Construction and Project Management
Lecture 2

Planning

The terms planning & scheduling are often used interchangeably. However, if a distinction is required, planning refers to the process of generating a time frame for the project, which becomes a schedule when start and finish dates are assigned to the activities. In the past, scheduling generally referred to resource scheduling. This is better understood with an example. For instance, planning is providing a time frame for the project, like aiming to complete a project in 60 months, while fixing a start and finish date is scheduling.

Steps in Planning:

- **Collect requirements:** This is basically to plan what falls under the broad idea. For instance, if you were to construct a hospital, what are the departments that would fall under the hospital, etc.

- **Define scope:** Scope is basically one's long sight about a project. Would the project be feasible? Is the investment going to bring returns to the investor? How many people would be impacted through the project?, etc.

- **Create WBS (Work Breakdown Structure):** For instance, a project's pre construction structure. It's where we need to assign the activities related to the project, breakdown the project's activities so as to delegate work effectively and efficiently, etc. This is done in order to be efficient and effective in whatever you plan on incorporating.

- **Define Activities:** Here you describe the process of each activity, how many people are required to incorporate the activity, how much time can the activity take, what must be the end result or needed impact of such an activity, what machinery are you going to use, etc.

- **Sequence Activities:** This prevents chaos and confusion. When activities are sequenced in the right order, activities can be more effectively and efficiently performed.

- **Estimate activity resources:** What are the resources required for each activity so as to keep a careful count for each activity. For instance, one particular activity may require more machinery than manpower. In such cases, a count must be taken to check on investments, cost, etc.

- **Estimate activity duration:** This is done in order to maintain a strict discipline, to finish the work on time. Time must be allotted to different activities or else people would take their own sweet time and work would never get done.

- **Develop schedule:** A day to day basis schedule must be prepared so as to be more prompt and efficient. It also means to set a start date and a deadline for each activity.

- **Estimate costs and Determine Budget:** Here, you take note of the expenses for each activity, then group it together to estimate an overall budget.

- **Plan Quality:** This depends on the quality you plan on maintaining. This must be followed from day one.

- **Develop Human Resource Plan:** For instance, a single building will require only one project manager, while the same developer for multiple number of buildings will require about 6 project managers.

- **Plan Communications**: This is nothing but the communication protocol. There are so many contractors for a particular project. For example, an electrical contractor for a particular project will be contacted regarding electrical supplies or operations for the project.

- **Plan Risk Management:** This needs to be assessed prior. The necessary steps to be taken in order to curb risks need to be assessed and inculcated by companies.

- **Identify Risks:** One needs to identify the risks involved in a particular project.

- **Perform Qualitative Risk Analysis**

- **Perform Quantitative Risk Analysis**

- **Plan Risk Responses:** One needs to ensure that they are not under stress while responding to risks. If one plans responses to risks in advance, the response is bound to be effective to the risks involved, thereby solving a foreseen situation or problem for effective work to be implemented.

- **Plan Procurements:** This is to plan the material needed for an activity in advance. For instance, if a certain machine is required for an activity, it must be planned in advance.

Scheduling

The basic approach of all scheduling techniques is to form a network of activity and event relationship that graphically portrays the sequential relations between the tasks in a project. Such a network is a powerful tool for planning and controlling a project and has the following benefits:

> It is a consistent framework for planning, scheduling, monitoring and controlling the project.

> It illustrates the interdependence of all tasks, work packages and work elements.

> It denotes the time when specific individuals and resources must be available for work on a given task.

> It aids in ensuring that proper communication takes place between departments and functions.

> It determines an expected project completion date.

> It identifies the so called critical activities, which, if delayed, will delay the project's completion as well.

> It also identifies activities with slack that can be delayed for specified periods without penalty, or from which resources may be temporarily borrowed without harm.

> It determines the dates on which tasks must be started if the project is to stay on schedule.

> It illustrates which tasks must be coordinated to avoid resource or timing conflicts.

> It also illustrates which tasks may be run in parallel to achieve the predetermined project completion date.

> It relieves some interpersonal conflict by clearly showing task dependencies.

> It may, depending on the information used, allow an estimate of the probability of project implementation by various dates, or the date corresponding to a particular prior probability.

PROJECT SCHEDULING/ ANALYZING TOOLS:

BC - Bar Chart

PERT - Programme Evaluation and Review Technique

CP - Critical Path Analysis

CPP & S - Critical Path Planning and Scheduling

DCPM - Decision Critical Path Method

GRASP - General Resource Allocation and Scheduling Programming

GERT - Graphical Evaluation and Review Techniques

LCES - Least Cost Estimating and Scheduling

PEP - Programme Evaluation Procedure

PNA - Precedence Network Analysis

LOB - Line of Balance Technique

LPC - Linear Programme Chart

TSN - Time Scale Network

How traditional methods are used, what are the merits and demerits of traditional methods:

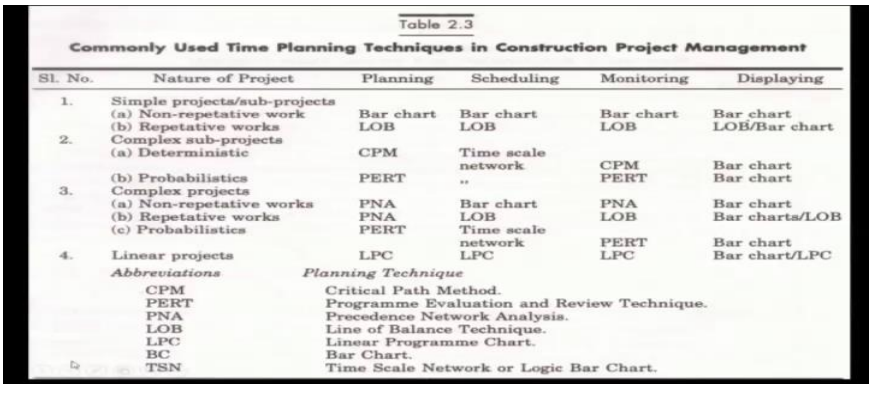


Table 2.3

Commonly Used Time Planning Techniques in Construction Project Management

Sl. No.	Nature of Project	Planning	Scheduling	Monitoring	Displaying
1.	Simple projects/sub-projects				
	(a) Non-repetative work	Bar chart	Bar chart	Bar chart	Bar chart
	(b) Repetative works	LOB	LOB	LOB	LOB/Bar chart
2.	Complex sub-projects				
	(a) Deterministic	CPM	Time scale network	CPM	Bar chart
	(b) Probabilistics	PERT	,,	PERT	Bar chart
3.	Complex projects				
	(a) Non-repetative works	PNA	Bar chart	PNA	Bar chart
	(b) Repetative works	PNA	LOB	LOB	Bar charts/LOB
	(c) Probabilistics	PERT	Time scale network	PERT	Bar chart
4.	Linear projects	LPC	LPC	LPC	Bar chart/LPC

Abbreviations — *Planning Technique*

CPM	Critical Path Method.
PERT	Programme Evaluation and Review Technique.
PNA	Precedence Network Analysis.
LOB	Line of Balance Technique.
LPC	Linear Programme Chart.
BC	Bar Chart.
TSN	Time Scale Network or Logic Bar Chart.

Gantt Chart/ Bar Chart

Traditional Management System

A traditional phased approach identifies a sequence of steps to be completed. In the 'traditional approach', five developmental components of a project can be distinguished (four stages plus control).

Initiation stage - This stage deals with the conceptualization of the project, the designing of a project.

Planning and Design - at site level, what is to be executed.

Designing, Executing and Monitoring and Controlling - These three go hand in hand, since designs need to be executed and design can be changed during the execution stage. This can be done only with effective and efficient monitoring and controlling.

Then comes the last stage - **closing.**

Traditional Management System

Typical development phases of an engineering project:

> Initiation

> **P**lanning and design

> Execution and Construction

> Monitoring and Controlling systems

> Completion and finish point

Not all projects will have every stage. This will vary according to the type and kind of project and certain projects can be terminated even before they reach completion.

Many industries use variations of these project stages. For example, when working on a brick and mortar design and construction, projects will typically progress through stages like pre-planning, conceptual design, schematic design, design development, construction drawings (or contract documents), and construction administration (production of drawings and further maintenance).

Gantt Chart/ Bar Chart

This method, introduced in 1917, is the oldest and most extensively used method for production planning, scheduling and control. The Gantt chart shows the relationship between different activities over a time span. Time frame, expressed either in terms of hours, days, weeks or even months, is shown on the horizontal X axis and activities are plotted against the Y axis.

A horizontal bar chart is used in project scheduling. Each activity or task is depicted as a block over time, actual performance is recorded in real time and compared to planned deadlines necessary for completion.

A Gantt chart is used for the following activities:

> Establish the initial project schedule

> Allocate resources

> Monitor and report progress

> Control and communicate the schedule

> Display milestones

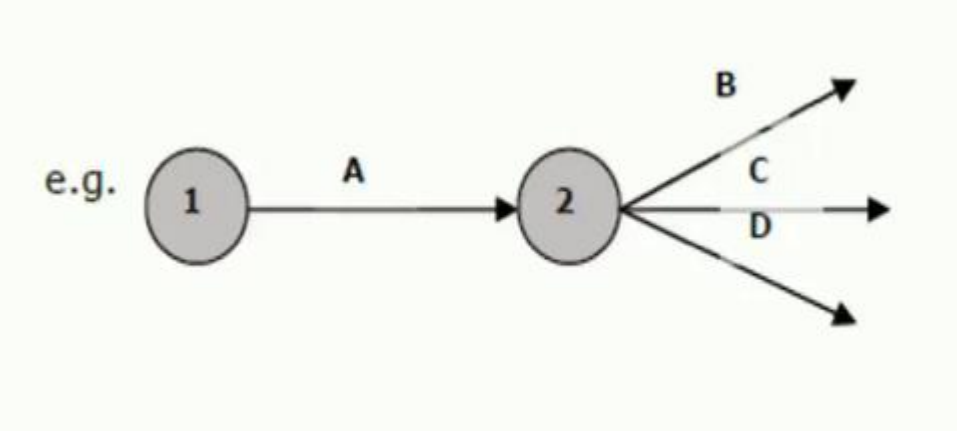
> Identify and report problems.

Scheduling in Bar Chart

Each activity or event on the schedule should have a responsible individual assigned, so there is clear ownership and schedule status can be updated without confusion. Here, one should know the meaning of 'activity' and 'event'.

Activity - An activity is a part of the project denoted by an arrow on the network. The tail of the arrow indicates the start of the activity, whereas the head indicates the end of the activity.

"Event" - Event is the stage or the point where all previous jobs merging in it are completed and jobs bursting out are yet to be completed.



From the above diagram, 1 and 2 denotes the event from where activities A, B, C and D can merge or burst out. Scheduling process needs duration of the activity.

Table 1.1: Activities for a project with duration

No.	Activity	Duration (day)
1	Project idea / kickoff meeting	07
2	Pre feasibility study of the project	30
3	Administrative approval of the project	15
4	Preparation of the DPR	35
5	Sanctioning the DPR	15
6	Implementation of the project	180
7	Overview of the project progress	25
8	Sending the completion report of the project	07

But for scheduling any of the tasks in the above table, each should have a start date and completion date. So, all the duration of the above activities should be specified by start date and end date as presented in table 1.2

Table 1.2: Activities for a project with time schedule

No	Activity	Duration (Day)	Start Date	Completion Date
1	Project idea / kickoff meeting	07	1-1-07	7-1-07
2	Pre feasibility study of the project	30	8-1-07	6-2-07
3	Administrative approval of the project	15	7-2-07	22-2-07
4	Preparation of the DPR	35	23-2-07	30-3-07
5	Sanctioning the DPR	15	31-3-07	14-4-07
6	Implementation of the project	180	15-4-07	14-10-07
7	Review of the project progress	35	22-4-07 22-5-07 22-6-07 22-7-07 22-8-07 22-9-07	26-10-07 26-5-07 26-6-07 26-7-07 26-8-07 26-9-07
8	Sending the completion report of the project	07	15-10-07	20-10-07

So this can be further explained with the help of a bar chart.

Table 1.3: Bar Chart of a project progress

No	Activity	Jan 07			Feb 07						March 07			April 07			Oct. 07				
		1	7	8	5	6	7	21	22	23	29	30	31	13	14	15	13	14	15	19	20
1	Project idea /																				
2	Pre feasibility																				
3	Administrative																				
4	Preparation of																				
5	Sanctioning																				
6	Implementation																				
7	Review of the																				
8	Sending the																				

Bar Chart - Advantages

> This is a simple and inexpensive method and can be developed even by supervisory staff with some amount of training.

> These charts clearly show the decided time and work schedules for every job. Monitoring and control are easier and can be done within a minimum time frame and at the lowest cost.

> These charts can be changed and updated quickly at a lower cost.

> There is no need to develop the customized Gantt chart boards as the standard chart boards are available in the market.

Bar Chart - Disadvantages

> They do not show job inter-relationships and interdependence.

> Cost implications cannot be shown.

> With these charts, it is not possible to depict other alternatives for project completion.

> The shape and form of Gantt charts can differ according to the nature of the requirement.

Load Charts - Useful for manufacturing projects during peak or heavy load periods. The format of the Gantt Load Chart is similar to the Gantt Project planning chart.

Project Planning Chart - addresses the time of the individual's work elements, giving a timeline for each activity of a project. These charts are easy to understand and show when each activity starts and finishes. However, the chart cannot determine when each activity may start or if we can start a particular activity before finishing the preceding activity.