Unit 1 Introduction to Software Project Management

(1) What is Project?

It is defined as a sequence of task that must be completed to attain a certain outcome.

"Any Temporary endeavor with a definite beginning and end. Depending upon the complexity, it can be managed by a single person or hundreds.

Characteristics:

* Has a clear start and end date.
* A project has boundaries
* Planning is required
* Specific objectives | products are to be met | created.
* Carried out in several phases
* May be simple or large and complex.

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(2) What is software Project?

It is a coll^n of and integration of various components of the s/w, that begins with early investigation and ends with proper implementation.

It is carried out according to the execution methodologies in a specific period of time to achieve intended s/w product.

(3) What is software project management?

It is an art of and science of planning and leading s/w projects. It is subdiscipline of project mgt. where s/w projects are planned, implemented, monitored and controlled.

Most IT related projects are managed in Agile style to keep up with the increasing pace of business and

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based on customer and stakeholder feedback.

S/w Engineering Problems:

(a) Problem of scale:

For every projects, different methods are used where any method used for smaller projects cannot scale up for doing large and complex projects and sometimes different technologies too.

(b) Cost, schedule and quality:

Main component to be considered as cost is person-month i.e. persons cost is considered to be total no. of person-months spent in the project. Likewise same goes for schedule where discipline is priority and to build up a quality product on time and within specified cost.

(c) The Problem of Consistency:

As, high quality, low cost and small cycle time are primary objectives of any project and also the "Consistency". And all of these {quality, cost, cycle} need to be consistent and with no any compromise.

[These problems may vary, depends upon which reference you're taking to study]

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S/W product attributes :

Quality may be defined from different perspectives. Let's see, how one can measure the quality attributes of product:

* Reliability * Maintainability * Usability * Portability
* Correctness * Efficiency * Flexibility * Reusability
* Interoperability * Integrity/security etc.

(a) Reliability : If the product is reliable enough to sustain any condition or not? Should give correct results consistently.

(b) Maintainability : Should be easy to maintain, update, upgrade time to time and maintainance should also be cost effective.

(c) Usability : The application should be easy to use, user friendly as well as easy to learn. Navigation should be simple.

(d) Portability : Should be portable in costing, technology, behaviour and maintainances.

(e) Efficiency : Measured as time required to complete any tasks given to system and should be real time calculations.

(f) Security : Sufficient to prevent unauthorized access to systems functions, prevent information loss etc.

[You can describe rest of them. If you need
But 5 points are enough for exams.]

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S/w projects v/s other types of projects:

The product of s/w project have certain characteristics that makes them different.

(a) Invisibility: For physical projects like road, bridge, house, the progress can be easily ~~vsi~~ seen but with s/w, progress is not immediately visible.

(b) Complexity: Every penny to huge amount of cost spent on s/w projects contains more complexity than any other engineered artifacts.

(c) Flexibility: Best strength for s/w projects is that it is flexible. They are subject to a high degree of change when needed.

(d) Conformity: For physical products, systems and materials can have some complexity but they are governed by physical laws that are consistent. But s/w developers have to confirm the reqn of human clients which keeps on fluctuating.

Categorizing software Projects:

(A) Compulsory Projects	Voluntary Projects
Those projects in which the staff of an org. have to use the project if they want to use it.	Those projects that are voluntarily used by users. Eg: Computer Game, School projects etc.

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(B) Information Systems (projects)	Embedded Systems (projects)
* These projects are used by staffs to carry out office processes and tasks. * Eg: Stock Control system	These systems are used to control machines. Eg: A system (elevator) controlling equipment in a building.

(C) Objective Based Projects	Product Based Projects
Such projects whose requirement is to meet certain objectives which could be a no. of ways is objective based product	Such projects whose reqn is to create a product, the details of which have been specified by the client.

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Project Management Cycle:

Projet mgt. cycle is usually broken down into 4 phases:

Initiation → Planning → Execution → closure (General)

Initiation → Planning → Execution → Controlling & Monitoring → Closure (Enhanced)

(A) Initiation:

First you (we) need to identify a business need, problem, or opportunity so that our team can meet those needs and solve problems. In this step, we have to figure out objectives for our projects, determine its feasibility and identify major deliverables (features) for project.

* Do feasibility study
* Identify scope
* Develop business case etc.

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(B) Planning:

In this phase, we breakdown larger projects into smaller tasks, build our team and prepare schedule for completion of assignments.

* Create Project plan
* Estimate Budget
* Create Workflow diagrams
* Gather resources etc.

(C) Execution:

Now it's our time to get to work. Here, we have to turn our plan into action and keep life cycle of project on track, organize team members and make sure work is going on as per the original plan.

* Create tasks and organize workflow
* ~~Bri~~ Breifing team members on tasks
* Monitor quality of work.

(Controlling and monitoring comes under this phase)

(D) Closure:

Now, we have to provide final deliverables, release project resources and determine success of projects and most important "perform evaluation on what did and what did not works with project."

* Analyze project
* Analyze team performances
* Documentation
* Conduct post implementation

[Remember either these *ed points or paragraph or BOTH. What you find easy to Remember/Learn]

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SPM Frameworks:

A SPM framework consists of processes, tasks and tools used to take a project from start to finish. It encompasses all the key components reqn for planning, managing and governing projects.

It is broken into three parts:

(A) Project Life Cycle
(i) Initiation (ii) Planning (iii) Execution (iv) Controlling and Monitoring (v) Closure [They are already described]

(B) Project Control Cycle:
It is process of "monitoring and controlling" the project.
[Elongate (them) if you need more explanation]

(C) Tools and Templates:
Project plans, Project mgt reports, risk logs etc are common tools and templates for managing projects.

Examples
PRINCE2 : High structured frameworks used for upfront planning.

CCPM: Critical Chain Project Mgt. primarily focus on resource allocation for projects.

XPM: Extreme Proj. Mgt. designed for complex and fast envn changing projects.

Scrum : Used to break down projects to 2-4 weeks sprints.

Waterfall : Most traditional method.
Next phase is started only after completion of previous phase.

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Types of Project Plan:

(a) Quality Plan	Describe quality procedures and standards that will be used in project.
(b) Validation Plan	Describes the approach, resources and schedule used for system validation.
(c) Configuration Mgt. plan	Describes configuration mgt. procedures and structures to be used.
(d) Maintenance plan	Predicts the maintainance requirements of system, maintainance cost etc.
(e) Staff Development Plan	Describes how skills and exposience of the projects team members will be developed.

Problems with S/w Project:

* Poor estimates and plans
* Lack of quality standards and measures
* Lack of techniques to make progress visible
* Poor Role definition
* Incorrect success criteria.
* Lack of quality control
* Lack of training
* Remote management etc.

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Requirement Analysis → Specification → Design → Coding → Verification and Validation → Implementation and Installation → Maintainance and Support

Fig: Project Life Cycle.

Activities Covered by SPM

(a) Feasibility study
↳ Information gathering ↳ Estimations ↳ Strategic plannings
[* Introduction then description of current situation then problem discription then proposed development then estimated costs and recommendations are described]

(b) Planning (c) Project Execution

(d) Requirement Analysis (e) Specification

(f) Design (g) Coding (h) Verification and Validation

(i) Implementation | Installation (j) Maintainance & Support

[Those 5/6 steps of software engineering method can be described. These above points.]

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Unit 2

Project Analysis

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Intro:

Project analysis is an assessment of every expense or problem related to a project, prior to the beginning of work on it. After evaluating the profitability of a project, the selection process is undertaken.

The decisions made during the selection of a project directly affect and frame a project's requirement analysis.

Stages of project analysis

(a) Project Identification
(b) Project Formulation [opportunity, feasibility, support, report studies are done]
(c) Market and Demand Analysis
(d) Technical Analysis
(e) Economic and Financial Analysis
(f) Social Cost Benefit Analysis

[These points can be described same as name suggests by yourself (Theory)]

(1) # Strategic Assesment:

* Used to assess (evaluate) whether a project fits in the long term goal of org.
* Usually carried out by senior / Top level Mgt.
* To perform this, one needs a strategic plan that clearly defines the objectives of org.
* Also, Evaluates projects against the strategic

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plan or the overall business objectives Programme Mgt.

* Suitable for projects developed for use in the org. portfolio mgt. (evaluation)
* Also suitable to evalute the projects developed for other companies by s/w houses.

Objectives

* How does the project contribute to the long term goal of org?
* Will the product increase the market share? By how much?

Strategic Analysis Process:

a. Know your goal : You goal should be detailed, realistic and should match the value of your company.

b. Collect and Analyze Information: Collect and gather the appropriate data that relates to needs of your project.

c. Construct a strategy : Review collected information, determine resources, identify business areas and let have some backup plans if strategy does not go as per original plan.

d. Implement your strategy : Now implement your strategy. if does not go as per the plan, make changes or create new plans.

e. Evaluate and Control : Do performance measurements, consistent views of external and internal issues and take corrective measures accordingly.

[Internal and External strategic analysis is same as both enun in POM]

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(2) Technical ~~Analysis~~ Assessment:

Technical assessment are a combination of application based techniques and knowledge based questions employed to measure an employee's understanding of concepts, tools and frameworks on a required technical skills or technology and same goes for the mgt. team who looks after this department.

* Evaluates the functionality of hardware and software that are to be used for project.
* Checks whether the present and available technology good enough for developing proposed projects.
* Whether it will be scalable in future or not and will it be compatible with future technology.

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(3) Economic Analysis:

It is the study of economic systems. It may also be a study of a production process or an industry.

The analysis aims to determine how effectively the economy or something within it is operation.

Eg: An economic analysis of a company focuses mainly on how much profit it is making.

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a. Present Worth: (Value)

It is a concept that states an amount of money today is worth more than same amount in the future.
Receiving $1,000 today is more worth than $1,000 after 5 years.

Eg:
if an investor receives $1,000 today, and can earn a rate of return 5% per year, the $1,000 today is certainly worth more than receiving it five years from now.

$$\text{Present Value} = \frac{FV}{(1+r)^n}$$

where,
FV = Future Value
r = Return rate
n = No. of periods

b. Future Worth (Value)

Future Value (FV) is the value of a current asset at future date based on an assumed rate of growth. The future value is important to investors and financial planners, as they use it to estimate how much an investment made today will be worth ~~to~~ in the future.

$$FV = I * (1 + (R * T))$$

where,
I = Investment amount
R = Interest rate
T = No. of Years

(c) Annual Worth (Value):

The annual worth ~~is~~ is the net of ~~to~~ all the benefits and costs incurred over a one year period.

This virtual number is called equivalent uniform annual worth ~~growth~~ (EUAW) and is equal to total benefit and cost of the system, which is evenly spread throughout years of its life.

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Annual Worth (AW) = PW (A/P, i, n) = FW (A/F, i, n)

Internal Rate of Return (IRR) Method

IRR is used to evaluate projects or investment. The IRR estimates a projects breakeven discount rate (rate of return) that indicates projects potential for profitability.

Based on IRR, a company will decide to either accept or reject a project. If an IRR of a new project exceeds a company's required rate of return, that project is most likely be accepted.

If IRR falls below required rate of return, the project should be rejected.

A positive IRR means that a project or investments is expected to return some value to the org. and vise versa.

The IRR is always compared to the cost of capital as well as to industry averages.

O(NPV) $IRR = P0 + P1/(1+IRR) + P2/(1+IRR)^2 + P3/(1+IRR)^3 + Pn/(1+IRR)^n$

Where,

P0 = Initial investment

P1, P2, P3 ... Pn = cash flow in periods 1, 2, 3, ... n

IRR = Projects internal rate of return

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NPV = Net Present Value
N = Holding periods

Example

Company X has a year long project that is going to cost $1,000 and has a discount rate of 8%. At the end of the year, the company will receive $1,300. Calculating the NPV for this project looks like:

~~NPV = -100 + 18~~

In general, if NPV is greater than 0, a project is worth pursuing.

The IRR calculation for this same project puts NPV at 0. When NPV is 0, it acts as break even point, that looks like:

~~0 = -1,000 + 1300(1+IRR)~~

IRR is generally calculated as the percentage discount rate that would produce an NPV of zero (0). Mostly, it is easily calculated using a spreadsheet or any other program that provides the functions for calculating the IRR.

Cost Benefit Analysis:

The process of comparing the projected ~~and~~ or estimated costs and benefits (opportunities) associated with project decision to determine whether it makes sense from business prespective.

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Most important and common way for carrying out economic assessments of proposed project or the system.

~~tth~~ Things to be considered:

* Expected cost of development
* " " " operation of system
* Benefits obtained

Comprises of following basic steps:

(a) Identify Cost:

Identifying all the cost and benefits of carrying out the project and operating the system used for development.

* Includes developmental costs, operating costs and the benefits to be gained from ~~new~~ new system.
* If the proposed system needs to be replaced (for any reason) then these above mentioned costs too need to be changed so that they reflect the proper cost and benefits of new system.

Ex: Sales order processing system

(b) Express these costs and benefits as Common Unit:

Now, we have to express each of the cost of development and operation of system, benefits it provides as well as the

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net benefit (or simply profit) which is the difference of costs and benefits in terms of money.

Types of Cost

(a) Developmental Cost :
Includes wages and salary of the employee's and the staffs that took part in developmental of project.

(b) Operational Cost : Amount of cost required to operate the system, that is to be used for development.

(c) Setup Cost : Amount of cost used for implementing the systems like h/w, s/w, staff training etc.

Types of Benefits

(a) Direct Benefits
Obtained directly by making the use of system.
Eg: Computerized salary provision (No more paper works)

(b) Assumeable Indirect Benefits
Also called as secondary benefits that we can gain by just improving the performance by updating or upgrading the technology or system.
Eg: Provide user friendly UI to employees of s/w that they are using.

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(c) Intangible Benefits :

AKA Indirect benefits that we can get in the form of works, process, development or sometimes money too.

Eg: Enhancing the skills & knowledge of employee may lead to project completion on before time and also better & explanatory form.

Things to be done/followed or Cared during developmental stage:

* Proper on time payment of salaries/wages to staffs
* Borrowing of money from banks for projects
* Paying of interest on time
* Use of resources in proper way etc.

~~Cost~~ Cost Benefit Ratio Analysis (BCR)

A BCR is a ratio used in a cost benefit analysis to summarize the overall relationship b/w the relative costs and benefits of a proposed project.

BCR can be expressed in monetary or qualitative terms.

If a project has a BCR greater than 1.0, the project is expected to deliver a positive net present value to a firm and its investors.

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(BCR)s are most often used in capital budgeting to analyse the overall value for money of undertaking a new project but does not provide any sense of how much economic value will be created.

Ex. The company decides to lease the equipment needed for the project for $50,000 rather than purchasing it. The inflation rate is 2% and the renovations are expected to increase the company's annual profit by $1,00,000 for next three years.

The NPV of the total cost of the lease does not ~~lead~~ need to be discounted because initial cost of $50,000 is paid upfront.

The NPV of projected benefits is:

$= [(\$100,000/(1+0.02)^1) + (\$100,000/(1+0.02)^2) + (\$100,000/(1+0.02)^3)]$

$\Rightarrow \$288,388$

when divided by $50,000 = 5.77

This means,

the company has BCR of 5.77, that indicates the project's estimated benefits significantly outweight its costs.

i.e. for every $1 the company can expect the benefit of $5.77.

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Limitations

* The rules of less than 1.0 to reject and greater than 1.0 to accept the project, may sometime ~~mit~~ mislead and can provide false sense of comfort with project

* ~~Cant~~ Shouldn't be used alone. Need to be used as tool in conjuction with other types of analysis to make proper decision.

Gradient / Uniform Gradient Cash Flow: (Arithmetic)

A type of cash flow where the cash flow changes (increases / decreases) by same amount in each cash flow period.

Eg: If cash flow gradient in period 1 is \$500, then in period 2 it will be \$600 and so on, with amount increasing by \$100 in each periode.

This is an gradient cash flow with the Gradient (G) equals to \$100.

The standard factor notation eqn for present worth of GSF (Gradient Flow Series) is

$$P = G(P/G, i, n)$$

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This eqn find the present worth of only the gradient (G) (i.e $100) but not the base amount of money, on which the gradient was built (i.e. $500 for above example).

The base amount's time period is 1 that must be handled separately as Uniform Cash Flow Series.

P = present worth of base amount + present worth of gradient amount

$= A(P/A, i, n) + G(P/G, i, n)$

where,

A = amount of money in period 1

G = change in amount b/w to periods

n = no. of periods (from 1 to end of gradient)

i = interest rate per period

If gradient cash flow decreases from one period to another, instead of increasing, the only change in general eqn is that the plus (+) sign becomes minus (−).

P/G factor formula for gradient only

$$P = \frac{G}{i}\left[\frac{(1+i)^n - 1}{i(1+i)^n} - \frac{n}{(1+i)^n}\right] \quad \text{or} \quad P = G(P/G, i, n)$$

A/G factor for annual equivalent of gradient only

$$A = G\left[\frac{1}{i} - \frac{n}{(1+i)^n - 1}\right] \quad \text{or} \quad A = G(A/G, i, n)$$

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~~P/G and A/G factor are~~

Ex

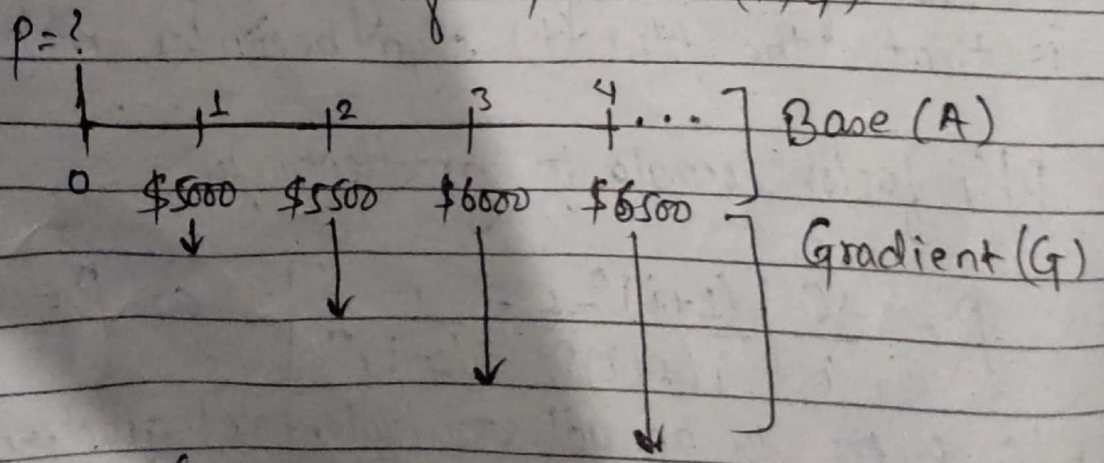
A highway department expects the cost of maintainance for a peice of heavy construction equipment to be \$5,000, In year 1, to be \$5,500 in year 2 and so on increase anually by \$500 for 10 years. At the interest rate of 10% per year, determine the present worth of 10 years of maintainance cost.

Sol^n

$A = \$5000$
$G = \$500$
$n = 10$ yrs
$i = 10\%$ per annum
$P = ?$

We know,

P = Present worth of base (P/A) + present worth of Gradient (P/G)



$P = \$5000\,(P/A, 10\%, 10) + \$500\,(P/G, 10\%, 10)$
$= \$5000\,(6.1446) + \$500\,(22.8913)$
$= \$42,169$

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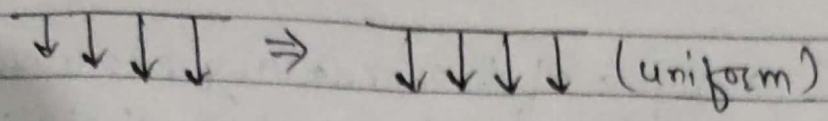
Find annual worth



A = Base amount (A) + Annual worth of gradient (A|G)

$= 5000 + 500(A|G, 10\%, 10)$

$= 5000 + 500(3.7255)$

$= \$\ 6862.75 / year$ //

Comparison of Mutually Exclusive Alternatives:

When alternatives are mutually exclusive only one can be selected because only one method is needed. Therefore, the alternatives are compared against each other and one having the most favourable present worth (P|W) is selected as "The Best".

Mutually exclusive projects can be of two general types:

* Those having only costs
* Those having costs and revenue

For cost alternatives, one can be selected if it would be the one with lowest cost (least -ve)

For revenue alternatives, one may be selected if one or more alternative had $P|W \geq 0$, where we can choose the one having larger P|W value.

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[MARR = Min^m Acceptable Rate of Return]

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Ex

Mutually exclusive Cost Alternatives

Q. An economic analysis of three mutually exclusive cost projects yeilded the results as shown below:

Project ID	AX	BX	CX
PW @ i = MARR	-$10,000	-$7000	-$15,000

Soln

Since the projects are mutually exclusive cost alternatives, only one can be selected. The one with the lowest cost of alternative (least -ve) is BX. So, BX is selected.

Mutually exclusive Revenue Alternatives

Q. From economic analysis result of mutually exclusive revenue alternatives shown below:

Project ID	A5	B5	C5
PW @ i = MARR	-$10,000	-$2000	-$6,000

Soln

Since, projects are mutually exclusive revenue alternatives, only one can be selected, but also only if PW @ i = MARR is greater than 0. But in this case none of the project exceeds MARR as all are PW < 0, so, none of the projects are selected here.

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Unit 3 — Activity Planning and Scheduling [7TH]

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Introduction

A plan for managing a resource use or value to achieve specific objectives.

Activity plan means any plan, that is developed for each individual based on their activity evaluation and here on this topic, we are actually talking about how activities are planned to handle the development of certain projects.

These plans should include strategies for how these activities can become part of individuals (working on projects) becomes daily routine.

Objectives of Activity Plan

ⓐ Feasibility Assessment:

Main thing to be discussed here whether the project we are working on is feasible or not? Whether it is valuable or not? (for market) Can it be developed by existing resources and technologies? etc.

ⓑ Resource Allocation

How can we allocate best and productive resources for the product (project)?

* What resources will be needed?
* The project plan (activity plan) helps to understand the relationship b/w time, availability, efficiency etc. of resources with our project to make it sure for implementation.

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(c) Motivation

If the targets are provided and in addition, also the monitoring of the process about how much we have been through the process, then that will be the best motivation for the employees.

* It confidents them about the target is being achieved soon.

(d) Detailed Costing :

Provide the detailed cost and expenditures that will be needed for developing the project. And this will be provided in more detailed form only after the activity plan and resource allocation are done properly.

(e) Coordination :

The project plan, when for large projects involves more than one single project team (as tasks are divided) so that they can provide effective enforcement for communication as well as coordination.

This coordination helps many juniors to learn new skills and work with other teams as well as inside the team.

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When to Plan?

Planning is always an ongoing process as it gets refined after each iterations as well as after each steps of developmental tasks that provides more accurate and detailed information than previous plan/iteration/step.

During Feasibility study, the main purpose of planning is to either achieve the goal in specified time or to avoid the problems of not achieving goal for some challenges or both.

After we're done with feasibility study, the the project proceeds and emphasis is placed upon the production of activity planning to ensure resource availability and cash flow control.

Also, Replanning and monitoring it, is done throughout the production process to ensure that plan is not going off the track.

Project Schedules

After plan is satisfied and before starting to work on that, "The project plan must be developed to the level, showing date when each activity should start and end, also when and how much resources will be required", which we call a project schedule.

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Creating Project Schedule comprises of four main stages:

(a) Creating and Activity Plan:
Here, we decide, what activities to be carried out and in what order they are to be done.

(b) Activity Risk Analysis:
Now, the presence of risks for now, or may emerge in future are subjected to analyse and identify them.

(c) Resources Allocation:
The expected availability of resources, all [need -ed] to carry our project plan are subjected along with when, how and what resources to be used.

(d) Schedule Production:
Once resources are allocated for each activity, now we position them to draw up and publish a project schedule that indicates plan's execution and end dates along with the resource requirement statement for each activity.

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Work Break Down Structure (WBS):

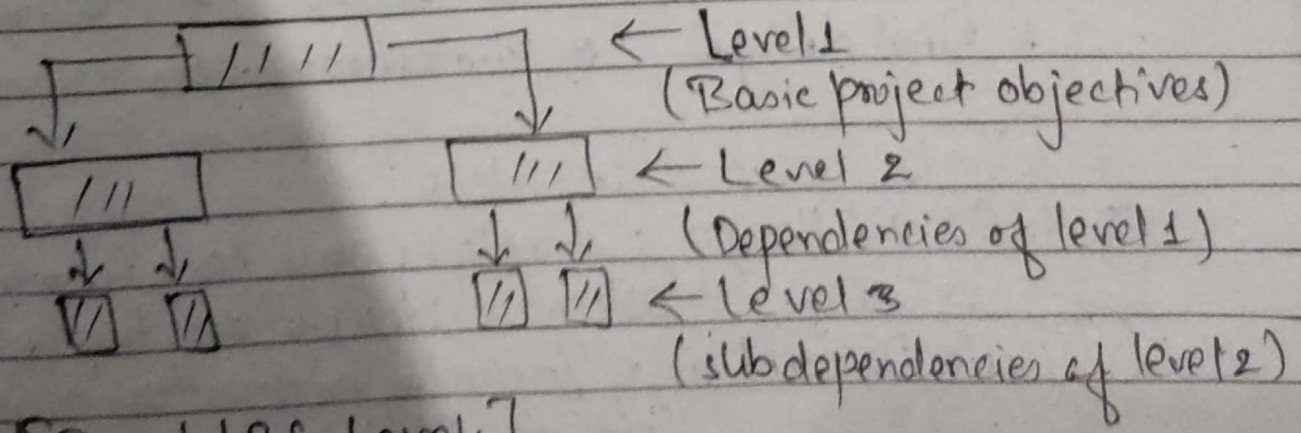
A WBS is a visual breakdown of a project thats organized into multiple levels. Basically, it's a way to visualize required deliverables in a more digestible way.

Project managers use WBS to help team visualize projects and dependency-related deliverables. It can be created using a combination of workflow mgt. software and specific methodolies. Some of these methods are: Timelines, Kanban Boards, Calenders etc.

Its a great tool when working on complex project scopes and no matter what visual method we choose, the breakdown structure should be comprised of:

(a) A project baseline (project plan, description, name etc)
(b) Project Stakeholders
(c) An organized project schedule
(d) Project deliverables and subtasks.

Levels of WBS



[Fig: WBS Levels]

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(A) Level 1: Most simplified form of project since it contains parent task. AKA project objectives.

Eg: [For revamp your website design]
↳ Launch New website design

(B) Level 2: A little bit complicated breakdown structure as it depends on scope of project. Includes sub tasks.

Eg: * To launch new website we need
* Revamp brand guidelines
* Create messaging framework
* Redesign your logo
* Add new photographs etc.

(C) Level 3: Here the dependencies are further breakdown into sub dependencies.

Eg: Level 2 example is broken down to level 3 as:

* Brand Colors * Design UX * Headline
* Mission Statement * Sketches * Mockups
* Final designs * Photoshoot etc.

What's Included in WBS

(a) WBS Dictionary : Explains each task in more detail.
Eg: task names, descriptions, budgets etc.

(b) Task Description : Includes both : task name and its description.

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(c) Task Owner : It helps in accountability and communication. Task owners may be project managers, department heads or managers depending upon type of task.

(d) Task Budget : Helps to track us, how close we are to our allocated budget.

(e) Completion Date : Helps to catch our timeline delays in real time and work on them to prevent from ~~deadline~~ deadline issues.

(f) Task status : Provides task progress along with high level overview of team productivity.

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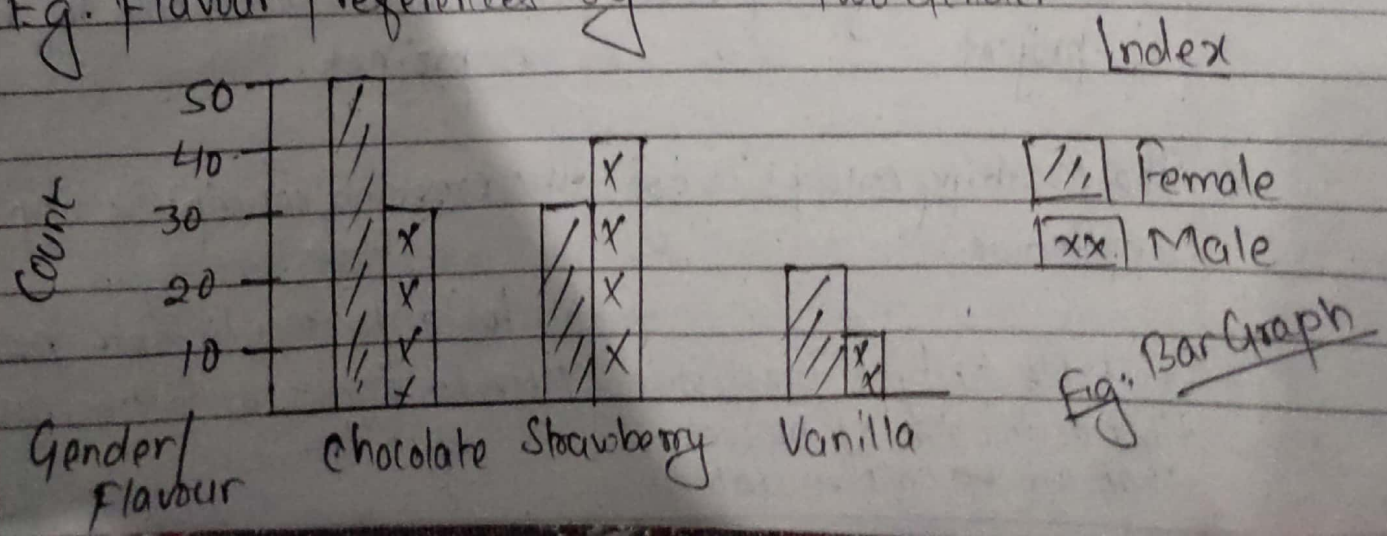
Bar Chart (Graph):

They are used to compare things b/w different groups or to track changes over the time.

It plots the data using rectangular bars or columns (bins) that represent the total amount of observations in the data for that category.

Eg: Flavour Preferences by Two Genders



Eg: Bar Graph

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Networks Planning Model: (IMP)

NPM is a critical path ~~that~~ models or networks that shows the sequential dependencies among activities in a project.

It permits the calculation of the earliest project completion date.

It is a project scheduling model, the models the projects activities and their relationships as a n/w, where the time flows from left to right. These techniques are originally developed in 1950's and best known among them are:

* Critical Path method [CPM]
* Program Evaluation Review Technique [PERT]
* and here, we study one another method
* Precedence Diagramming Method (PDM)

PERT	CPM
Event Oriented Technique	Activity Oriented Technique
Focus on time of completion of project.	Focus on time cost trade off in a project
The crashing concept is not applicable	The crashing concept is applicable
Suitable for high precision time estimation of projects that are unpredictable.	Suitable for predictable ~~produ~~ projects where activities are repititive.

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(A) Critical Path Method (CPM):

A CPM is a technique where you find identify tasks that are necessary for project completion and determine scheduling flexibilities.

A critical path in in project mgt. is the longest sequence of activities that must be finished on time in order to complete an entire project. Any delays in critical tasks will delay the project.

CPM discovers the most important tasks in project timeline, identifying task dependencies and calculating task durations.

CPM was developed in late 1950s as a method to resolve the issue of increased cost due to insufficient scheduling.

WHY CPM?

* Improves Future Planning: Used to compare expectations with actual progress so that data used from current projects can inform future project plans.

* Facilitates More Effective Resource Mgt: Prioritize tasks, giving them a better idea of how and where to deploy resources.

* Helps Avoid Bottlenecks: Bottlenecks in project results in loss of valuable time. CPM helps to model our activities in network form so that we can clearly distinguish which activities can and can't run in parallel.

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Finding Critical Path using CPM

a. List project tasks and details
b. Identify task dependencies for project
c. Create ~~new~~ n/w diagram of tasks
d. Estimate each task duration
e. Find critical path based on longest sequence
f. Calculate total Float

CPM example

Do CPM analysis and identify the critical path of project.

Activity	Predecessor	Duration (in Months)
A	–	5
B	A	4
C	A	5
D	B	6
E	C	3
F	D, E	4

Soln We have to start from independent activity i.e. where predecessor is not present. [i.e A in above table].

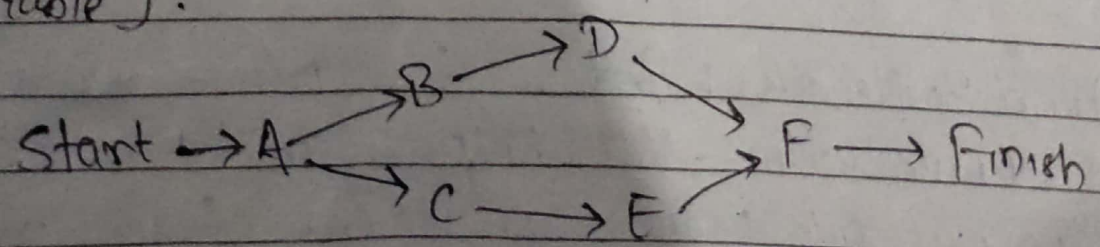

Fig: N/w diagram [Activity on Node (AON)]

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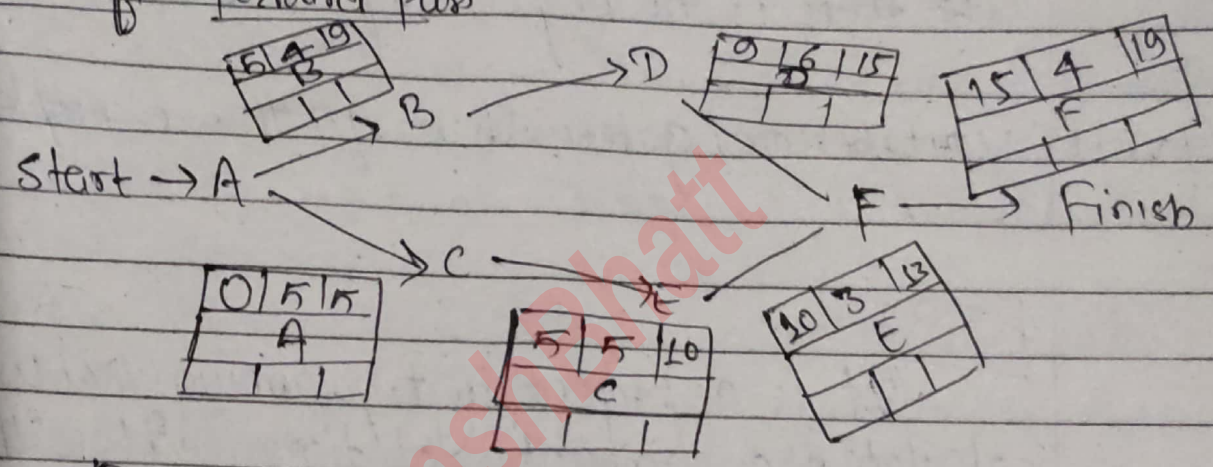
Now, We do activity labelling :

(ES)		(EF)
Early start	Duration	Early Finish
Node		
Late start	slack	late finish
(LS)		(LF)

Now,

CPM after Forward Pass

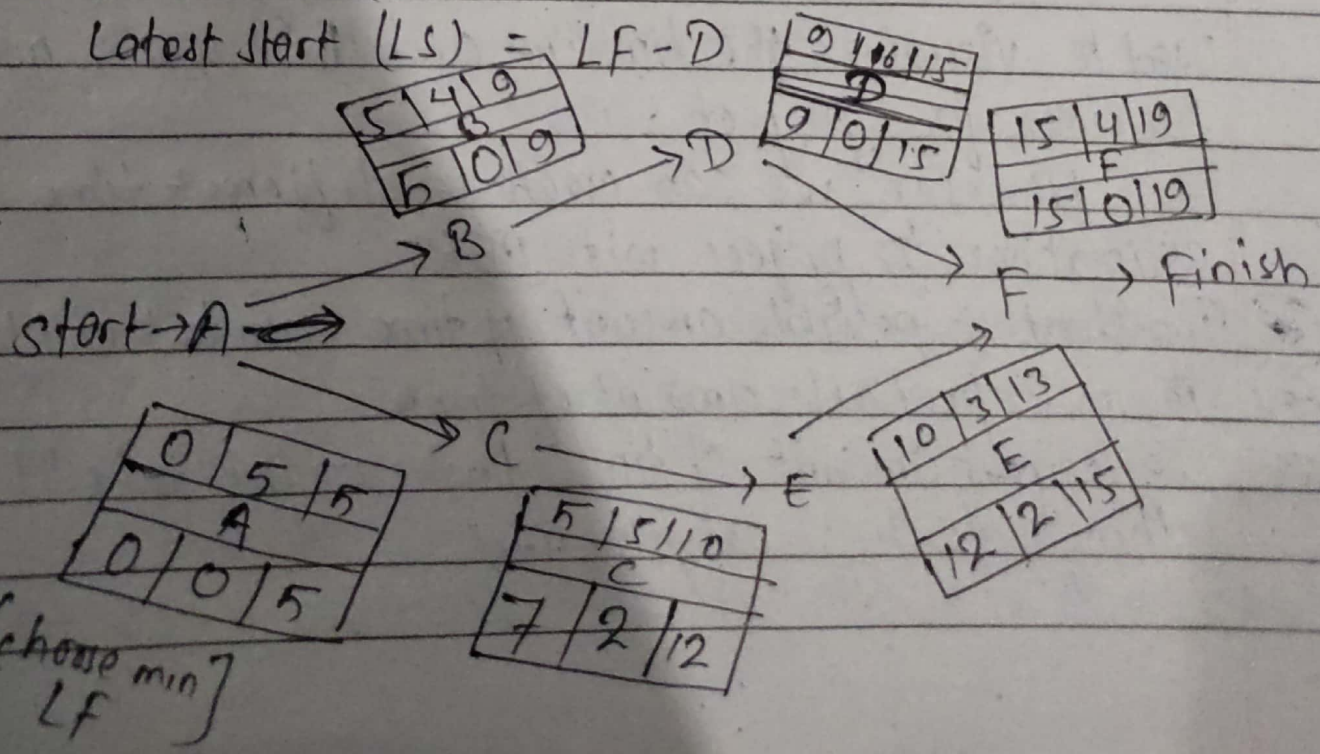


[For last (We will use maximum value in this case)]

Again, CPM after Backward Pass

Stack Time (SL) = LF − EF

Latest Start (LS) = LF − D



(choose min LF)

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Now, The possible paths are:

$A \to B \to D \to F$ and $A \to C \to E \to F$

where we will choose the path $A \to B \to D \to F$ because the value of slack is zero (0) in this path.

i.e there is no any delay in activities.

[visit youtube.com/gatesmasher for this example]

(B) PERT:

It is a project mgt. planning tool used to calculate the amount of time it will take to realistically finish a project. PERT charts are used to plan tasks within a project - making it easier to schedule and coordinate team members.

PERT is similar to CPM as they both are used to visualize the timeline and the work must be done for a project.

However we can create 3-different time estimations for project with PERT

- The shortest possible amount of time each task will take
- The most probable amount of time
- The longest amount of time, tasks might take if things don't go as planned.

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PERT is calculated backward from a fixed end date since contractors' deadlines typically cannot be moved.
(visit youtube for numerical if you need)

(c) Precedence Diagram Method:

It is a visual representation technique that depicts the activities involved in a project. It is a method of constructing a project schedule n/w diagram that uses boxes/nodes to represent activities and connects them with arrows that show the dependencies.

As CPM and PERT are limited to "start-end" relationship (i.e. activity B cannot start until Activity A is completed), PDM was ~~dev~~ developed subsequent to PERT/CPM techniques and its f-n is to permit a more accurate depiction of relationships among various activities.

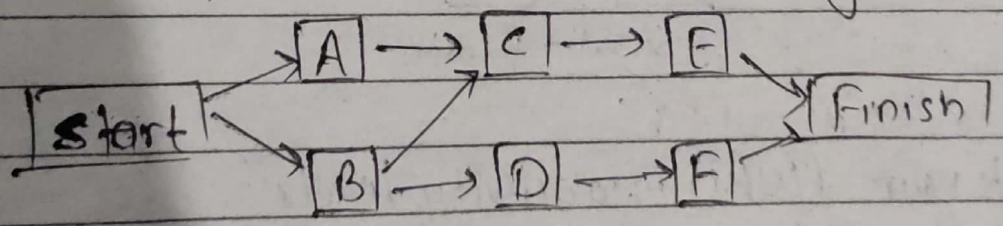

Fig: PDM

Benefits

* Highlights relations and dependencies among ~~acti~~ activities to ensure planning efficiency.
* Identify possible missing activities
* Helps develop overall project schedule
* Good communication tool for project team members.

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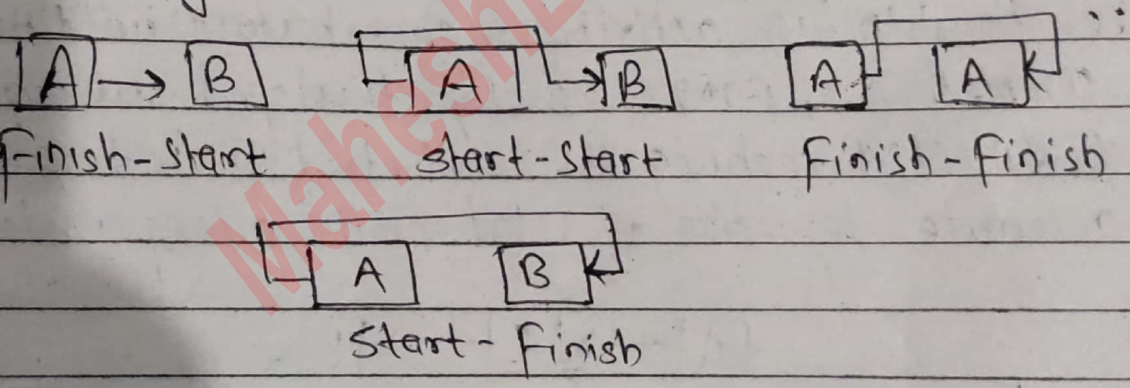
PDM can be done by 4-methods:

(A) Finish-Start: An activity cannot start before a previous activity has ended. Most common method.

(B) Start-Start: There is defined relationship b/w start of activities.

(C) Finish-Finish: Defined relationship b/w end dates of activities

(D) Start-Finish: There is defined relationship b/w start of one activity and end of successor activity. Used rarely.



How to develop PDM:

a. Break your (WBS) into activity levels
b. List all activities and their sequence in table
c. Add relationships and dependencies to each activity in table
d. Draw a diagram.

[Visit youtube for numerical if you need]

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Shortening Project Duration:

If we wish to shorten the overall duration of a project we would normally consider attempting to reduce activity durations.

In many cases, it can be done by applying more resources to the task: working overtime or procuring additional staff.

Eg:

The critical path indicates where we must look to save time if we are trying to bring forward the end date of project.

As we reduce activity times along the critical path, we must continually check for any new critical path emerging and, redirect our attention, where necessary

Identifying Critical Activities:

Critical activities are those, for which the start and finish times are strictly defined. They are critical in sense, that their ~~delg~~ delay results in delay of whole project.

The critical path identifies identifies those activities which are critical to an end date of the project; however the activities that are not on critical path may become critical.

As the project, proceeds, activities will be invariably use up some of their float and this will require a periodic recalculation of n/w.

As soon as the activities along critical path use up their total float then that path will become a critical

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path and a no. of hitherto (previous) non-critical activities will suddenly become critical.

Therefore, it is a common practice to identify 'near-critical' paths - those whose lengths are within (say) 10-20% of duration of critical path, or those ~~whose~~ with total float of less than (say) 10% of project is uncompleted duration.

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-E-N-D-

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