Final Revision – PM (ILO8021)

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What is Project?

- A project is a ***temporary endeavor*** undertaken to create ***unique product,*** service or result.
- Project Characteristics:

1. Temporary
2. Unique
3. Progressive Elaboration

Conflicts in Project Management

- A conflict is a common phenomenon in the workplace.
- A conflict is a situation when the interests, needs, goals or values of the project stakeholders interfere with one another.
- Project managers should see conflicts as opportunities to growth and as opportunities to move the project forward towards delivery.
- The major causes of conflict are poor communication, inadequate leadership, irresponsible behavior, insufficient resources and limited budget.

Conflicts in Project Management

- Since conflicts are unavoidable, how do you view conflicts?

From the Traditional view points, the following are noted:

- Conflicts are considered as bad
- Conflicts are caused by trouble makers
- Conflicts should be avoided

And from the Contemporary view points, the following are noted:

- Conflicts are inevitable
- Conflicts are often beneficial
- Conflicts should be managed

Approaches to Conflict Resolution

There are 5 modes for conflict resolution in project management. They are:

1. Confronting – win-win style
2. Compromising – give and take style
3. Smoothing – accommodating style
4. Forcing – competing style
5. Avoiding – withdrawal style

Confronting Strategy

- This is also described as problem solving, integrating, collaborating or win-win style.
- It involves the conflicting parties meeting face-to-face and collaborating to reach an agreement that satisfies the concerns of both parties.
- This style involves open and direct communication which should lead the way to solving the problem.
- Confronting should be used when:

1. Both parties need to win.
2. You want to decrease cost.
3. You want to create a common power base.
4. Skills are complementary.
5. Time is sufficient.
6. Trust is present.
7. Learning is the ultimate goal.

Compromising Strategy

- This is also described as a “give and take” style.
- Conflicting parties bargain to reach a mutually acceptable solution.
- Both parties give up something in order to reach a decision and leave with some degree of satisfaction.
- Compromising should be used when:

1. Both parties need to win.
2. You are in a deadlock.
3. Time is not sufficient.
4. You want to maintain the relationship among the involved parties.
5. You will get nothing if you do not compromise.
6. Stakes are moderate.

Smoothing Strategy

- This is also referred to as accommodating or obliging style.
- In this approach, the areas of agreement are emphasized and the areas of disagreement are downplayed.
- Conflicts are not always resolved in the smoothing mode.
- A party may sacrifice it's own concerns or goals in order to satisfy the concerns or goals of the other party.
- Smoothing should be used when:

1. Goal to be reached is overarching.
2. You want to create obligation for a trade-off at a later time.
3. Stakes are low.
4. Liability is limited.
5. Any solution is adequate.
6. You want to be harmonious and create good will.
7. You would lose anyway.
8. You want to gain time.

Forcing Strategy

- This is also known as competing, controlling, or dominating style.
- Forcing occurs when one party goes all out to win its position while ignoring the needs and concerns of the other party.
- As the intensity of a conflict increases, the tendency for a forced conflict is more likely.
- This results in a win-lose situation where one party wins at the expense of the other party.
- Forcing should be used when:

1. A “do or die” situation is present.
2. Stakes are high.
3. Important principles are at stake.
4. Relationship among parties is not important.
5. A quick decision must be made.

Avoiding Strategy

- This is also described as withdrawal style.
- This approach is viewed as postponing an issue for later or withdrawing from the situation altogether.
- It is regarded as a temporary solution because the problem and conflict continue to reoccur over and over again.
- Avoiding should be used when:

1. You cannot win.
2. Stakes are low.
3. Stakes are high, but you are not prepared.
4. You want to gain time.
5. You want to maintain neutrality or reputation.
6. You think problem will go away.
7. You win by delaying.

PM knowledge areas as per PMI

- Project Integration Management: Develop project charter, develop project management plan, monitor and control project work, perform integrated change control, close project.
- Project Scope Management: Collect Requirements, define scope, create WBS, validate scope, control scope.
- Project Time Management: Plan schedule, develop schedule, control schedule, define activities, their duration and resources required.
- Project Cost Management: Plan cost management, estimate cost, determine budget, control cost.
- Project Quality management: Plan quality management, perform quality assurance, control quality.
- Project Human Resource Management: Plan human resource management, create project team, manage project team.
- Project Communication Management: Plan communication management, manage communication and control communication.
- Project Risk Management: Identify risks, perform risk analysis, plan risk responses, control risks.
- Project Procurement Management: Plan procurement management, conduct procurement, control procurements, close procurements.
- Project Stakeholder Management: Identify stakeholders, manage and control stakeholders.

Projects Selection models (Non-Numeric)

- **Sacred Cow-** Project is suggested by a senior and powerful official in the organization
- **Operating Necessity -** Project is required to keep the system running
- **Competitive Necessity -** Project is necessary to sustain a competitive position
- **Product Line Extension -** Projects are judged on how they fit with current product line, fill a gap, strengthen a weak link, or extend the line in a new desirable way.
- **Comparative Benefit Model -** Several projects are considered and the one with the most benefit to the firm is selected

Projects Selection models (Numeric)

- Payback Period (PB)
- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Profitability Index (PI)

Example 1: Invest $2,000 now, receive 3 yearly payments of $100 each, plus $2,500 in the 3rd year. Use 10% Interest Rate. Calculate NPV. Calculate NPV with 6% Interest Rate also.

Solution:

(A): For 10% interest rate
Let us work year by year (remembering to subtract what you pay out):
Now: PV = **–$2,000**
Year 1: PV = $100 / 1.10 = **$90.91**
Year 2: PV = $100 / 1.10^2 = **$82.64**
Year 3: PV = $100 / 1.10^3 = **$75.13**
Year 3 (final payment): PV = $2,500 / 1.10^3 = **$1,878.29**
Adding those up gets: **NPV** = −$2,000 + $90.91 + $82.64 + $75.13 + $1,878.29 = **$126.97**

(B): For 6% interest rate
Now: PV = **–$2,000**
Year 1: PV = $100 / 1.06 = **$94.34**
Year 2: PV = $100 / 1.06^2 = **$89.00**
Year 3: PV = $100 / 1.06^3 = **$83.96**
Year 3 (final payment): PV = $2,500 / 1.06^3 = **$2,099.05**
Adding those up gets: **NPV** = −$2,000 + $94.34 + $89.00 + $83.96 + $2,099.05 = **$366.35**

- A four year financial project is forecast to have net cash inflows of $20,000; $25,000; $30,000 and $50,000 in the next four years. It will cost $75,000 to implement the project payable at the beginning of the project. If the required rate of return is 0.2, conduct a discounted cash flow calculation to determine the NPV.

- Given a hurdle rate of 12% and an expected inflation rate of 2%, calculate the discount factor for the second year of a project’s life.

Example: A project requires an initial investment of $225,000 and is expected to generate the following net cash inflows:

Year 1: $95,000
Year 2: $80,000
Year 3: $60,000
Year 4: $55,000

Compute net present value of the project if the minimum desired rate of return is 12%. Recalculate NPV for 14% and compute the IRR.

Solution:

$$NPV = \sum \frac{cash\ flow}{(1+i)^t} - initial\ investment$$

where:

i=Required return or discount rate

t=Number of time periods

For discount rate R1 = 12%

$$NPV1 = \frac{95000}{(1+0.12)^1} + \frac{80000}{(1+0.12)^2} + \frac{60000}{(1+0.12)^3} + \frac{55000}{(1+0.12)^4} - 225000$$

= $84821.43 + $63775.51+$42706.81 + $34953.49 - $225000

=$1257.25

For discount rate R2 = 14%

$$NPV2 = \frac{95000}{(1+0.14)^1} + \frac{80000}{(1+0.14)^2} + \frac{60000}{(1+0.14)^3} + \frac{55000}{(1+0.14)^4} - 225000$$

= $83333.33 + $61557.40 + $40498.29 + $32564.42 - $225000

= -$7046.56

$$IRR = 12\% + \frac{1257.25\times(14-12)\%}{1257.25-(7046.56)} = 12\% + 0.30\% = 12.30\%$$

Stages of Team Development

- Bruce Tuckman’s 5 stages of team development:

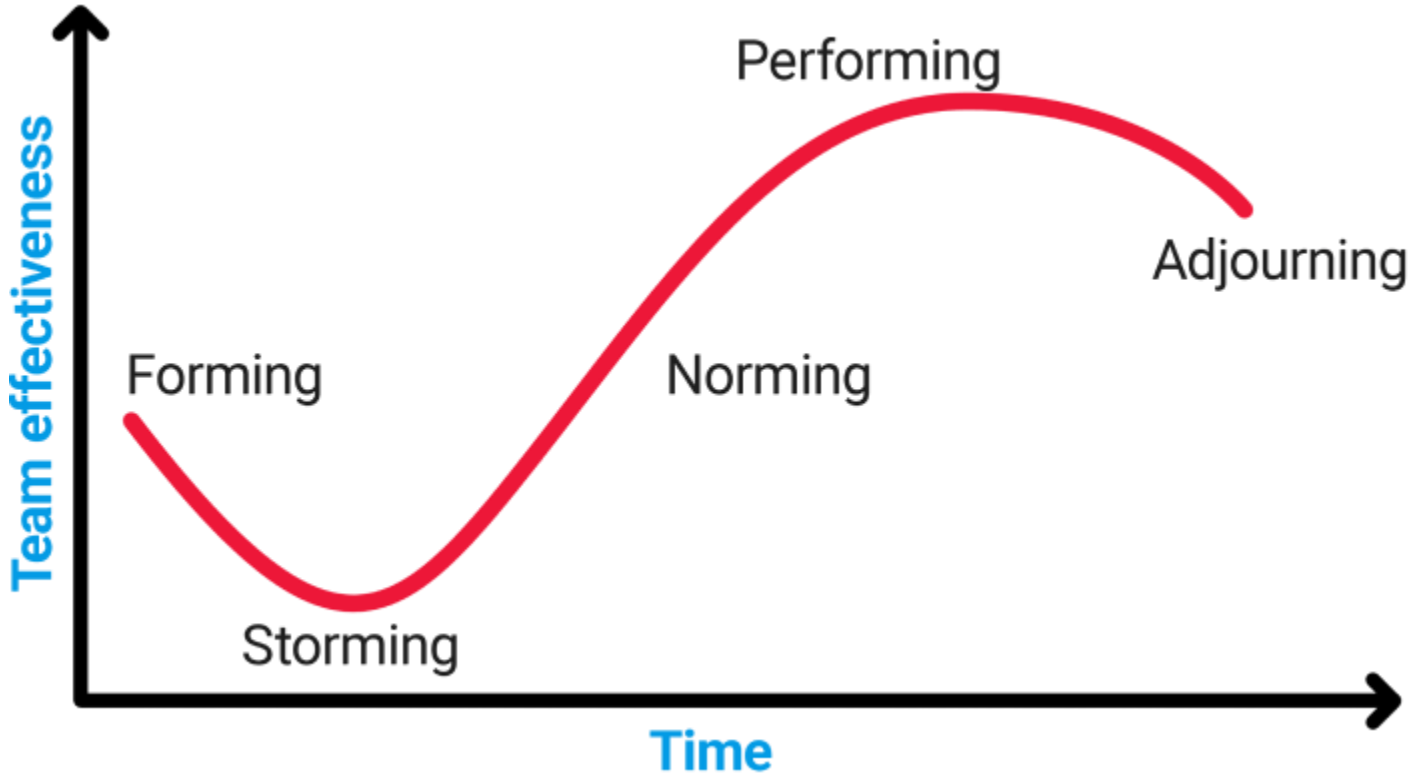
Stage 1: Forming

Stage 2: Storming

Stage 3: Norming

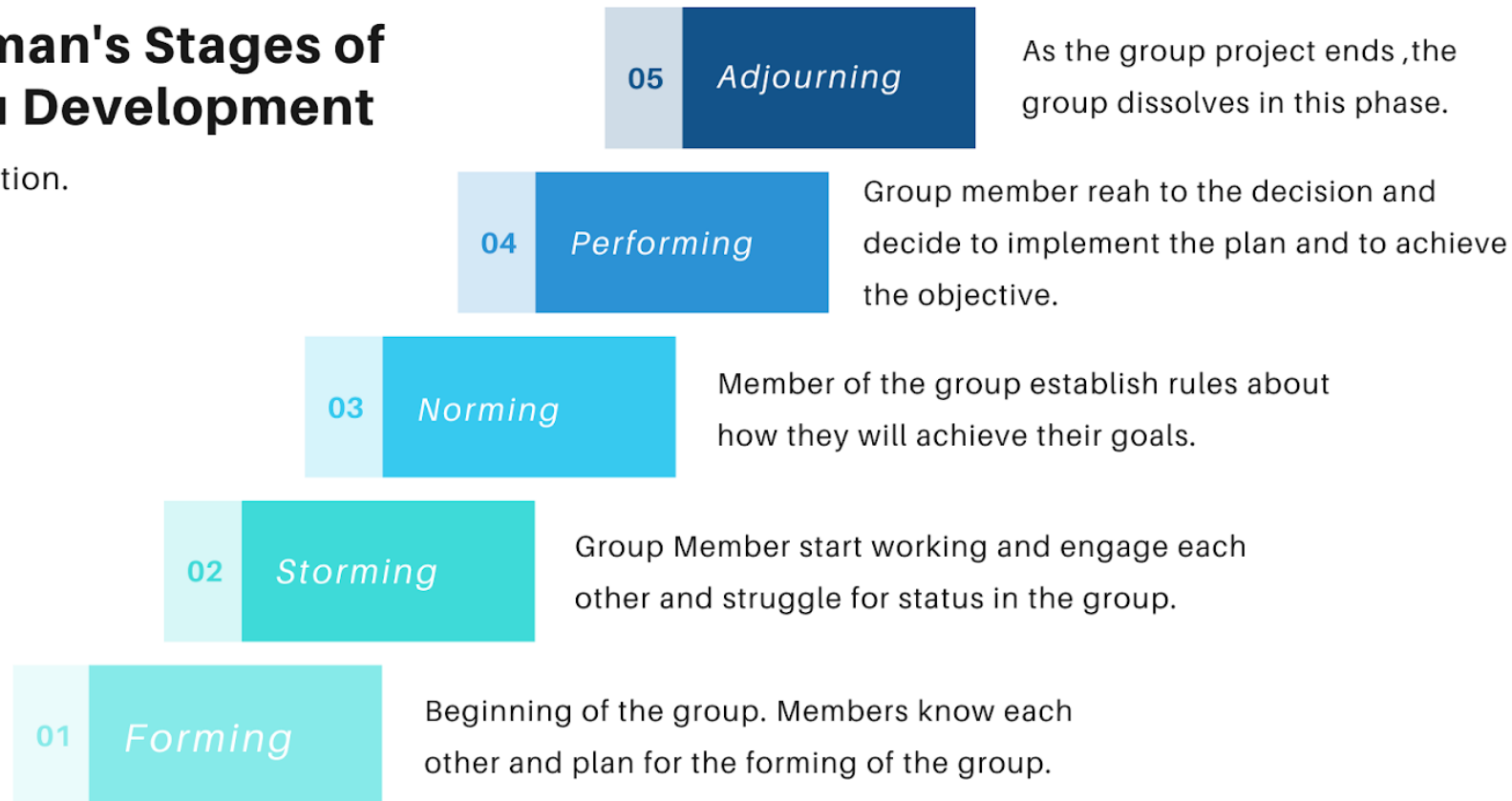
Stage 4: Performing

Stage 5: Adjourning



Tuckman's Stages of Gropu Development

An illustration.



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Project Portfolio Process (PPP)

- The project portfolio process is a method which can maximize the output potential of all projects undertaken by your organization at a given time, subject to limited resource constraints.
- The PPP attempts to link the organization's projects directly to the goals and strategy of the organization.
- This occurs not only in the project's initiation and planning phases, but also throughout the life cycle of the projects.
- PPP is also a means for monitoring and controlling the organization's strategic projects.

Steps in Project Portfolio Process

1. Establish a Project Council
2. Identify Project Categories and Criteria
3. Collect Project Data
4. Assess Resource Availability
5. Reduce the Project and Criteria Set
6. Prioritize the Projects within Categories
7. Select the Projects to Be Funded and Held in Reserve
8. Implement the Process

Step 1. Establish a Project Council

- The main purpose of the project council is to establish and articulate a strategic direction for those projects spanning internal or external boundaries of the organization, such as cross-departmental or joint venture.
- The project council must include:

1. Members from senior management
2. the project managers of major projects;
3. the head of the Project Management Office, if one exists;
4. particularly relevant general managers;
5. those who can identify key opportunities and risks facing the organization; and
6. anyone who can derail the progress of the PPP later on in the process.

Step 2. Identify Project Categories and Criteria

- In this step, various project categories are identified.
- Identifying separate categories not only facilitates achievement of multiple organizational goals (e.g., long term, short term, internal, external, tactical, strategic) but also keeps projects from competing with each other on inappropriate categories.
- Categories can be: Derivative Projects, Platform Projects, Breakthrough Projects and R&D Projects

Step 3. Collect Project Data

- For each existing and proposed project, assemble the data appropriate to that category's criteria.
- Be sure to update the data for ongoing projects and not just use the data from the previous evaluation.
- Challenge and try to verify all data; get other people involved in validating the data, perhaps even customers (e.g., market benefit).
- Document any assumptions made so that they can be checked in the future as the project progresses.

Step 4. Assess Resource Availability

- Assess the availability of both internal and external resources, by type, department, and timing.
- For instance, the availability of labour is assessed conservatively, excluding vacations, personal needs, illness, holidays, and regular functional (non-project) work.

Step 5. Reduce the Project and Criteria Set

- In this step, multiple screens are employed to try to narrow down the number of competing projects. The result of this step may involve canceling some ongoing projects or replacing them with new, more promising projects.
- Evaluation criteria:

1. Whether the project supports the goals of the organization
2. Whether the required competence exists in the organization
3. Whether there is a market for the offering
4. How profitable the offering is likely to be
5. How risky the project is
6. If the right resources are available at the right times
7. If the project is dominated by another existing or proposed project

Step 6. Prioritize the Projects within Categories

- Apply the scores and criterion weights to rank the projects within each category.
- When checking the results of this step, however, reconsider the projects in terms of their benefits first and their resource costs second.
- The council should summarize the “returns” from the projects to the organization.

Step 7. Select the Projects to Be Funded and Held in Reserve

- The first task in this step is an important one: determining the mix of projects across the various categories and time periods.
- Be sure to leave some percent (often 10–15 percent) of the organization's resource capacity free for new opportunities, crises in existing projects, errors in estimates, and so on.
- Overall, the focus should be on committing to fewer projects but with sufficient funding to allow project completion.
- Document why late projects were delayed and why some, if any, were defunded.

Step 8. Implement the Process

- The first task in this final step is to make the results of the PPP widely known.
- Top management must now make their commitment to this project portfolio process totally clear by supporting the process and the results.
- The council will have to concern itself with the reliability and accuracy of proposals competing for limited funds.
- The PPP needs to be repeated on a regular basis.
- The process should be flexible and improved continuously.

Work Breakdown Structure (WBS)

- The procedure for subdividing the overall project into smaller elements is called the work breakdown structure or WBS.
- Its purpose is to define the total project into “ pieces of work ” called work packages.
- Dividing the project into work packages makes it easier to prepare project schedules and cost estimates, and to assign management and task responsibilities.
- The first step in creating a WBS is to divide the total project into major categories.
- These major categories then are divided into subcategories that, in turn, are subdivided, and so on.
- This level-by-level breakdown continues so that the scope and complexity of work elements is reduced with each level of breakdown.
- Each descending level represents an increasingly detailed definition of the project work.
- The WBS is decomposed into work packages.
- The deliverable orientation of the hierarchy includes both internal and external deliverables.

WBS (contd..)

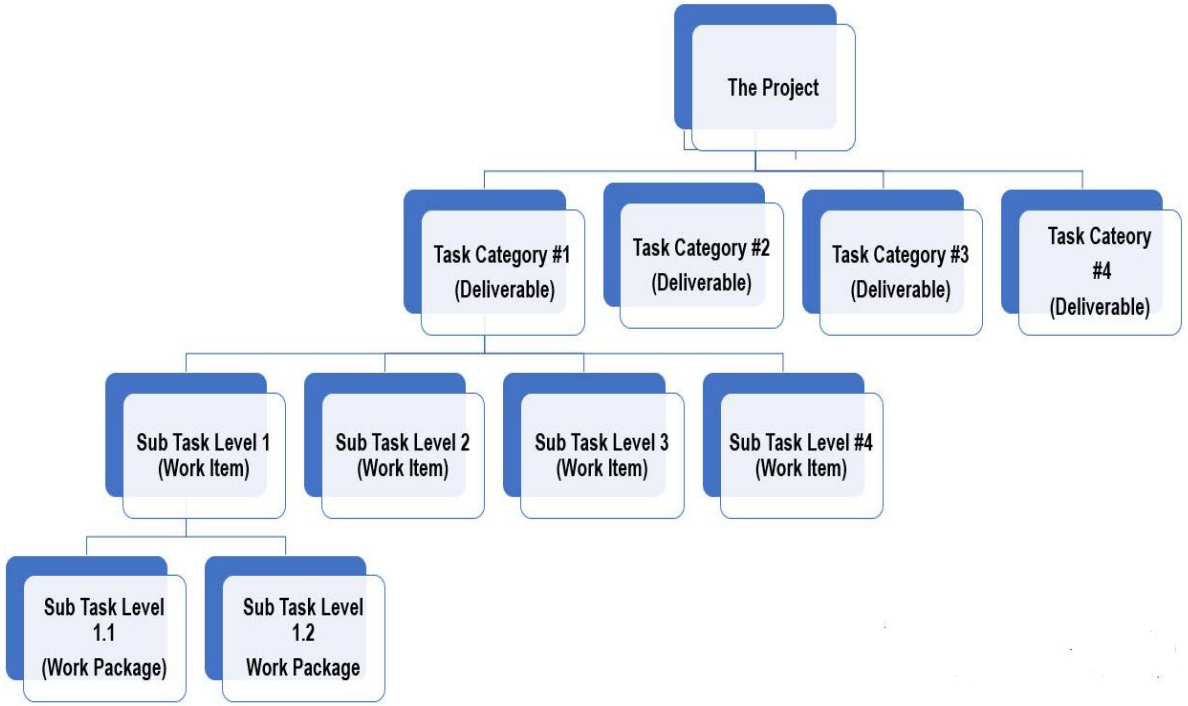
- A typical WBS might consist of the following four levels (the number of levels varies, as does the name of the element description at each level; different project methodologies use different terms):

Level	Element Description
1	Project
2	Subproject
3	Activity
4	Work Package

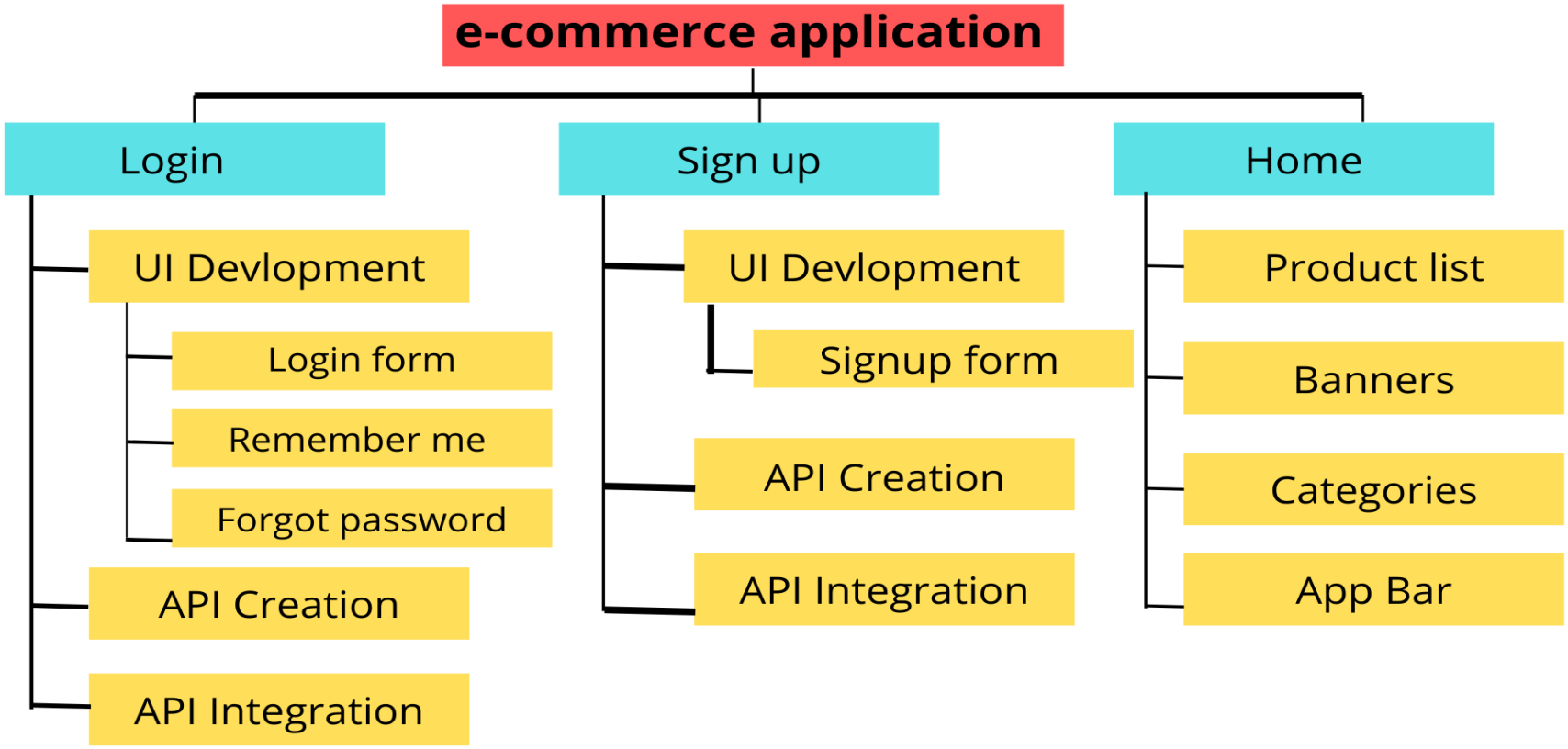
- There are two types of WBS:

1) Deliverable-Based and

2) Phase-Based



WBS Example 1



Benefits of WBS

- It helps to assign responsibilities to the project team.
- It helps the top-level management to allocate the project budget, based on which departmental budgets can be calculated.
- It helps to estimate the cost, time and risks involved in several activities of the project.
- It indicates the project milestones and control points.
- It can help identify items/ work packages that need to be outsourced to external parties.
- It helps to identify communication points and formulate a communication plan.

a = opt b = pess m: most likely

3. In the following table, task durations are given in days.

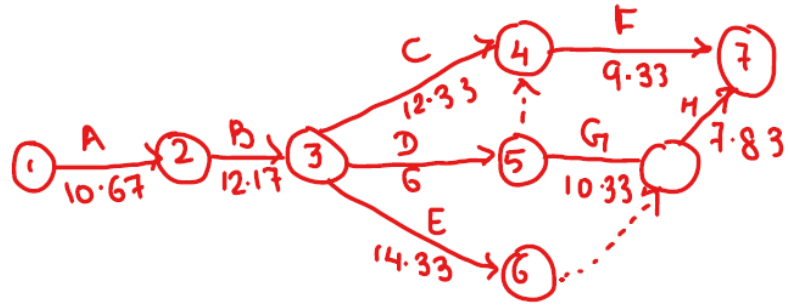
Activity	Predecessor	a	m	b
A	-	8	10	16
B	A	11	12	14
C	B	7	12	19
D	B	6	6	6
E	B	10	14	20
F	C,D	6	10	10
G	D	5	10	17
H	E,G	4	8	11

$t_e = \frac{a+4m+b}{6}$

$V = \left(\frac{b-a}{6}\right)^2$

a. Find the expected time and variance for each activity.
b. Draw the network diagram and find the critical path and time.
c. Find the probability that the critical path will be completed in 50 days.
d. Find the probability that the other main path will be completed in 50 days.
e. What is the probability that the entire network will be completed in 50 days?
f. How many days are required for the critical path to have a 0.95 probability of completion?

Network Diagram:



Solution:

Activity	Predecessor	a	m	b	Duration	Variance
A	-	8	10	16	10·67	1·78
B	A	11	12	14	12·17	0·25
C	B	7	12	19	12·33	4·00
D	B	6	6	6	6	0·00
E	B	10	14	20	14·33	2·78
F	C,D	6	10	10	9·33	0·44
G	D	5	10	17	10·33	4·00
H	E,G	4	8	11	7·83	1·36

Paths:- A-B-C-F 44·5 days ✓
A-B-D-F 38·17 days
A-B-D-G-H 47 days ✓
A-B-E-H 45 days

critical path and time:

Critical Path = A-B-D-G-H
Duration = 47 days
T_e = 47 days
V_p = 7·39

The probability that the critical path will be completed in 50 days:

T_s = 50 days

$$P(x \le 50) = F(50) = \phi\left(\frac{T_s - T_e}{\sqrt{V_p}}\right) = \phi\left(\frac{50-47}{\sqrt{7.39}}\right) = \phi(1.10)$$

$$= 0.8643$$

$$= 86.43\%$$

The probability that the other main path will be completed in 50 days

Other main path = A - B - E - H $T_e = 45$ days

$V_p = V_A + V_B + V_E + V_H$

$= 6.17$

$P(X \le 50) = F(50) = \phi\left(\frac{T_s - T_e}{\sqrt{V_p}}\right) = \phi\left(\frac{50-45}{\sqrt{6.17}}\right) = \phi(2.01)$

$= 0.97778$

$= 97.78\%$

The probability that the entire network will be completed in 50 days

A-B-C-F $T_e = 44.5$ $V_p = 6.47$

A-B-D-F $T_e = 38.17$ $V_p = 2.47$

$P(X \le 50) = F(50) = \phi\left(\frac{T_s - T_e}{\sqrt{V_p}}\right) = \phi\left(\frac{50-44.5}{\sqrt{6.47}}\right) = \phi(2.16) = 0.9846$

$= 98.46\%$

$P(X \le 50) = F(50) = \phi\left(\frac{T_s - T_e}{\sqrt{V_p}}\right) = \phi\left(\frac{50-38.17}{\sqrt{2.47}}\right) = \phi(7.52) = 1$

Prob. that entire n/w will be completed in 50 days

$0.8643 \times 0.9778 \times 0.9846 \times 1$

$= 0.832 \quad = 83.2\%$

How many days are required for the critical path to have a 0.95 probability of completion?

$\phi\left(\frac{T_s - T_e}{\sqrt{V_p}}\right) = 0.95 \Rightarrow z = \frac{T_s - T_e}{\sqrt{V_p}}$

$\therefore 1.64 = \frac{T_s - T_e}{\sqrt{V_p}}$

$= \frac{T_s - 47}{\sqrt{7.39}}$

$\therefore T_s = 1.64 \times \sqrt{7.39} + 47$

$= 51.45$ days

Project Management Information System (PMIS)

- A PMIS is typically a computer-driven system to aid a project manager in the development of the project.
- A PMIS can calculate schedules, costs, expectations, and likely results.
- The goal of a PMIS is to automate, organize, and provide control of the project management processes.
- The Project Management Book of Knowledge (PMBOK) states that a PMIS is “an information system consisting of the tools and techniques used to gather, integrate, and disseminate the outputs of project management processes. It is used to support all aspects of the project from initiating through closing and can include both manual and automated systems.”

PMIS (contd..)

- PMIS are system tools and techniques used in project management to deliver information.
- Project managers use the techniques and tools to collect, combine and distribute information through electronic and manual means.
- PMIS is used by upper and lower management to communicate with each other.
- A typical PMIS software system has:

➢WBS creation tools

➢Calendaring features

➢Scheduling abilities

➢PERT Charts, Gantt Charts

➢Calculating critical path, project schedule

➢Resource tracking and levelling

PMIS (contd..)

- It is an automated system to quickly create, manage, and streamline the project management processes.
- PMIS also includes a configuration management system.
- Configuration management is an approach for tracking all approved changes, versions of project plans, blueprints, software numbering, and sequencing.

Essential Features of a PMIS

- **Schedule and Planning:** Computes early and late schedule, slack times and the critical path
- **Resource Management:** Including resource loading, leveling, allocation, etc.
- **Budget:** Associate cost with individual tasks for more accurate budget estimation and generation.
- **Control and Performance:** Analyze and control cost and performance, updating existing plans as actual against planned data changes, provide what-if scenarios for the project manager.
- **Reporting and Communication:** Creation of graphs and charts of collected and analyzed data that can be shared with stakeholders and team members.
- **Integration and Ease of Use:** Some PMIS will access data from different projects for multi-project analysis, integrating with other systems, such as payroll, inventory, etc. The easier a PMIS is to use, the less time and money required to train.

Examples of PMIS

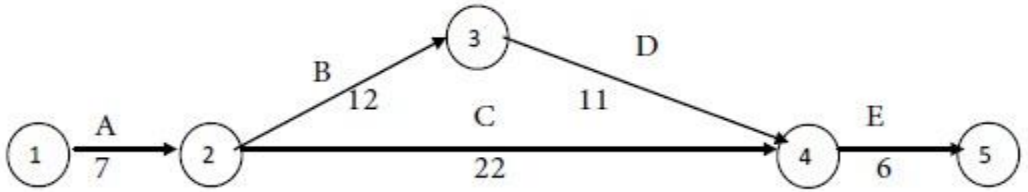
- Microsoft Project (MS Project)
- Project Scheduler
- Welcom
- Trakker
- Primavera

Example 3. The management of a company is interested in crashing of the following project by spending an additional amount not exceeding Rs. 2,000. Suggest how this can be accomplished.

Activity	Predecessor Activity	Normal Time (Weeks)	Crash Time (Weeks)	Normal Cost (Rs.)	Crash Cost (Rs.)
A	-	7	6	15,000	18,000
B	A	12	9	11,000	14,000
C	A	22	21	18,500	19,000
D	B	11	10	8,000	9,000
E	C, D	6	5	4,000	4,500

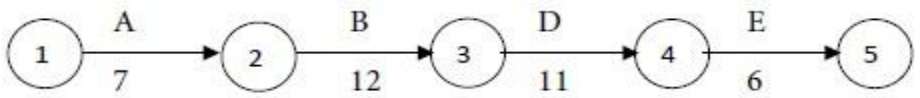
Solution:

We have the following network diagram for the given project with normal costs:



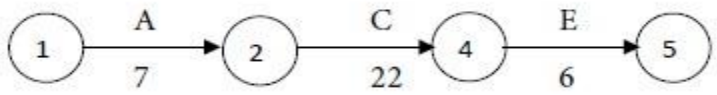
There are two paths for this project as detailed below:

Path I



The time for the path = 7 + 12 + 11 + 6 = 36 weeks.

Path II



The time for the path = 7 + 22 + 6 = 35 weeks.

Maximum of {36, 35} = 36.

Therefore Path I is the critical path and the critical activities are A, B, D and E. The non-critical activity is C.

The crash cost per unit time for the activities in the project are provided in the following table.

Activity	Normal	Crash Time	Normal Cost	Crash Cost	Crash cost - Normal Cost	Normal Time - Crash Time	Crash Cost per unit time
A	7	6	15,000	18,000	3,000	1	3,000
B	12	9	11,000	14,000	3,000	3	1,000
C	22	21	18,500	19,000	500	1	500
D	11	10	8,000	9,000	1,000	1	1,000
E	6	5	4,000	4,500	500	1	500

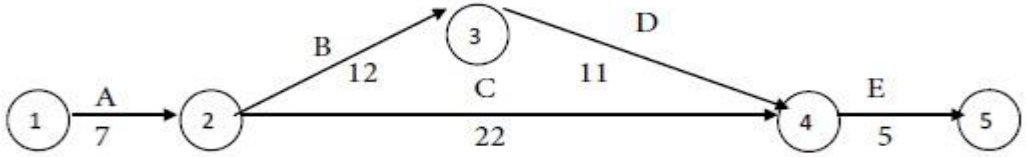
Cost Slope

We have to choose one of the activities A, B, D and E for crashing. The crash cost per unit time is as follows:

Rs. 3,000 for A; Rs. 1,000 for B; Rs. 1,000 for D; Rs. 500 for E.

The least among them is Rs. 500. So we have to choose the activity E for crashing. We reduce the time of E by one week by spending an extra amount of Rs. 500.

After this step, we have the following network with the revised times for the activities:



The revised time for Path I = 7 + 12 + 11 + 5 = 35 weeks.

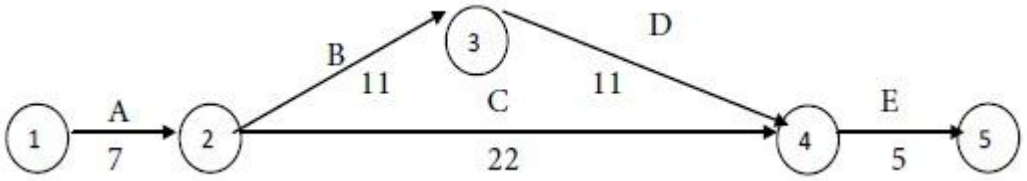
The time for Path II = 7 + 22 + 5 = 34 weeks.

Maximum of {35, 34} = 35.

Therefore Path I is the critical path and the critical activities are A, B, D and E. The non-critical activity is C.

The time of E cannot be reduced further. So we cannot select it for crashing. Next B and D have the smallest crash cost per unit time. Let us select B for crashing. Let us reduce the time of B by one week at an extra cost of Rs. 1,000.

After this step, we have the following network with the revised times for the activities:



The revised time for Path I = 7 + 11 + 11 + 5 = 34 weeks.

The time for Path II = 7 + 22 + 5 = 34 weeks.

Maximum of {34, 34} = 34.

Since both paths have equal times, both are critical paths. So, we can choose an activity for crashing from either of them depending on the least crash cost per unit time. In path I, the activities are A, B, D and E. In path II, the activities are A, C and E.

The crash cost per unit time is the least for activity C. So we select C for crashing. Reduce the time of C by one week at an extra cost of Rs. 500.

By the given condition, the extra amount cannot exceed Rs. 2,000.

Since this state has been met, we stop with this step.

Result: The following crashing scheme is suggested for the given project:

Reduce the time of E, B and C by one week each.

Project time after crashing is 33 weeks.

Extra amount required = 500 + 1,000 + 500 = Rs. 2,000.

Q. The table shows estimation of probability and likely impact of certain risks in a project of “Restoring and refurbishing a heritage building housing a museum” by project engineer of a city municipal corporation. Total project cost is Rs. 100 Million and duration is 1 year.

Code	Risk	Probability	Impact (Mn Rs.)
A	Damage to structural artwork of building	20%	15
B	Theft of or damage to antique items	60%	80
C	Structural deterioration more than expected	80%	30
D	Loss of revenue due to delay in project	40%	5
E	Architect fees exorbitant due to likely increase in scope during execution	60%	2

Device a suitable impact scale and make a probability impact matrix and comment on the severity of each risk based on the same. (June 2018)

Solution:

Given: Total Project Cost 100 Mn

Total Project Duration 1 Year

Code	Risk	Probability	Impact (Mn Rs.)
A	Damage to structural artwork of building	20%	15
B	Theft of or damage to antique items	60%	80
C	Structural deterioration more than expected	80%	30
D	Loss of revenue due to delay in project	40%	5
E	Architect fees exorbitant due to likely increase in scope during execution	60%	2

The impact of various risks is given in Rs. Terms. Following impact scale can be deviced.

Cost Impact on Project	Impact Level	Impact Scale
Less than 2% of project cost: Rs. 2 Mn and below	Very Low	0.05
Between 2% to 10% of project cost: Rs. 2 Mn to Rs. 10 Mn	Low	0.1
Between 10% to 20% of project cost: Rs. 10 Mn to Rs. 20 Mn	Moderate	0.2
Between 20% to 40% of project cost: Rs. 20 Mn to Rs. 40 Mn	High	0.4
More than 40% of project cost: Rs. 40 Mn and above	Very High	0.8

Based on given probability scale and the proposed impact scale following matrix can be developed as a template for assessing risk priority, based on probability and impact scale, based on product of P (probability) and I (Impact).

	Impact ➔	0.05	0.1	0.2	0.4	0.8
Probability ↓	**0.2**	0.01	0.02	0.04	0.08	0.16
	0.4	0.02	0.04	0.08	0.16	0.32
	0.6	0.03	0.06	0.12	0.24	0.48
	0.8	0.04	0.08	0.16	0.32	0.64
	1	0.05	0.1	0.2	0.4	0.8

The Green zone (Top left corner PxI < 0.04) is low priority risk zone and Red zone (Bottom right corner PxI > 0.16) is Top priority risk zone. Remaining area has moderate priority risks.

Now for the given case

Code	Risk	Probability	Impact Level	Impact Scale
A	Damage to structural artwork of building	0.2	Moderate	0.2
B	Theft of or damage to antique items	0.6	Very High	0.8
C	Structural deterioration more than expected	0.8	High	0.4
D	Loss of revenue due to delay in project	0.4	Low	0.1
E	Architect fees exorbitant due to likely increase in scope during execution	0.6	Very Low	0.05

Placing each risk in the Probability Impact Matrix

	Impact →	**0.05**	**0.1**	**0.2**	**0.4**	**0.8**
Probability	**0.2**	0.01	0.02	0.04 **(A)**	0.08	0.16
	0.4	0.02	0.04 **(D)**	0.08	0.16	0.32
	0.6	0.03 **(E)**	0.06	0.12	0.24	0.48 **(B)**
	0.8	0.04	0.08	0.16	0.32 **(C)**	0.64
	1	0.05	0.1	0.2	0.4	0.8

Based on the placement of various risks in the P & I matrix
The Low priority risks are A, D and E (Less severe risks)
There are no moderate priority risks The high priority risks are C and B (Very Severe risks).

Risk Response Strategies

- The risk can have both positive as well as negative impacts on the project.
- In case the risk is negative, one would try to avoid or reduce its impact.
- If the impact of risk is positive, one would try to increase the likelihood of its occurrence.
- Risk Response Strategies for Negative Risks: Escalate, Avoid, Mitigate, Transfer, Accept
- Risk Response Strategies for Positive Risks: Escalate, Exploit, Enhance, Share, Accept

Risk Response Strategies for Negative Risks

- **Escalate:** You use the escalate risk response strategy when you cannot manage risk on your own because you lack the authority, resources, or knowledge required for a response.
- **Mitigate:** This risk response strategy helps you lessen the impact or probability of the risk. Put simply, this strategy decreases the severity of the risk.
- **Transfer:** You use this strategy when you lack skills or resources to manage the risk, or you are too busy to manage it.
- **Avoid:** Here, you try to eliminate the risk or its impact. You do this by changing your project management plan, changing the project scope, or by changing the schedule.
- **Accept**: You can use this risk response strategy with positive and negative risks. Here you take no action to manage the risk other than acknowledging it.

Risk Response Strategies for Positive Risks

- **Escalate:** You use this strategy when you cannot realize an opportunity, as you lack the authority to take the necessary steps to make it happen.
- **Enhance:** In the enhance risk response strategy, you try to increase the chance of a risk happening so you can realize the risk. In this case, you try to realize the opportunity. The enhance risk response strategy is the opposite of the mitigate strategy.
- **Exploit:** In the exploit risk response strategy, you ensure that the opportunity is realized. Here, you do not try to realize the opportunity, you ensure you realize it.
- **Share:** You use the share risk response strategy when you cannot realize the opportunity on your own. So, you team up with another company and work together to realize it.
- **Accept:** In the accept risk response strategy, you take no action to realize the opportunity. You leave the opportunity as is, and if it happens on its own, you will benefit from it.

Formulae

- ACWP (AC), BCWS (PV), BCWP (EV)
- Schedule Variance SV = EV – PV
- Cost Variance CV = EV – AC
- Schedule Performance Index SPI = EV / PV
- Cost Performance Index CPI = EV / AC
- Cost Schedule Index CSI = EV^2 / (AC) (PV)
- Time Variance: A time variance is the difference between the standard hours and actual hours assigned to a job.

  Time Variance = ST – AT = AT (CSI – 1)

AT is the day given to carry Earned Value Analysis.

Example 1: A consulting project has an actual cost of Rs. 45000, scheduled cost of Rs. 35000, and value of completed work Rs. 40000. Find the schedule and cost variance. Also find SPI and CPI.

Solution:

AC = Rs. 45000, PV = Rs. 35000, EV = Rs. 40000

Schedule Variance SV = EV – PV = 40000 – 35000 = Rs. 5000

Cost Variance CV = EV – AC = 40000 – 45000 = Rs. -5000

Schedule Performance Index SPI = EV / PV = 40000 / 35000 = 1.14

Cost Performance Index CPI = EV / AC = 40000 / 45000 = 0.88

Example 2: A software development project at day 70 exhibits an actual of Rs. 78000 and a scheduled cost of Rs. 84000. The software manager estimates a value completed of Rs. 81000. What are the cost and schedule variances and CSI? Estimate the time variance.

Solution:

AC = Rs. 78000, PV = Rs. 84000, EV = Rs. 81000, AT = 70 days

Schedule Variance SV = EV – PV = 81000 – 84000 = Rs. -3000

Cost Variance CV = EV – AC = 81000 – 78000 = Rs. 3000

SPI = EV / PV = 81000 / 84000 = 0.96

CPI = EV / AC = 81000 / 78000 = 1.03

CSI = EV^2 / (AC) (PV) = 81000^2 / (78000)(84000) = 1.001

Time Variance = ST – AT = AT (CSI – 1) = 70 (1.001 - 1) = 0.07 days

Scope Creep

- A definition provided by the PMBOK® Guide (5th edition) states that scope creep is *the uncontrolled expansion to product or project scope without adjustments to time, cost, and resources*.
- **Causes of scope creep**

1. Project scope is not defined clearly enough.
2. Changed client's priorities or needs.
3. Poorly identified stakeholder needs and interests.
4. Poor initial analysis of what's necessary and reasonable.
5. Inability to say no.

- **How to Avoid Scope Creep?**

1. Identify all stakeholders and understand their goals.
2. Clearly define project scope.
3. Plan room for changes in advance.
4. Take action as early as possible.
5. Know when to say no.

Contracts

- ‘Contract’ as the term specifies is an agreement between two parties in general.
- In project management, it’s a formal agreement between a buyer and a seller (more often referred to as supplier).
- The agreement is made to procure goods and services required for the agreed project.
- This document needs to be prepared by the Project Manager (or the contract project manager if assigned).
- It is in coordination with Procurement Manager during the project planning stage.
- It has to be documented as a Procurement Management plan, which is a part of the primary Project Management Plan.
- Contract Management, a part of the Project management, deals with the vendor/seller/supplier (as termed in the contract).
- It also manages the procurements according to the terms and conditions set in the ‘Contract.’
- The terms and conditions are agreed mutually between the buyer and seller.

Types of contract

- Most of the contractual relationships are broadly categorized as either:

1. Fixed-Price contract
2. Cost reimbursable
3. Time & Materials Contract

Fixed Price Contracts

- In this category, the contract involves a fixed price for a defined product or service or the result to be supplied/provided.
- These types of contracts are recommended when the scope of service is completely defined and final.
- **Here are the different types of Fixed Price contracts used in managing projects:**

1. **Firm Fixed Price (FFP)**
2. **Fixed Price Incentive Fee (FPIF)**
3. **Fixed Price with Economic Price Adjustments (FPEPA)**

Firm Fixed Price (FFP)

- The prices of the goods and services are set and are never subjected to change unless the scope is changed and agreed mutually.
- This type is favorable mostly to the buying organizations because the extent of buying the goods remains unchanged and recurring buying happens.

Fixed Price Incentive Fee (FPIF)

- The price ceiling is set, and the seller needs to perform and fulfill the contract requirements within that price.
- All the costs above the price ceiling are the responsibility of the seller.
- This type gives both the buyer and the seller some flexibility for performance with technical incentives.
- The incentives are tied to achieving agreed upon metrics such as cost, schedule and technical expertise of the seller.

Fixed Price with Economic Price Adjustments (FPEPA)

- It is suitable when the contracts are executed in different countries and payments are made in a different currency.
- Also, if the seller's work lasts for a few years (3-5 years generally) this contract is fitting.
- This contract gives an option to make adjustments in the predefined final payment as agreed to in the contract.
- It can be due to changed conditions such as inflating rates (may increase or decrease) on specific commodities.

Cost reimbursable contracts

- This type of contract involves cost reimbursement (payments to the work done) for the costs incurred during completion of the contractual job.
- It is along with a pre-defined fee representing seller profit.
- It is recommended if the scope of the work is expected to change during the contract period.
- **This type of contract includes:**

1. **Cost Plus Fixed Fee (CPFF)**
2. **Cost Plus Incentive Fee (CPIF)**
3. **Cost Plus Award Fee (CPAF)**

Cost Plus Fixed Fee (CPFF)

- The seller gets all the allowable costs agreed in the contract.
- The seller also receives a fixed fee payment, which is calculated as a percentage of initial estimated project costs.
- Unless the project scope changes, this fee remains unchanged.

Cost Plus Incentive Fee (CPIF)

- The seller gets the reimbursements for all the costs incurred on performing the work agreed in the contract.
- Based on the final costs incurred (greater or lesser than the initial planned cost), both the buyer and the seller share their expenses.
- The sharing is based upon a pre-negotiated cost-sharing formula.
- Generally, it is an 80/20 split over the target costs based on the actual performance of the seller.

Cost Plus Award Fee (CPAF)

- In this type, the seller gets his/her legitimate reimbursements.
- But a majority of the fee is received upon meeting some technical/subjective performance that is pre-set in the contract.
- This solely depends on the buyer’s determination and the seller’s performance.

Time & Material Contracts (T&M)

- This a hybrid type of contract combining the features of Fixed as well as Cost Reimbursable contracts.
- This is often used when contractual requirements (scope) is not known/ prescribed.
- Also, this type of contract is suitable for acquisition/hiring of experts, project staff required for a particular period.

Project Termination

- A project is a temporary endeavor, so it has a beginning and also an end.
- Project termination (or *close-out*) is the last stage of managing the project, and occurs after the implementation phase has ended.
- **During the last phase of the project life cycle, meaning the project closure, everything should be detailed in order to measure if the project went as planned and if the outcome is done as required by the customer.**
- Project closure activities ensure the recording project documents, archiving in organizational process assets, making final payments, releasing resources and completing the project.
- Every project teaches lessons to the organization whether it's a success or is a failure.
- So even after a project finishes, the documentation of this project is going to be helpful for completing the coming projects successfully.

Reasons that can end up / terminate a project

1. Poor management skills.
2. Bad decisions being made which reflect on the skills of the PM.
3. Failure to deliver the overall result.
4. Inability to identify the risks before it's too late within a project.
5. Inadequate risk procedures and control measures implemented.
6. Insufficient resources, staff, fundings, support, professional advice etc...
7. Business politics and stakeholder disputes which have a major impact on the project's stability.
8. Skills shortages within the team, lack of communications, cooperation, time keeping, training and so forth.
9. Lack of commitment, motivation and dedication towards accomplishment because of unrealistic timeframes, targets and expectations.

Types of Project Termination (1/2)

1. Termination by Extinction

- Termination by extinction occurs when the project is stopped due to its either successful or unsuccessful conclusion.
- In the successful case, the project has been transferred to its intended users and all final phase-out activities are conducted.
- The project's final budget is audited; team members receive new work assignments, and any material assets the project employed are dispersed or transferred according to company policies or contractual terms.

2. Termination by Addition

- Termination by addition concludes the project by institutionalizing it as a formal part of the parent organization.
- In effect, the project has been "promoted" to a formal, hierarchical status within the organization.
- The project has indeed been terminated, but its success has led to its addition to the organizational structure.

Types of Project Termination (2/2)

3. Termination by Integration

- Termination by integration represents a common, but exceedingly complicated, method for dealing with successful projects.
- The project's resources, including the project team, are reintegrated within the organization's existing structure following the conclusion of the project.

4. Termination by Starvation

- Termination by starvation can happen for a number of reasons, such as political, a placated sponsor, or general budget cuts.

Leadership Styles

Style	Coercive	Authoritative	Affiliative	Democratic	Pacesetting	Coaching
•The leader's modus operandi	•Demands immediate compliance	•Mobilizes people toward a vision	•Creates harmony and builds emotional bonds	•Forges consensus through participation	•Sets high standards for performance	•Develops people for the future
•The style in a phrase	•"Do what I tell you.“	•"Come with me.“	•"People come first.“	•“What do you think”	•"Do as I do, now.“	•"Try this.“
•Underlying emotional intelligence competencies	•Drive to achieve, initiative, self-control	•Self confidence, empathy, change catalyst	•Empathy, building relationships, communication	•Collaboration, team-leadership, communication	•Conscientiousness, drive to achieve, initiative	•Developing others, empathy, self-awareness
•When the style works best	•In a crisis, to kick start a turnaround, or with problem employees	•When changes require a new vision, or when a clear direction is needed	•To heal rifts in a team or to motivate people during stressful circumstances	•To build buy-in or consensus or get input from valuable employees	•To get quick results from a highly motivated and competent team	•To help an employee improve performance or develop long-term strengths
•Overall impact on climate	•Negative	•Most strongly positive	•Positive	•Positives	•Negative	•Positive