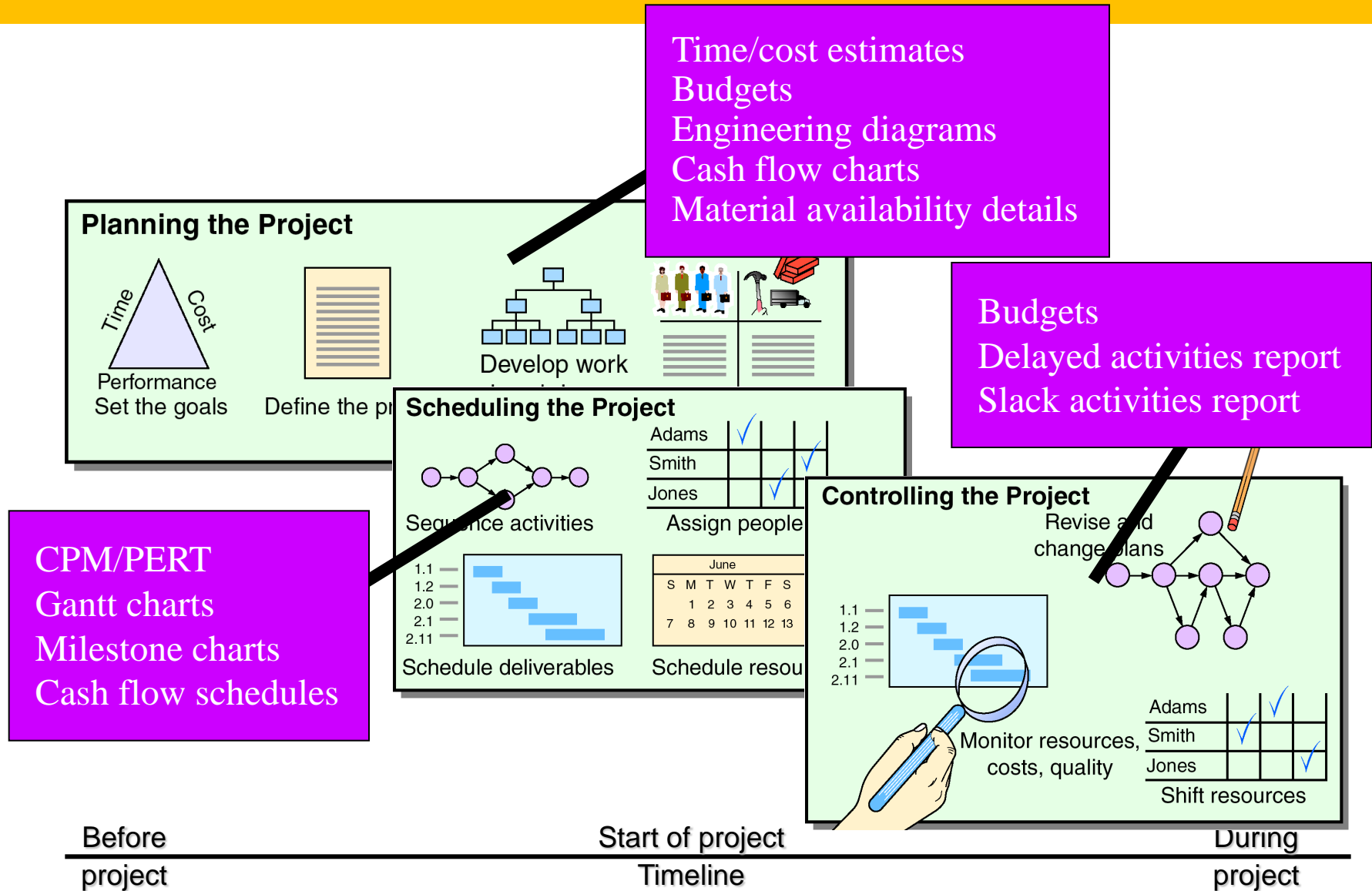


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# Project Stakeholders

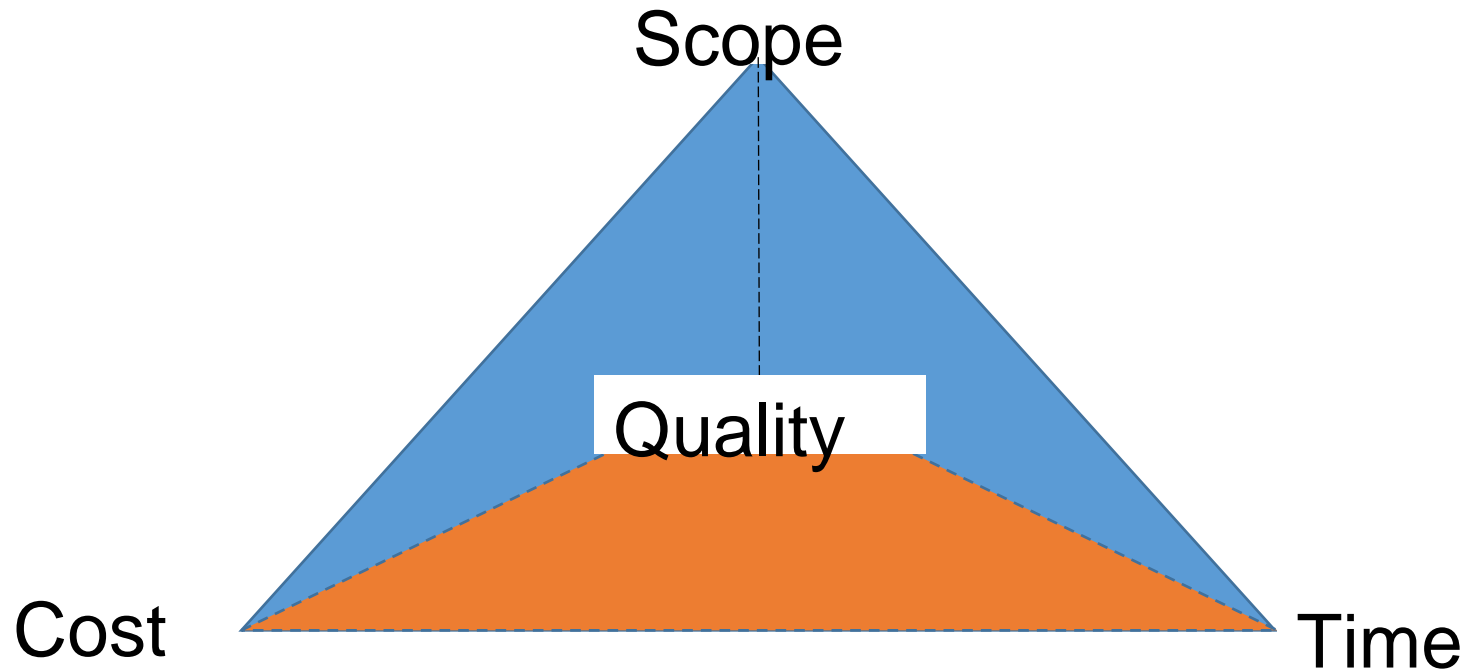
- Project sponsor
- Project Owner
- Project manager
- Customer/user
- Functional managers
- Performing organization
- Project team members
- Project management team
- Internal and external
- Contractors, suppliers and vendors
- Government agencies and media

# Project Common Resources

The main resources are (3M)

- Manpower (People)
- Money
- Materials And Machines.

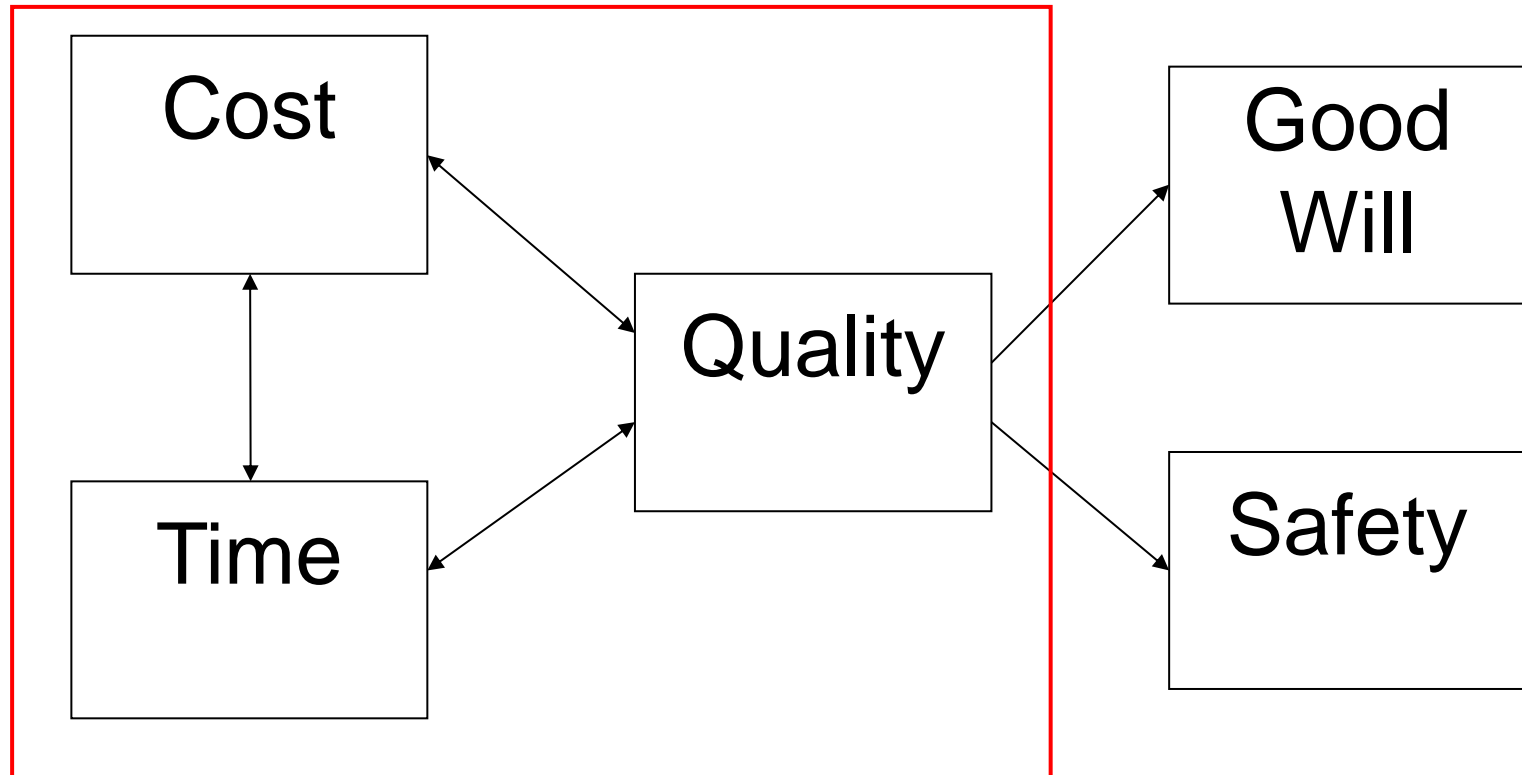
# Project Key factors



**Key factors** affect and vary the project

- Scope
- Cost
- Time, and
- Quality (affected by balancing the three factors)

# Project Management Objective



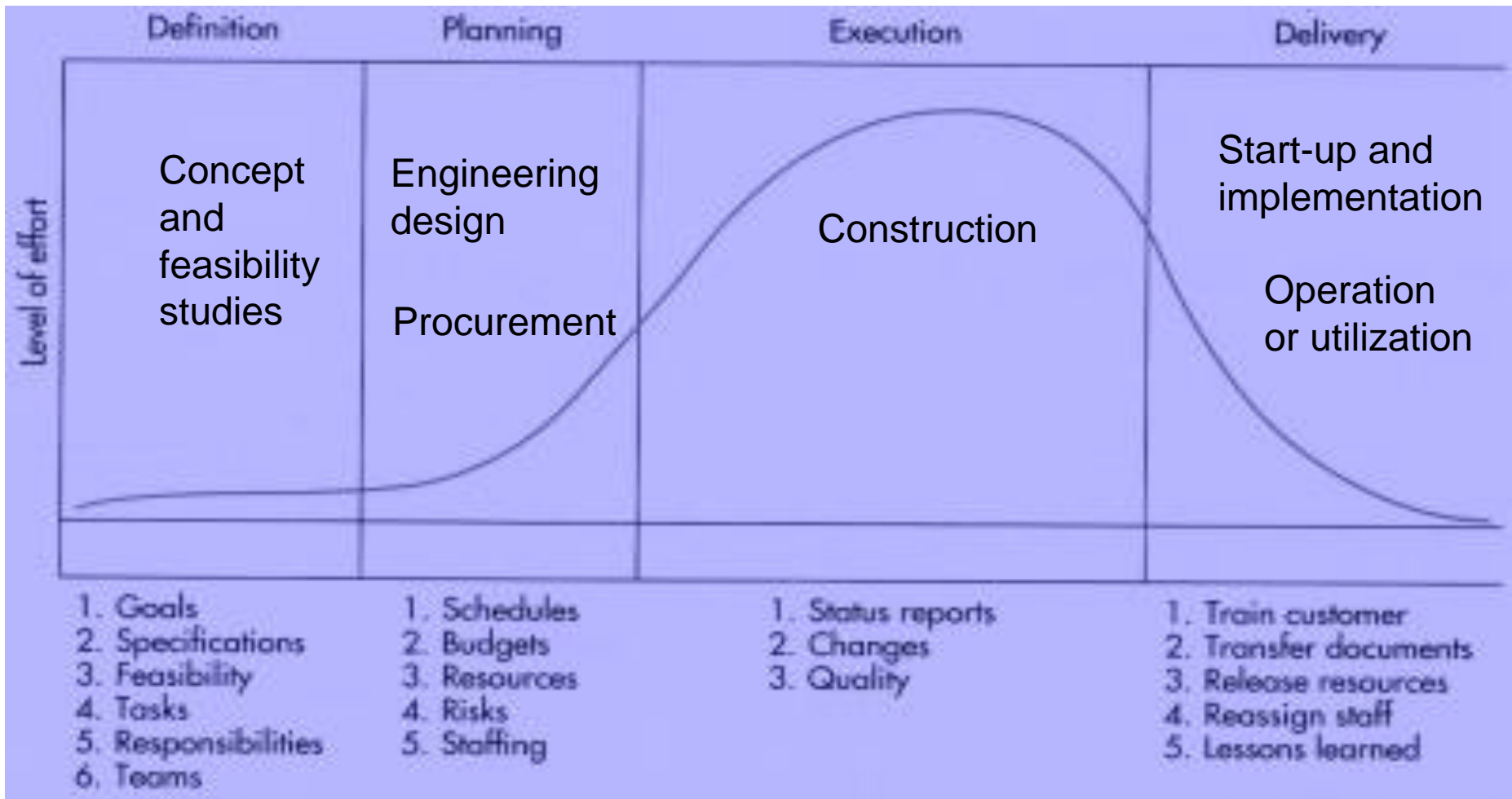
# Assessing Project Success

- *Within Schedule*
- *Within Budget*
- *Meeting Spec requirements*
  - ❖ *With minimal or agreed upon scope changes*
  - ❖ *Without disturbing workflow of organization*
- *Acceptance by customer and or user*
- *Customer Satisfaction*
- *Without negatively affecting corporate culture*

# Project Life Cycle

- Concept and feasibility studies.
- Engineering design.
- Procurement.
- Construction.
- Start-up and implementation.
- Operation or utilization

# Project Life Cycle



# Concept and feasibility studies (*Owner and Consultant*)

- Initiate the project idea through recognizing a need for the project which could be:
  - Satisfying a future demand (e.g. electricity)
  - Improving productivity (new machine)
  - Increasing income (real estate), or
  - Alleviating existing deficiencies, e.g.:
    - long waiting time at a road intersection,
    - limited office space,
    - small warehouse,
    - no competition edge-high competition-(manual vs. computerized word processing)



# Concept and feasibility studies (*Owner and Consultant*)

- Identify the possible alternatives and check their feasibility. Feasibility criteria are:
  - ***Technical***: approve the alternative that satisfies the technical restrictions,
  - ***Economical***: identify the most economical alternative,
  - ***Financial***: identify the source and availability of money to finance the alternative.

# Engineering Design

## *(Owner and consultant)*

- Preparing blue prints (**drawings**) and specs (**specifications**) for the project.

# Procurement

It involves contracting with a general contractor and subcontractor and ordering project resources.

# Construction

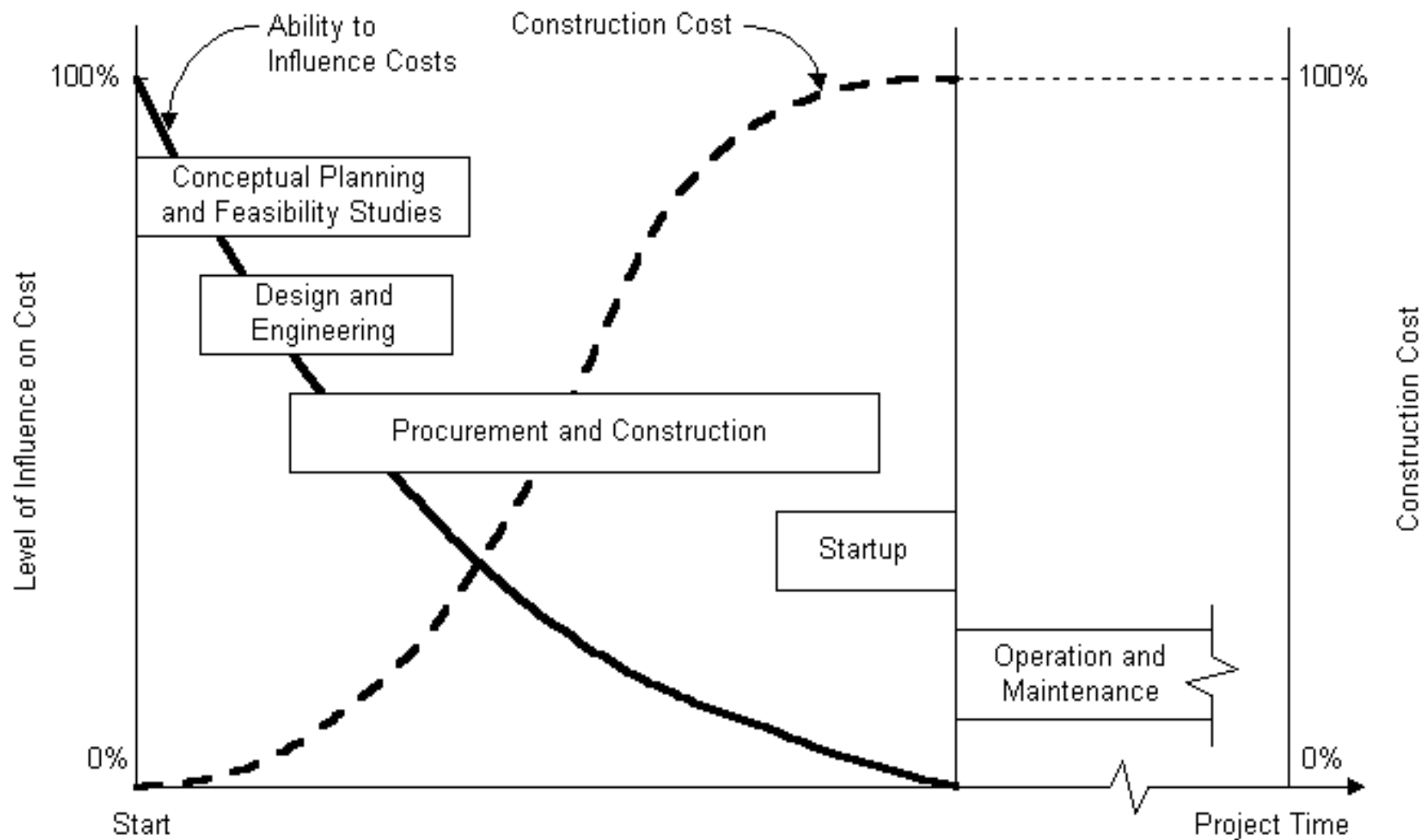
- It converts the blue prints and specs into physical structures.

# Start-up and implementation

- It involves testing the functionality of the components and the whole system.  
(Special attention in refineries and chemical plant)

# Operation and utilization (O&U)

- O&U involves the final phase of the project life cycle that will last up to the life of the project.



# Example of a Project Management Process

- **Planning Phase**
  - Listing of Activities
  - Gross Resource Requirements
  - Cost Estimates
  - Activity Durations



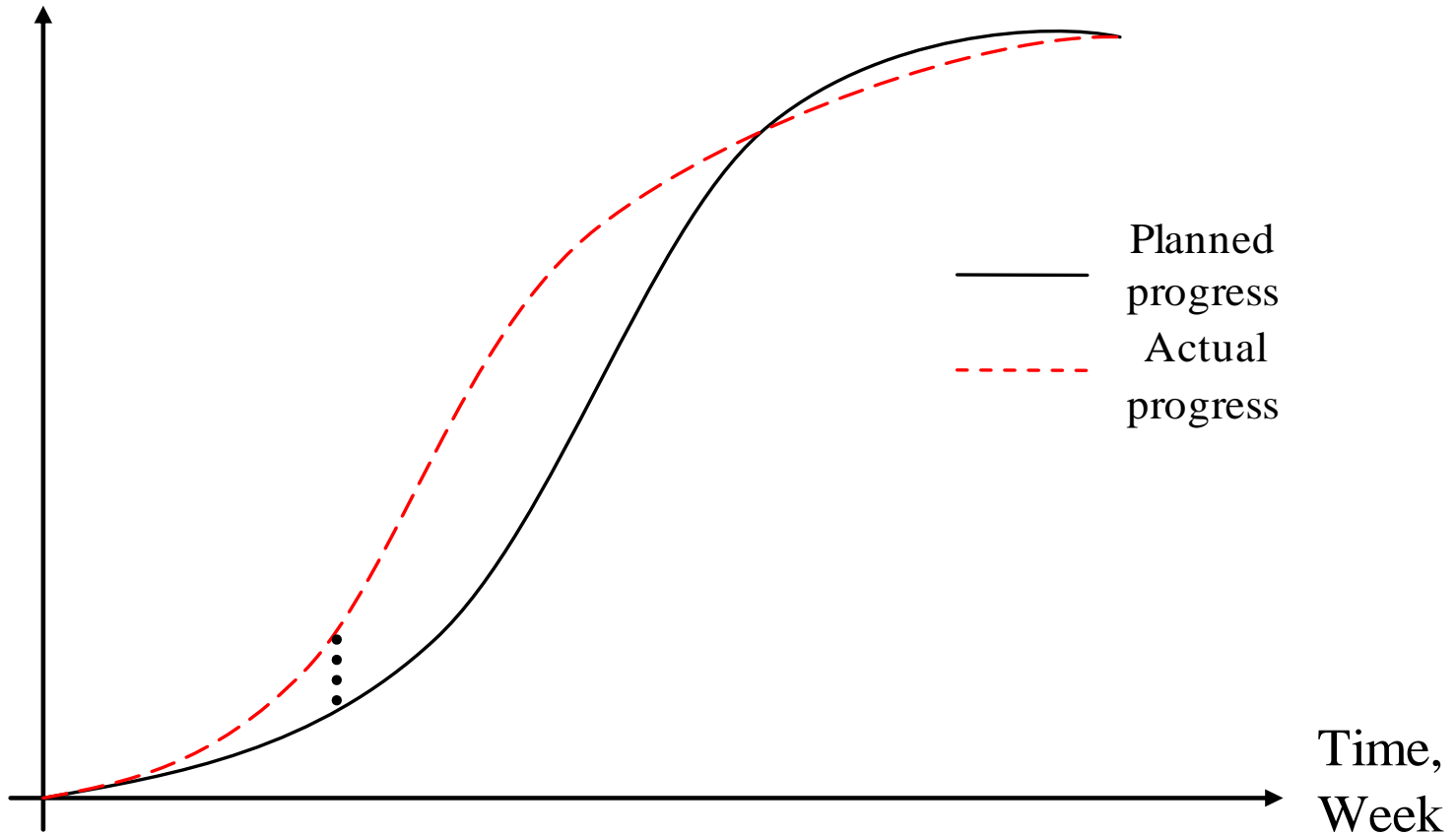
# Example of a Project Management Process

- **Scheduling**
  - Time ordering of Activities
  - Resource Requirement at each stage
  - Expected completion time of each task

# Example of a Project Management Process

- **Monitoring & Control**
  - Reviewing the difference between the schedule & actual performance
  - Analysis of the difference
  - Correction Measures

Progress \$, MH



Principles

1. Don't exceed resource Capabilities
2. Provide for continuity of operation
3. Start Critical Activities early