INFO 6007 – Project Management in IT

Week 1

A project is a temporary endeavour undertaken to create a unique product or service or result. Following are a few characteristics of a project:

- A project has a unique purpose. It has a well-defined objective.
- A project is temporary. It has a definite start and an end point.
- A project drives change and enables value creation.
- A project requires resources.
- A project can be part of a program, portfolio, or strategies.
- A project ends when they complete their objectives or has been terminated.
- A project can be large or small and take a short or long time to complete.
- A project should have a primary customer or sponsor.
- A project involves uncertainty.

A project is very diverse in terms of size, complexity, products produced, application area, and resource requirements. Especially in terms of IT, the IT project team members often have diverse backgrounds and skill sets. IT is a field of rapid developments and hence IT projects use these diverse technologies that change rapidly. Hence the team members in any of the technology area must be highly specialised.

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project managers must not only strive to meet the scope, cost, time, and quality goals of the project but also facilitate the entire process to meet the needs and expectations involved in project activities. It is a complex team-based activity where various types of technologies are an inherent part of the project management process.
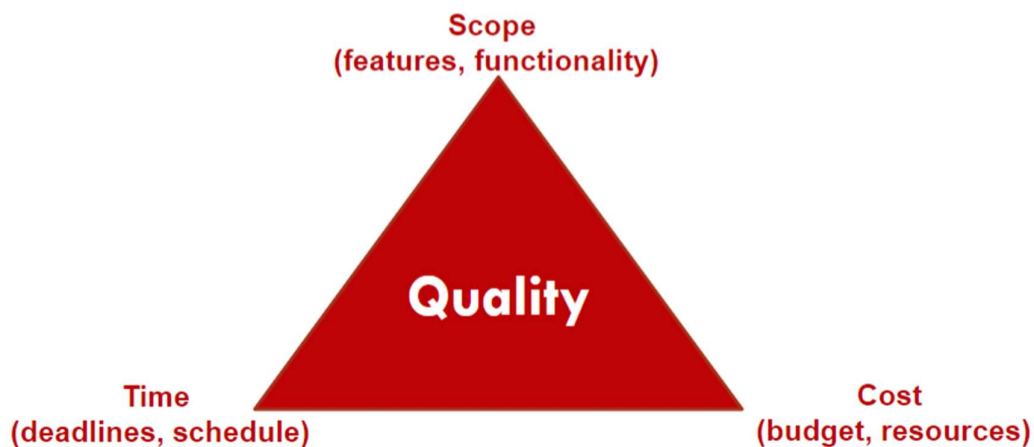
A difference between Project Manager and Program Manager:

Project Manager	Program Manager
They work with project sponsors, team, and other people involved in a project to meet project goals.	They oversee programs which are a group of related projects which are managed in a coordinated way to obtain benefits. They often act like bosses for project manager.

A project manager is expected to have the following skills:
- A good understanding of Project Management Body of Knowledge (PMBOK).
- Application area of knowledge, standards, and regulations.
- Project environment knowledge.
- General management knowledge and skills.
- Soft skills or human relations skills.
- A basic understanding of programming.
- See what programmers don't see.
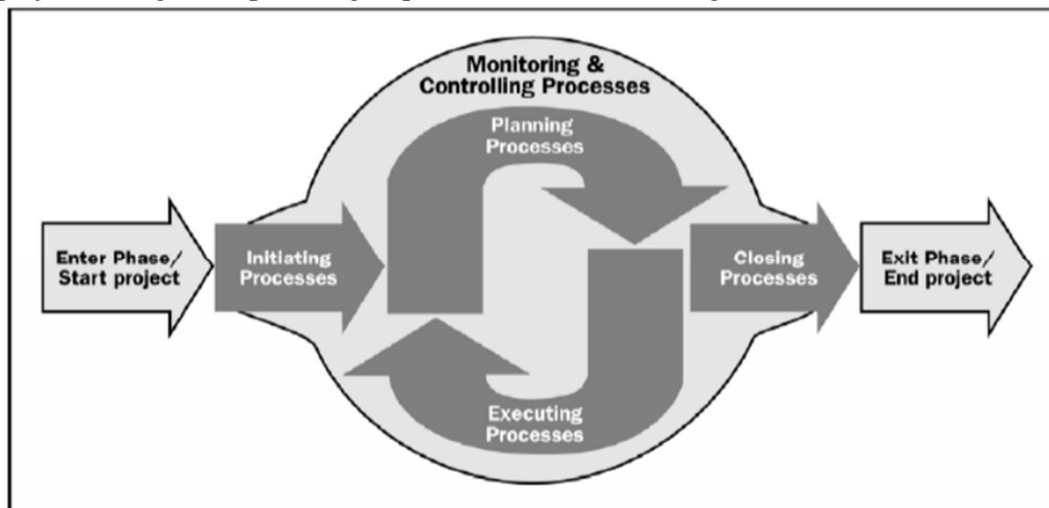- Explain programming language to the client using natural language.

The project management institute (PMI) is an international professional society for project managers founded in 1969. It provides 2 certifications:
- Project Management Professional (PMP)
- Certified Associate in Project Management (CAPM)

The Project Management Body of Knowledge (PMBOK) describes the best practices for managing projects. It defines project management as an application of knowledge, tools, and techniques to project activities to meet project requirements. Project Management has a lot of knowledge areas such as:

- Project integration management
- Project time management
- Project quality management
- Project communications management
- Project procurement management
- Project scope management
- Project cost management
- Project HR management
- Project risk management
- Project stakeholder management

A project management process group consists of the following:

- Initiating

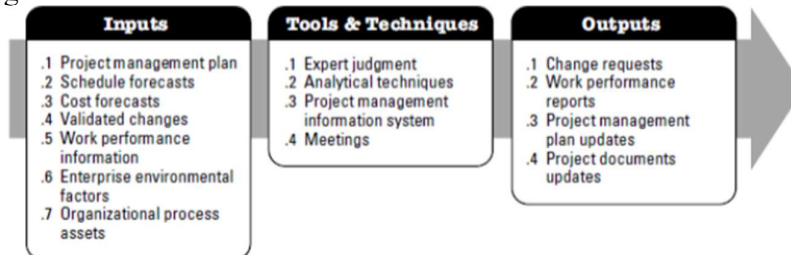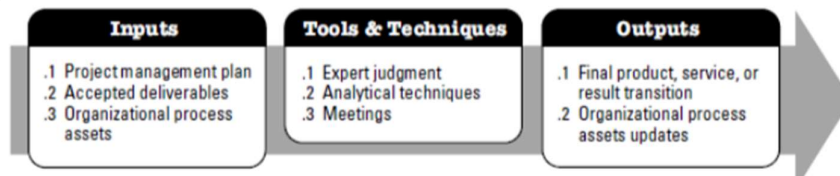| Inputs	Tools & Techniques	Outputs
.1 Project statement of work .2 Business case .3 Agreements .4 Enterprise environmental factors .5 Organizational process assets	.1 Expert judgment .2 Facilitation techniques	.1 Project charter

- Planning

Inputs	Tools & Techniques	Outputs
.1 Project charter .2 Outputs from other processes .3 Enterprise environmental factors .4 Organizational process assets	.1 Expert judgment .2 Facilitation techniques	.1 Project management plan

- Executing

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Approved change requests .3 Enterprise environmental factors .4 Organizational process assets	.1 Expert judgment .2 Project management information system .3 Meetings	.1 Deliverables .2 Work performance data .3 Change requests .4 Project management plan updates .5 Project documents updates

- Monitoring and control

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Schedule forecasts .3 Cost forecasts .4 Validated changes .5 Work performance information .6 Enterprise environmental factors .7 Organizational process assets	.1 Expert judgment .2 Analytical techniques .3 Project management information system .4 Meetings	.1 Change requests .2 Work performance reports .3 Project management plan updates .4 Project documents updates

- Closing

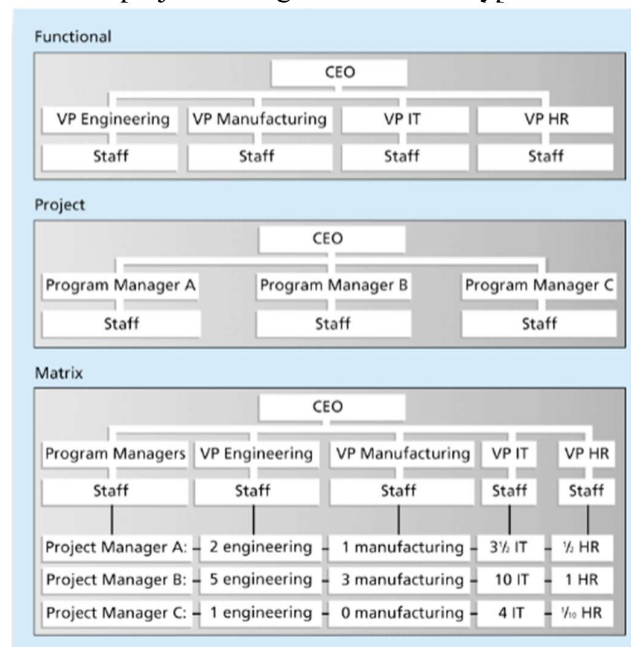| Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Accepted deliverables .3 Organizational process assets	.1 Expert judgment .2 Analytical techniques .3 Meetings	.1 Final product, service, or result transition .2 Organizational process assets updates

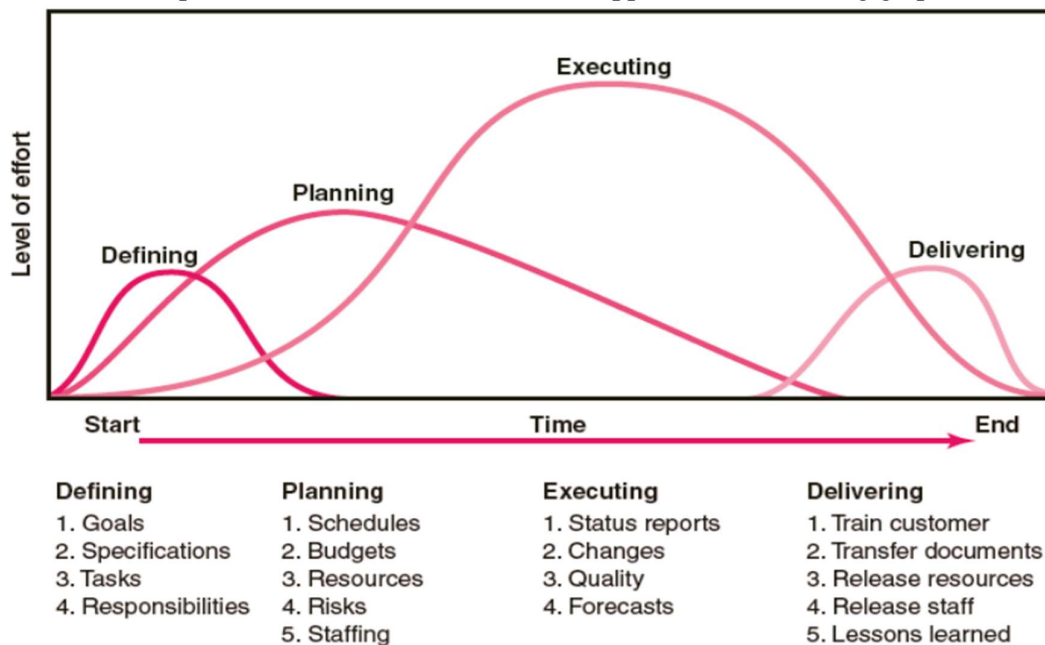Organisational Structures for project management are of 3 types. These are:

Further characteristics of these organisational controls are given below:

Project Characteristics	Organizational Structure Type				
	Functional	Matrix			Project
		Weak Matrix	Balanced Matrix	Strong Matrix	
Project manager's authority	Little or none	Limited	Low to moderate	Moderate to high	High to almost total
Percent of organization's personnel assigned full-time to project work	Virtually none	0–25%	15–60%	50–95%	85–100%
Who controls the project budget	Functional manager	Functional manager	Mixed	Project manager	Project manager
Project manager's role	Part-time	Part-time	Full-time	Full-time	Full-time
Common title for project manager's role	Project coordinator/ project leader	Project coordinator/ project leader	Project manager/ project officer	Project manager/ program manager	Project manager/ program manager
Project management administrative staff	Part-time	Part-time	Part-time	Full-time	Full-time

Week 2

A project life cycle is a collection of project phases that defines what work will be performed in each phase, what deliverables will be produced and when will it be produced, who is involved in each phase and finally how management will control and approve the work produced in each phase. The level of effort can be mapped in the following graph:

Defining
1. Goals
2. Specifications
3. Tasks
4. Responsibilities

Planning
1. Schedules
2. Budgets
3. Resources
4. Risks
5. Staffing

Executing
1. Status reports
2. Changes
3. Quality
4. Forecasts

Delivering
1. Train customer
2. Transfer documents
3. Release resources
4. Release staff
5. Lessons learned

Early project phases:
- Lowest number of resources usually required.
- Highest level of uncertainty for risk.
- Project stakeholders have greatest opportunity to influence the project.

Middle project phases:
- Certainty of project completion increases.

- More resources are needed.

Final project phases:
- Ensuring that the project requirements were met.
- The sponsor approves the completion of the project.

A methodology is a system of practices, techniques, procedures, and rules used by those who work in a discipline. Some popular Project management methodologies are:
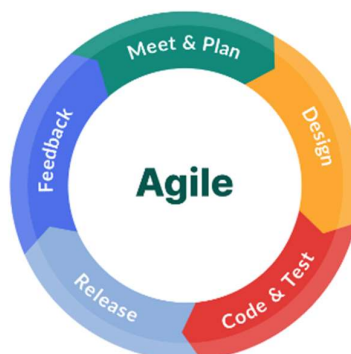- Waterfall project management

    It is a traditional project management technique which handles things sequentially from the concept and planning phase to the development and quality assurance and finally project completion and maintenance. It is most often applied to large software development projects as thorough planning and predictability are supreme to the project process and success.
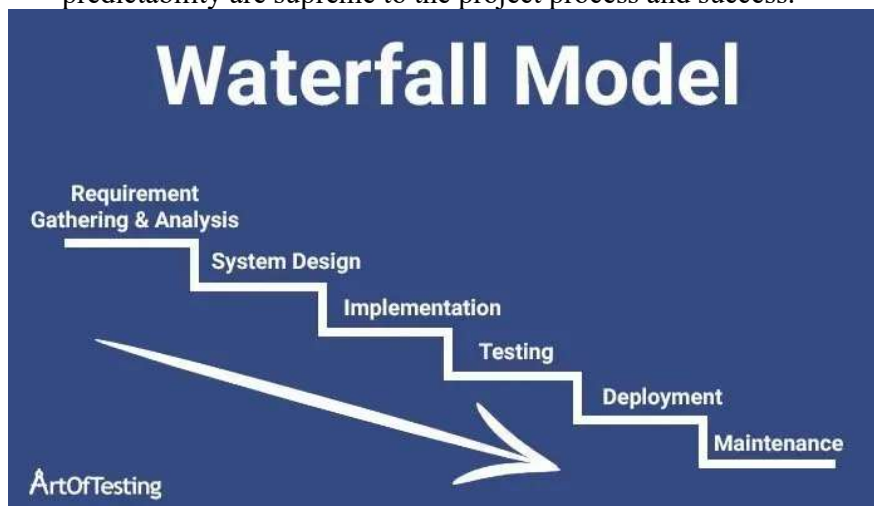
- Agile project management

    It focuses on adaptability to changing situations and constant, regular feedback. This is ideal when clients or management need to be in on the production process. Agile project management is usually ideal for smaller software projects and/or those with accelerated development schedules. Agile method is based on iterative and incremental development in which requirements and solutions evolve through collaboration. Agile management can be applied on multiple aspects such as scope, time, cost, risk, quality, etc. An extension of agile development is the scrum model which is an iterative project management methodology. Scrum model emphasises collaboration, functioning software, team self-management, and the flexibility to adopt to emerging business realities.

- PRINCE2
  - It is a government endorsed project management methodology released and supported by the UK government. It is a very process-oriented methodology which divides the project in multiple stages each with their own plans and processes to follow.

A deliverable is a product produced as part of a project such as hardware or software, planning documents or meeting minutes. Scope refers to all the work involved in creating the products of the project and the processes used to create them.

A project scope management is done in the following steps:
- Plan scope management

  Plan Scope Management is the process of creating a scope management plan that documents how the project scope will be defined, validated, and controlled.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Project charter .3 Enterprise environmental factors .4 Organizational process assets	.1 Expert judgment .2 Meetings	.1 Scope management plan .2 Requirements management plan

- Collect requirements

  Collect Requirements is the process of determining, documenting, and managing stakeholder needs and requirements to meet project objectives.

Inputs	Tools & Techniques	Outputs
.1 Scope management plan .2 Requirements management plan .3 Stakeholder management plan .4 Project charter .5 Stakeholder register	.1 Interviews .2 Focus groups .3 Facilitated workshops .4 Group creativity techniques .5 Group decision-making techniques .6 Questionnaires and surveys .7 Observations .8 Prototypes .9 Benchmarking .10 Context diagrams .11 Document analysis	.1 Requirements documentation .2 Requirements traceability matrix

- Define scope
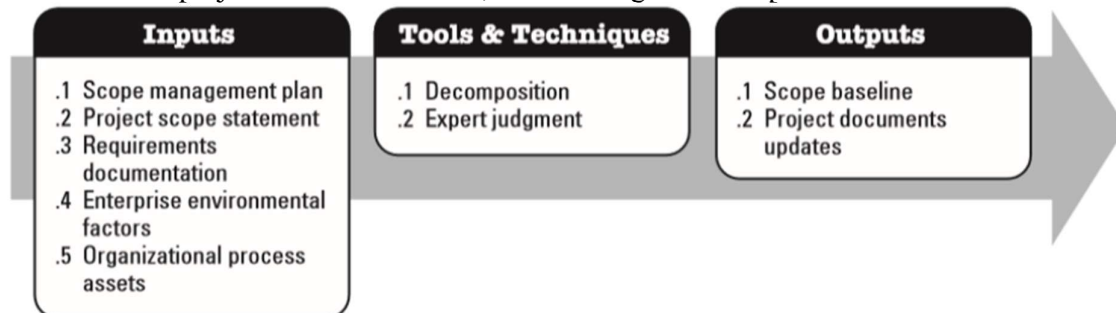
Define Scope is the process of developing a detailed description of the project and product.

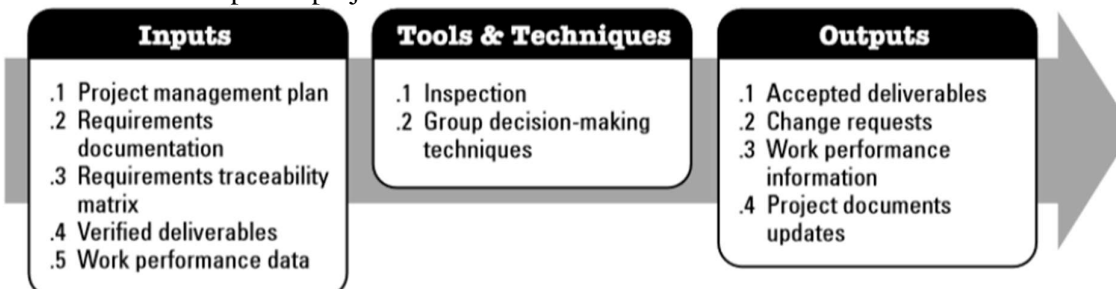| Inputs	Tools & Techniques	Outputs
.1 Scope management plan .2 Project charter .3 Requirements documentation .4 Organizational process assets	.1 Expert judgment .2 Product analysis .3 Alternatives generation .4 Facilitated workshops	.1 Project scope statement .2 Project documents updates

- Create WBS

Create WBS is the process of subdividing project deliverables and project work into smaller, more manageable components.

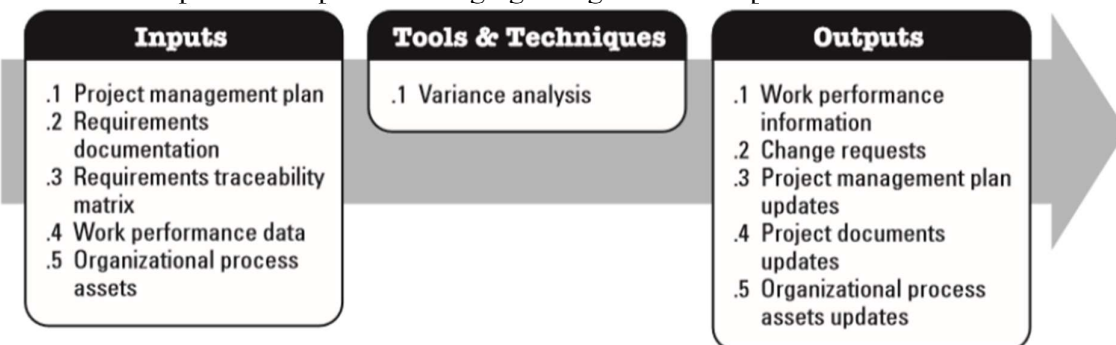| Inputs	Tools & Techniques	Outputs
.1 Scope management plan .2 Project scope statement .3 Requirements documentation .4 Enterprise environmental factors .5 Organizational process assets	.1 Decomposition .2 Expert judgment	.1 Scope baseline .2 Project documents updates

- Validate scope

Validate Scope is the process of formalizing acceptance of the completed project deliverables.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Requirements documentation .3 Requirements traceability matrix .4 Verified deliverables .5 Work performance data	.1 Inspection .2 Group decision-making techniques	.1 Accepted deliverables .2 Change requests .3 Work performance information .4 Project documents updates

- Control scope

Control Scope is the process of monitoring the status of the project and product scope and managing changes to the scope baseline.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Requirements documentation .3 Requirements traceability matrix .4 Work performance data .5 Organizational process assets	.1 Variance analysis	.1 Work performance information .2 Change requests .3 Project management plan updates .4 Project documents updates .5 Organizational process assets updates

The PMBOK describes requirements as conditions or capabilities that must be met by the project or present in the product, service, or result to satisfy an agreement or other formally imposed specification. The requirements management plan documents how project requirements will be analysed, documented, and managed.

It is important to use an iterative approach to defining requirements since they are often unclear early in a project. There are multiple methods for collecting requirements such as interviewing, focus groups, questionnaires, surveys, observation, prototyping, benchmarking, etc.

A requirements traceability matrix (RTM) is a table that lists requirements, various attributes of each requirement, and the status of the requirements to ensure that all requirements are addressed.

A WBS is a deliverable-oriented grouping of the work involved in a project that defines the total scope of the project. WBS is a foundation document that provides the basis for planning and managing project schedules, costs, resources, and changes. A work package is a task at the lowest level of WBS. Decomposition is subdividing project deliverables into smaller pieces. There are various approaches to creating a WBS, such as:
- Analogy approach
  - Review WBSs of similar projects and tailor your project.
- Top-down approach
  - Start with the largest items of the project and break them down.
- Bottom-up approach
  - Start with the specific tasks and roll them up.
- Mind-mapping approach
  - It is a technique that uses branches radiating out from a core idea to structure thoughts and ideas.

Scope validation involves the formal acceptance of the completed project deliverables. It is often achieved by a customer inspection and then sign-off on key deliverables. Scope control involves controlling changes to the project scope. The goals of scope control are to:
- Control the factors that cause scope changes.
- Assure changes are processed according to procedures.
- Manages changes when they occur.

Week 3

Delivering the project on time is one of the biggest challenges in IT project. Time has the least amount of flexibility and schedule issues are the main reason for conflicts on projects, especially during the second half of the projects. Project time management is done in the following steps:
- Plan schedule management

  It is the process of determining the policies, procedures, and documentation that will be used for planning, executing, and controlling the project schedule.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Project charter .3 Enterprise environmental factors .4 Organizational process assets	.1 Expert judgment .2 Analytical techniques .3 Meetings	.1 Schedule management plan

- Define activities

It is the process of identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables.

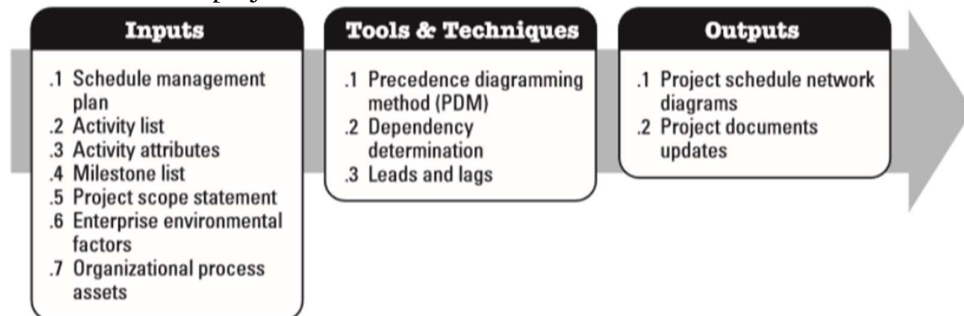| Inputs	Tools & Techniques	Outputs
.1 Schedule management plan .2 Scope baseline .3 Enterprise environmental factors .4 Organizational process assets	.1 Decomposition .2 Rolling wave planning .3 Expert judgment	.1 Activity list .2 Activity attributes .3 Milestone list
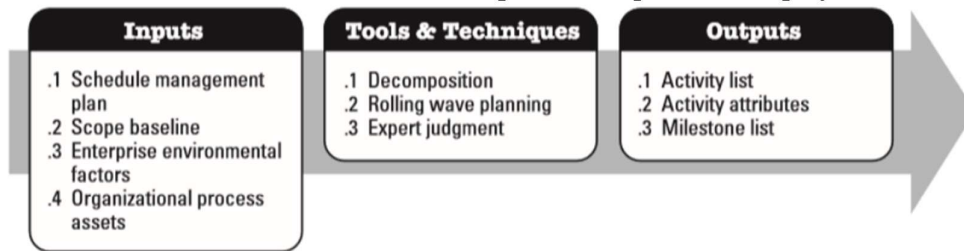
An activity or task is an element of work normally found on the WBS that has an expected duration, a cost, and resource requirements. An activity list is a tabulation of activities to be included on a project schedule that includes the activity name, activity identifier and a brief description of the activity. Activity attributes provide more information about the activity.

A milestone is a significant event in a project that occurs in time. It often takes several activities and many tasks to complete a milestone. They are a useful tool to set goals and monitor progress.

- Sequence activities

It is the process of identifying and documenting the relationships between project activities.
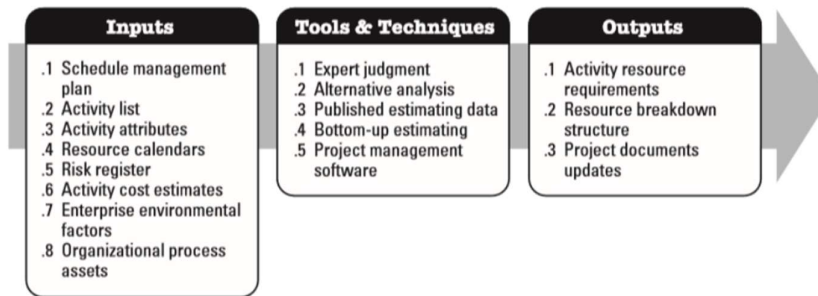
Inputs	Tools & Techniques	Outputs
.1 Schedule management plan .2 Activity list .3 Activity attributes .4 Milestone list .5 Project scope statement .6 Enterprise environmental factors .7 Organizational process assets	.1 Precedence diagramming method (PDM) .2 Dependency determination .3 Leads and lags	.1 Project schedule network diagrams .2 Project documents updates

Sequencing activities involve reviewing activities and determining tasks dependencies. One must determine dependencies to use critical path analysis. There are a total of 3 types of dependencies, these are:
- Mandatory dependencies
  - It is essential in the nature of the work being performed on a project, sometimes referred to as hard logic.
- Discretionary dependencies
  - It is defined by the project team as soft logic. It should be used with care since they may limit later scheduling options.
- External dependencies
  - It involves relationships between project and non-project activities.
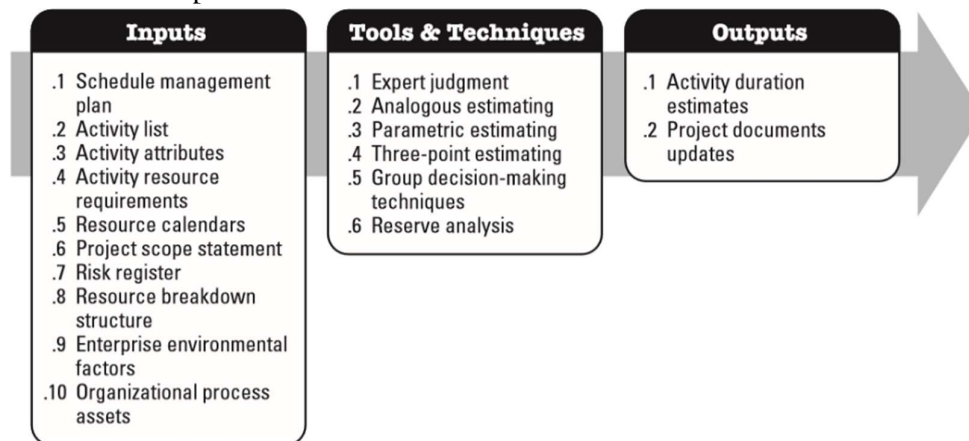- Estimate activity resources

It is the process of estimating how many resources a project team should use to perform project activities.

Inputs
.1 Schedule management plan
.2 Activity list
.3 Activity attributes
.4 Resource calendars
.5 Risk register
.6 Activity cost estimates
.7 Enterprise environmental factors
.8 Organizational process assets

Tools & Techniques
.1 Expert judgment
.2 Alternative analysis
.3 Published estimating data
.4 Bottom-up estimating
.5 Project management software

Outputs
.1 Activity resource requirements
.2 Resource breakdown structure
.3 Project documents updates

A resource breakdown structure is a hierarchical structure that identifies the project's resources by category and type. These resources are people, equipment, and materials.

- Estimate activity durations

It is the process of estimating the number of work periods that are needed to complete individual activities.

Inputs
.1 Schedule management plan
.2 Activity list
.3 Activity attributes
.4 Activity resource requirements
.5 Resource calendars
.6 Project scope statement
.7 Risk register
.8 Resource breakdown structure
.9 Enterprise environmental factors
.10 Organizational process assets

Tools & Techniques
.1 Expert judgment
.2 Analogous estimating
.3 Parametric estimating
.4 Three-point estimating
.5 Group decision-making techniques
.6 Reserve analysis

Outputs
.1 Activity duration estimates
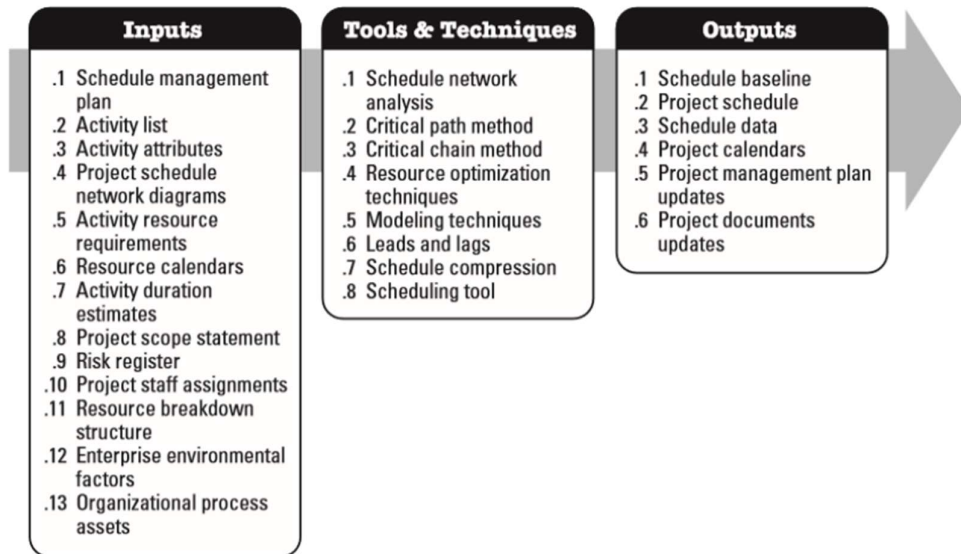.2 Project documents updates

Duration includes the actual amount of time worked on an activity plus the elapsed time. Effort is the number of workdays or work hours required to complete a task. Its often helpful to create 3-point estimates. 3-point estimate is an estimate that includes an optimistic, neutral, and a pessimistic estimate. This 3-point estimate is necessary for the PERT analysis method.

Lead time is when the activity is still running, and a second activity starts. The balance time remaining for the first activity is called as the lead time. Lag on the other hand is when the first activity finishes but there is a delay or wait period before the start of the second activity. This time delay is called as lag.
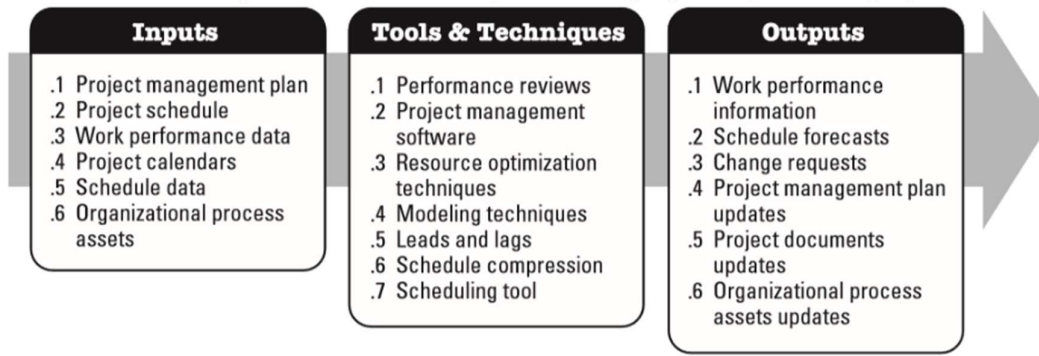
- Develop schedule

It is the process of analysing activity sequences, activity resource estimates, and activity duration estimates to create the project schedule.

Gantt charts are the best charts to provide a standard format for displaying project schedules. It lists the project activities and their corresponding start and finish dates in a calendar format.

Inputs	Tools & Techniques	Outputs
.1 Schedule management plan .2 Activity list .3 Activity attributes .4 Project schedule network diagrams .5 Activity resource requirements .6 Resource calendars .7 Activity duration estimates .8 Project scope statement .9 Risk register .10 Project staff assignments .11 Resource breakdown structure .12 Enterprise environmental factors .13 Organizational process assets	.1 Schedule network analysis .2 Critical path method .3 Critical chain method .4 Resource optimization techniques .5 Modeling techniques .6 Leads and lags .7 Schedule compression .8 Scheduling tool	.1 Schedule baseline .2 Project schedule .3 Schedule data .4 Project calendars .5 Project management plan updates .6 Project documents updates

- Control schedule
    - It is the process of controlling and managing changes to the project schedule.

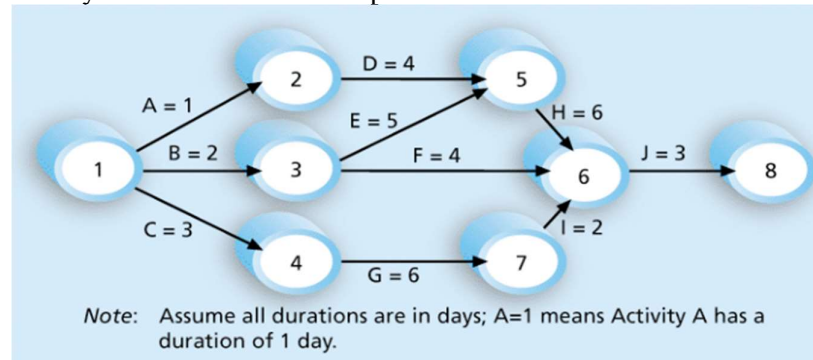| Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Project schedule .3 Work performance data .4 Project calendars .5 Schedule data .6 Organizational process assets	.1 Performance reviews .2 Project management software .3 Resource optimization techniques .4 Modeling techniques .5 Leads and lags .6 Schedule compression .7 Scheduling tool	.1 Work performance information .2 Schedule forecasts .3 Change requests .4 Project management plan updates .5 Project documents updates .6 Organizational process assets updates

Network diagrams are the preferred techniques for showing activity sequencing. A network diagram is a graphic display of the logical relationships of project activities. The most used network diagrams for a project are:

- Activity on the Node (AON)

Activity	Estimated Duration	Predecessor
A	5	None
B	4	A
C	5	B
D	6	B
E	7	D
F	3	C,D
G	6	D
H	7	F,G
I	8	E,G
J	3	H,I
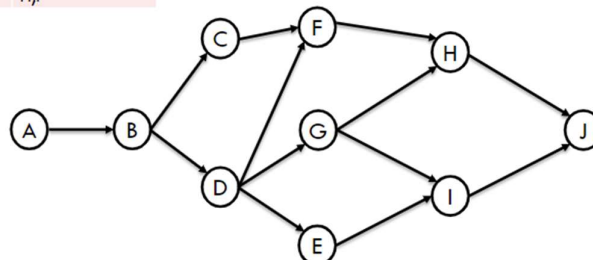
- Activity on the Arrow (AOA)
    - o Activities are represented by arrows.
    - o Nodes are the starting and ending points of activities.
   - o Can only show finish to start dependencies.

Note: Assume all durations are in days; A=1 means Activity A has a duration of 1 day.

- Precedence Diagramming Method (PDM)
    - o Activities are represented by boxes.
    - o Arrows show relationships between activities.
    - o It is better at showing the different types of dependencies.
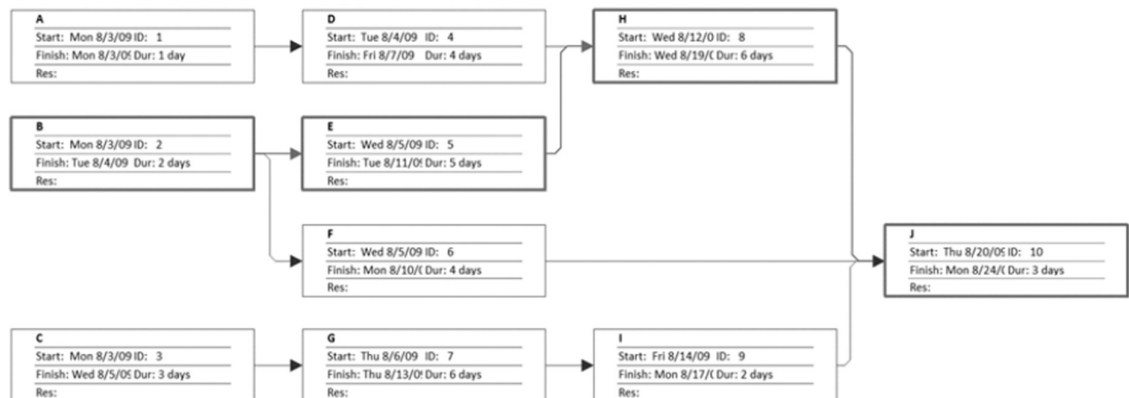
Task dependency	Example	Description
Finish-to-start (FS)	A / B	Task (B) cannot start until task (A) finishes.
Start-to-start (SS)	A / B	Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)	A / B	Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)	A / B	Task (B) cannot finish until task (A) starts.

Critical Path Method (CPM) is a network diagramming technique used to predict total project duration. A critical path for a project is a series of activities that determines the earliest time by which the project can be finished. The critical path is the longest path through the network diagram and has the least amount of slack. The slack is the amount of time an activity maybe delayed without delaying the subsequent activity. Critical path does not take the critical activities but only the time. There can be more than one critical path and it can change as the project progresses.
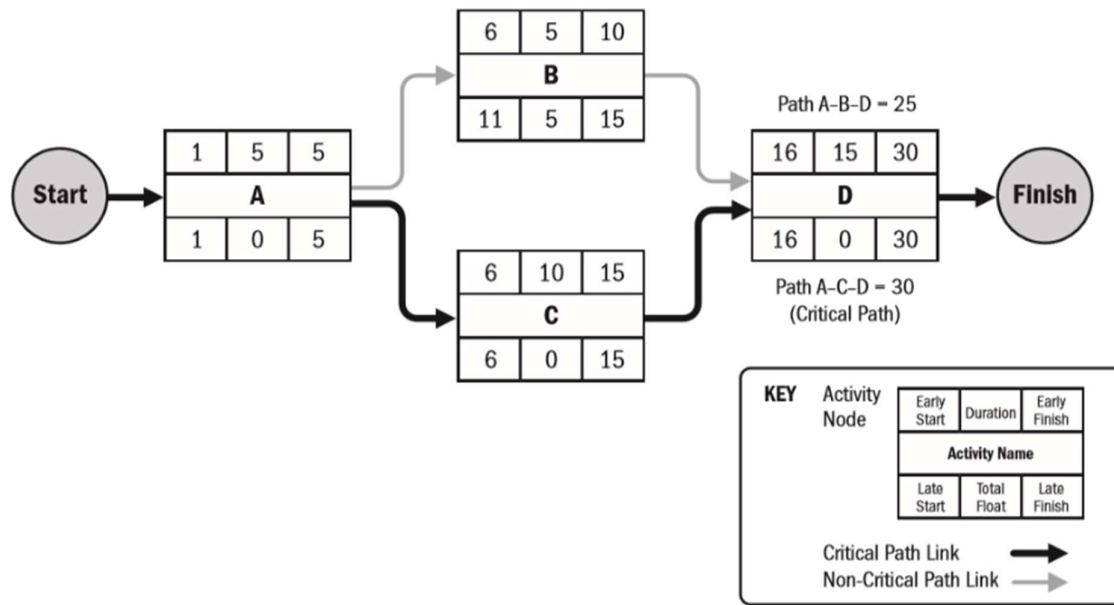
A forward pass through the network diagram determines the early start and finish dates. A backward pass determines the late start and finish dates. A project schedule can be shortened by adding more resources or changing the scope. Crashing activities by obtaining the greatest amount of schedule compression for the least incremental cost is also another option. Fast tracking activities by doing them in parallel or overlapping them also works to shorten the project schedule.

Critical chain scheduling is a method of scheduling that considers limited resources when creating a project schedule and includes buffers to protect the project completion date. It attempts to minimize multitasking. Multitasking is when a resource works on more than one task at a time. A buffer is additional time to complete a task. Critical chain scheduling removes buffers from individual tasks and instead creates a project buffer or feeding buffer. Project buffer is the additional time added before the project's due date. Feeding buffers on the other hand is additional time added before tasks on the critical path.

PERT is a network analysis technique used to estimate project duration when there is a high degree of uncertainty about the individual activity duration estimates. PERT uses probabilistic time estimates. These are duration estimates based on using optimistic, most likely, and pessimistic estimates (three-point estimates) of activity duration. The PERT formula is given by:

$$PERT\ weighted\ avergae = \frac{otpimistic\ time + 4 * most\ likly\ time + pessimistic\ time}{6}$$

Week 4

Cost is a resource sacrificed to achieve a specific objective. It is usually measured in monetary units like dollars. Project cost management includes the process required to ensure that the project is completed within an approved budget. Project Cost Management consists of 4 steps:
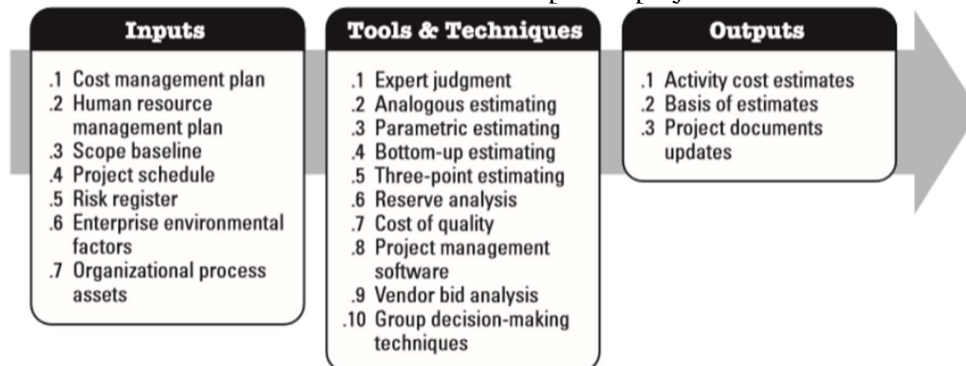
- Plan Cost Management

    This process deals with determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost. The project team uses expert judgement, analytical techniques, and

meetings to develop the cost management plan. It includes a level of accuracy, organisational procedural links, control thresholds, rules, reporting formats, etc.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Project charter .3 Enterprise environmental factors .4 Organizational process assets	.1 Expert judgment .2 Analytical techniques .3 Meetings	.1 Cost management plan

- Estimate Costs

    This process deals with developing an approximation or estimate of the costs of the resources needed to complete a project.

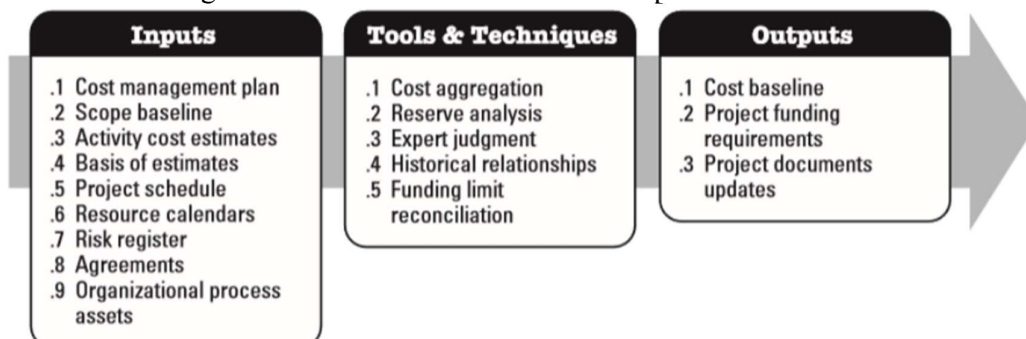| Inputs	Tools & Techniques	Outputs
.1 Cost management plan .2 Human resource management plan .3 Scope baseline .4 Project schedule .5 Risk register .6 Enterprise environmental factors .7 Organizational process assets	.1 Expert judgment .2 Analogous estimating .3 Parametric estimating .4 Bottom-up estimating .5 Three-point estimating .6 Reserve analysis .7 Cost of quality .8 Project management software .9 Vendor bid analysis .10 Group decision-making techniques	.1 Activity cost estimates .2 Basis of estimates .3 Project documents updates

Basic tools for cost estimates are the follows:
- Analogous (Top-down estimate)
    - Use actual costs of previous, similar projects as the basis for estimating the costs of current project.
- Bottom-up estimate
    - Involve estimating individual work activities and summing them to get project total
- Parametric modelling
    - Uses project characteristics in a mathematical model to estimate project costs.
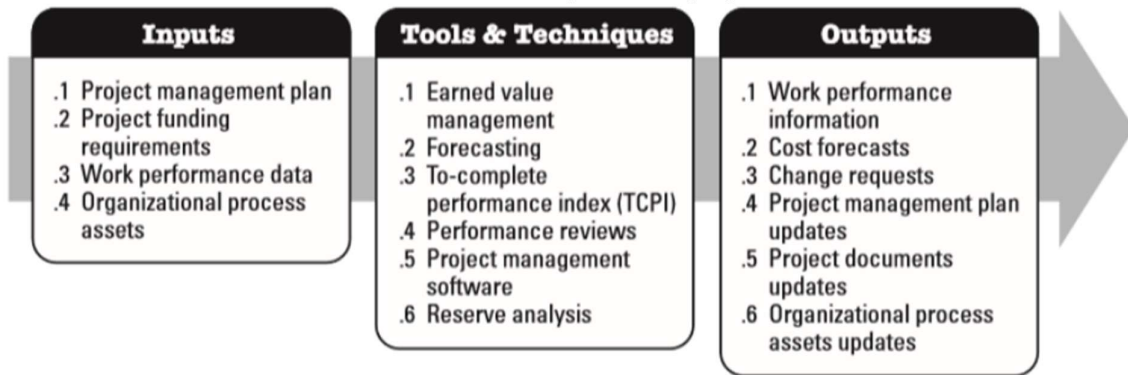- Determine Budget

    This process deals with allocating the overall cost estimate to individual work items to establish a baseline for measuring performance. The WBS is required for the cost budgeting process since it defines work items. The goal is to create a cost baseline. The cost baseline is a time phased budget that project managers use to measure and monitor cost performance.

Inputs	Tools & Techniques	Outputs
.1 Cost management plan .2 Scope baseline .3 Activity cost estimates .4 Basis of estimates .5 Project schedule .6 Resource calendars .7 Risk register .8 Agreements .9 Organizational process assets	.1 Cost aggregation .2 Reserve analysis .3 Expert judgment .4 Historical relationships .5 Funding limit reconciliation	.1 Cost baseline .2 Project funding requirements .3 Project documents updates

- Control Costs

This process deals with controlling changes to the project budget. This includes monitoring cost performance, ensuring that only appropriate project changes are included in revised cost baseline and informing the project stakeholders of authorized changes to the project that will affect costs.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Project funding requirements .3 Work performance data .4 Organizational process assets	.1 Earned value management .2 Forecasting .3 To-complete performance index (TCPI) .4 Performance reviews .5 Project management software .6 Reserve analysis	.1 Work performance information .2 Cost forecasts .3 Change requests .4 Project management plan updates .5 Project documents updates .6 Organizational process assets updates

Earned Value Management (EVM) is technique that combines scope, time, cost, and resource measurements to assess project performance and progress. It is a common method to measure the performance of projects. To calculate the EVM there are a few concepts to remember:

- Planned Value (PV)
  - It is the budget which is planned.
- Actual Cost (AC)
  - It is the total of direct and indirect costs incurred in accomplishing work.
- Earned Value (EV)
  - It is an estimate of the value of the physical work completed. EV is based on the original planned costs for the project.
- Scheduled Variance (SV)
  - It is a measure of schedule performance expressed as the difference between Earned Value and Planned Value. ($SV = EV-PV$)
- Cost Variance (CV)
  - It is the amount of budget deficit or surplus at a given point in time expressed as the difference between earned value and the actual cost. ($CV = EV-AC$)
- Schedule Performance Index (SPI)
  - It is a measure of schedule efficiency expressed as the ratio of earned value to planned value. ($SPI = EV/PV$)
- Cost Performance Index (CPI)
  - It is a measure of the cost efficiency of budgeted resources expressed as a ratio of earned value to actual cost. ($CPI = EV/AC$)
- Budget at Completion (BAC)
  - It is the original total budget for the project.
- Estimate at Completion (EAC)
  - It is an estimate of what it will cost to complete the project based on performance to date. ($EAC = BAC/CPI$)

A few financial terms to remember:
- Profits: Revenues – Expenditures.
- Profit margin: Ratio of revenue to profits.

- Life cycle costing: Considers the total cost of ownership.
- Cash flow analysis: Determines the estimated annual costs and benefits of a project.
- Tangible costs and benefits: Costs and benefits easily measurable in monetary terms.
- Intangible costs and benefits: Costs and benefits difficult to measurable in monetary terms.
- Direct costs: Costs that can be directly related to producing product and services.
- Indirect costs: Costs not directly related to the product and services but related to performing the project.
- Sunk cost: Cost that has been spent in the past.
- Reserves: Monetary value included in cost estimate to mitigate cost risk that are difficult to predict for the future.
- Contingency reserves: Monetary value for the future situations that are partially planned for and included in cost baseline.
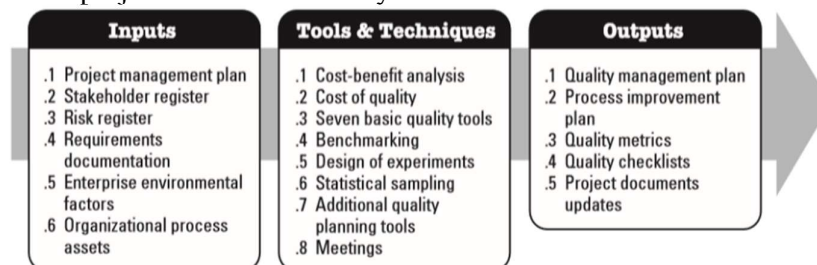- Management reserves: Monetary value for future situation that are unpredictable.

Week 5

Project quality is the degree to which a set of inherent characteristics fulfils requirements. This is defined by the ISO 9000 where ISO stands for International Organisation for Standardization.

Quality is based on control to requirements and fitness for use. Quality is a framework of culture, behaviours, processes, and tools that support consistently meeting the commitments to the client, corporation, and people. Project Quality management is made up of the following steps:

- Plan Quality Management

    It is the process of identifying which quality standards are relevant to the project and how to satisfy them.

Inputs	Tools & Techniques	Outputs
.1 Project management plan	.1 Cost-benefit analysis	.1 Quality management plan
.2 Stakeholder register	.2 Cost of quality	.2 Process improvement plan
.3 Risk register	.3 Seven basic quality tools	.3 Quality metrics
.4 Requirements documentation	.4 Benchmarking	.4 Quality checklists
.5 Enterprise environmental factors	.5 Design of experiments	.5 Project documents updates
.6 Organizational process assets	.6 Statistical sampling	
	.7 Additional quality planning tools	
	.8 Meetings	

    Meeting quality requirements include less rework, higher productivity, lower costs, increased stakeholder satisfaction and increased profitability. A cost benefit analysis for each quality activity compares the cost of the quality step to the expected benefit. The cost of quality can be widely distributed to costs of conformance (cost of control) and costs of non-conformance (costs of failure of control).

    To plan the Quality Management, we can use the cause-and-effect diagram, also known as the fishbone diagram. The cause-and-effect diagram trace complaints about quality problems back to the responsible production operations. They help to find the root cause of a problem.

    Another tool that can be used is a Quality Control Chart. A control chart is a graphic display of data that illustrates the results of a process over time. The main use of this chart is to prevent defects rather than detect or reject them. It allows one to determine if the process is in control or not.

The 7 run rule states that if 7 data points in a row are all below the mean, above the mean, or all increasing or decreasing then the process needs to be examined for non-random problems.

Another tool is the check sheet. It is used to collect and analyse data. It is sometimes called the tally sheet or checklist depending on the format.

Another tool are the flowcharts. Flowcharts are graphic displays of logic and flow of processes that help one analyse how problems occur and how processes can be improved. They show activities, decision points, and order of how information is processed.

Other tools are scatter diagrams, histograms, pareto charts, six sigma, etc. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes. It usually follows a 5-phase improvement process called DMAIC. This is:

- Define: problem, process, and customer requirements.
- Measure: define them, then collect, compile, and display data.
- Analyse: examine process and find improvement opportunities.
- Improve: generate solutions and ideas for improving the problem.
- Control: track and verify the stability of the improvements and the predictability of the solution.

- Perform Quality Assurances

It is the process for periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards.

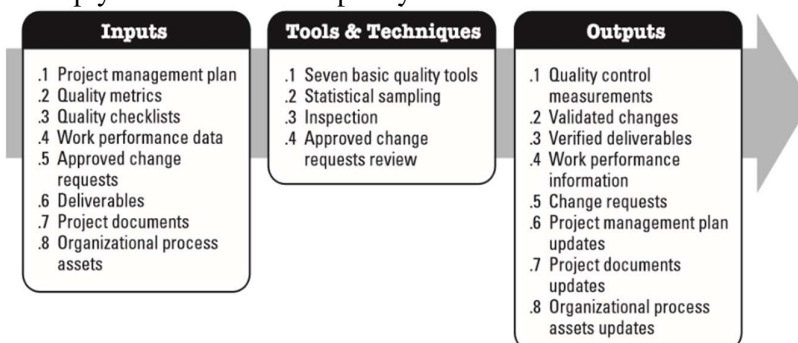| Inputs	Tools & Techniques	Outputs
.1 Quality management plan .2 Process improvement plan .3 Quality metrics .4 Quality control measurements .5 Project documents	.1 Quality management and control tools .2 Quality audits .3 Process analysis	.1 Change requests .2 Project management plan updates .3 Project documents updates .4 Organizational process assets updates

A quality audit is a structured, independent process to determine if project activities comply with organizational and project policies, processes, and procedures. The objectives of an audit would be:

- Identify all good and best practices being implemented.
- Identify all non-conformities, gaps, and shortcomings.
- Share good practices introduced or implemented.
- Proactively help in a positive manner.

- Control Quality

It is the process of monitoring specific project results to ensure that they comply with the relevant quality standards.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Quality metrics .3 Quality checklists .4 Work performance data .5 Approved change requests .6 Deliverables .7 Project documents .8 Organizational process assets	.1 Seven basic quality tools .2 Statistical sampling .3 Inspection .4 Approved change requests review	.1 Quality control measurements .2 Validated changes .3 Verified deliverables .4 Work performance information .5 Change requests .6 Project management plan updates .7 Project documents updates .8 Organizational process assets updates

Testing should be done during almost every phase of the IT product development life cycle. Testing does not sufficiently prevent software defects because the number of ways to test a complex system is huge and users will continue to invent new ways to use a system that its developer never considered. There are different types of testing. A few of them are:

- Unit testing
  - Tests each individual component to ensure it is as defect-free as possible.
- Integration testing
  - Occurs between unit and system testing to test functionally grouped components.
- System testing
  - Tests the entire system as one entity.
- User acceptance testing
  - It is an independent test performed by end users prior to accepting the delivered system.

ISO 9000 is a quality system standard that consists of 2 parts: continuous cycle of planning, controlling, and documenting quality in an organisation. It provides the minimum requirements needed for an organisation to meet its quality certification standards. Helps organisation around the world reduce costs and improve customer satisfaction.
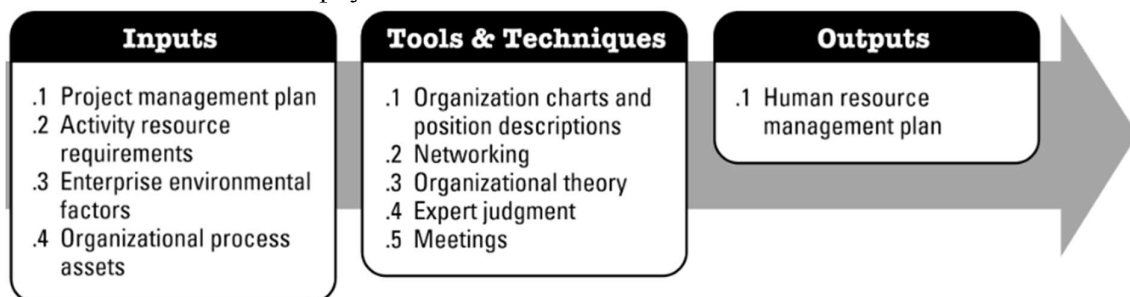
Maturity models are frameworks for helping organisations improve their processes and systems. There are 2 models which are very well known. These are CMMI and OPM3. CMMI is also known as Capability Maturity Model Integration released by Software Engineering Institute. It is a process improvement approach that provides organisation with the essential elements of effective processes. Project Management Institution released the Organisational Project Management Maturity Model (OPM3) in 2003.

The levels for CMMI ranges from incomplete, to optimizing. These levels from lowest to highest are incomplete, performed, managed, defined, quantitatively managed, and optimizing. Companies can't bid on government projects unless they have CMMI level 3.
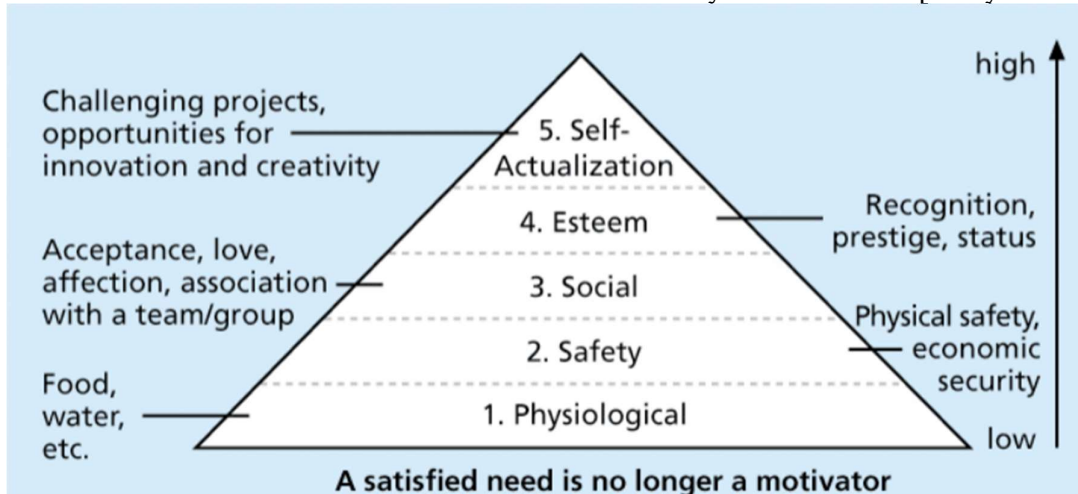
Week 6

Project resource management include:

- Plan resource management
  - Identifying and documenting the method of estimate, acquire, manage, and utilize physical and team resources.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Activity resource requirements .3 Enterprise environmental factors .4 Organizational process assets	.1 Organization charts and position descriptions .2 Networking .3 Organizational theory .4 Expert judgment .5 Meetings	.1 Human resource management plan

Planning Human Resource Management is the process of identifying and documenting project roles, responsibilities, required skills, reporting relationships, and creating a staffing management plan.

The key to managing people is to include motivational theories, influence and power, effectiveness, emotional intelligence, and leadership. There are 2 types of motivations, intrinsic and extrinsic. Intrinsic motivation causes people to participate in an activity for their own enjoyment. Extrinsic motivation causes people to do something for a reward or to avoid penalty. The motivation level can be based on the hierarchy of needs developed by Maslow.

Challenging projects, opportunities for innovation and creativity — 5. Self-Actualization

Recognition, prestige, status — 4. Esteem

Acceptance, love, affection, association with a team/group — 3. Social

Physical safety, economic security — 2. Safety

Food, water, etc. — 1. Physiological

high — low

A satisfied need is no longer a motivator

Projects are likely to succeed when project managers influence using their expertise and work challenge whereas projects are like to fail if project managers influence using their authority, money, or penalties.

Project managers can improve effectiveness on projects using the 7 habits, being proactive, beginning with an end in mind, putting first things first, think win/win, seek first to understand, then to be understood, synergize, and finally sharpen the saw. Good project managers are empathetic listeners and have a rapport with the team. They have good emotional intelligence. Emotional Intelligence is knowing and managing one's own emotions and understanding the emotions of others for improved performance.

Responsibility Assignment Matrix is a matrix that maps the work of the project as described in the WBS to the people responsible for performing the work as described in the OBS.
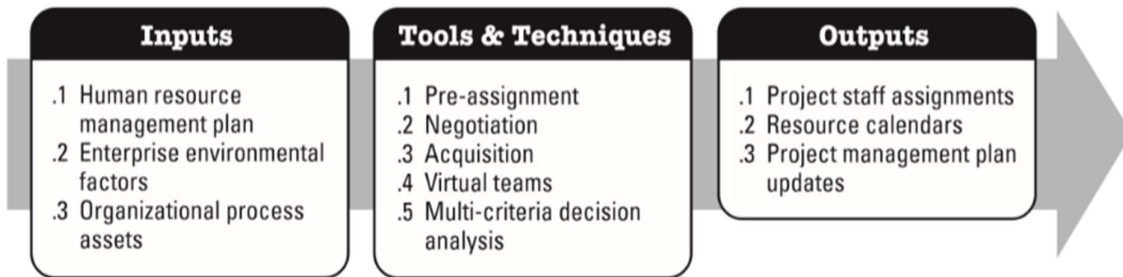
Another tool one can use is the RACI chart which ensures that only one person is accountable for any task to avoid confusion of responsibility.

- Estimate activity resources

Estimating team resources, type, and quantities of material and equipment needed to complete project works. There are various tools used to estimate activity resources such as Resource breakdown structure (RBS), Resource Histogram, etc.
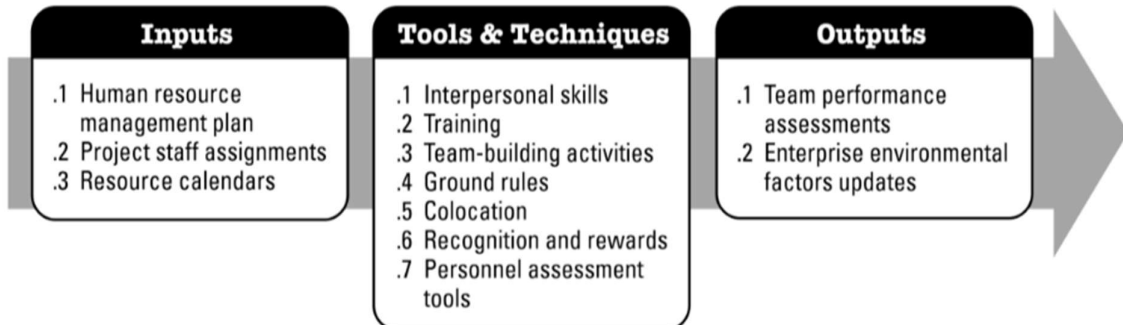
- Acquire resources

Getting the needed personnel assigned to and working on the project. Resource loading refers to the number of individual resources an existing schedule requires during specific time periods. Overallocation means more resources than are available are assigned to perform work at a given time. Resource leveling is a technique for resolving resource conflicts by delaying tasks. The main purpose of resource leveling is to create a smoother distribution of resource usage and reduce overallocation.

Inputs	Tools & Techniques	Outputs
.1 Human resource management plan .2 Enterprise environmental factors .3 Organizational process assets	.1 Pre-assignment .2 Negotiation .3 Acquisition .4 Virtual teams .5 Multi-criteria decision analysis	.1 Project staff assignments .2 Resource calendars .3 Project management plan updates

- Develop project team

Building individual and group skills to enhance project performance.

Inputs	Tools & Techniques	Outputs
.1 Human resource management plan .2 Project staff assignments .3 Resource calendars	.1 Interpersonal skills .2 Training .3 Team-building activities .4 Ground rules .5 Colocation .6 Recognition and rewards .7 Personnel assessment tools	.1 Team performance assessments .2 Enterprise environmental factors updates

Forming
Team acquaints and establishes ground rules. Formalities are preserved and members are treated as strangers.

Storming
Members start to communicate their feelings but still view themselves as individuals rather than part of the team. They resist control by group leaders and show hostility.

Norming
People feel part of the team and realize that they can achieve work if they accept other viewpoints.

Performing
The team works in an open and trusting atmosphere where flexibility is the key and hierarchy is of little importance.

Adjourning
The team conducts an assessment of the year and implements a plan for transitioning roles and recognizing members' contributions.
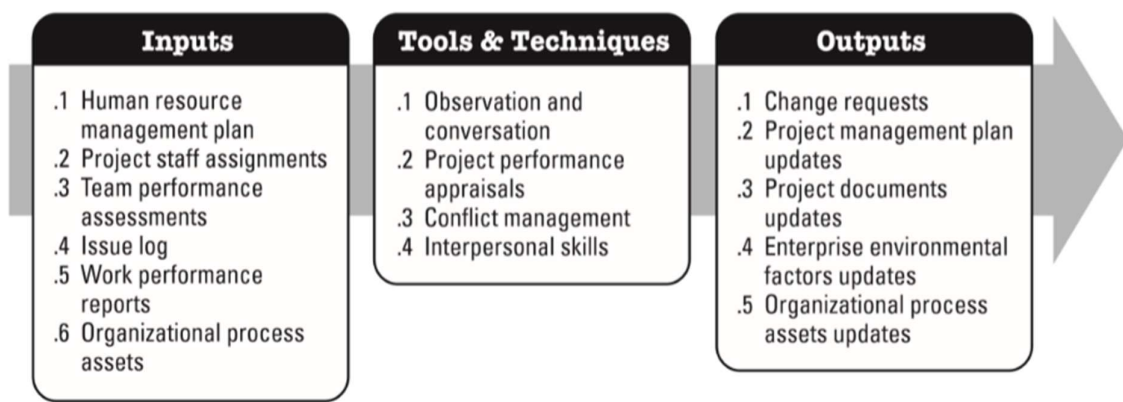
- Manage project team

Tracking team member performance, motivating team members, providing timely feedback, resolving issues and conflicts, and coordinating changes to help enhance project performance.

Conflict often produces important results, such as new ideas, better alternatives, and motivation to perform better and collaboration opportunities. Hence it is not too bad for conflicts to happen in a team.

Inputs	Tools & Techniques	Outputs
.1 Human resource management plan .2 Project staff assignments .3 Team performance assessments .4 Issue log .5 Work performance reports .6 Organizational process assets	.1 Observation and conversation .2 Project performance appraisals .3 Conflict management .4 Interpersonal skills	.1 Change requests .2 Project management plan updates .3 Project documents updates .4 Enterprise environmental factors updates .5 Organizational process assets updates

There are many ways of handling a conflict. Some of these are:

- Confrontation: Directly face a conflict using a problem-solving approach.
- Compromise: Use a give-and-take approach.
- Smoothing: De-emphasize areas of difference and emphasize areas of agreement.
- Forcing: The win-lose approach.
- Withdrawal: Retreat or withdraw from an actual or potential disagreement.
- Collaborating: Decision makers incorporate different viewpoints and insights to develop consent and commitment.

There are 5 dysfunctions of a team. These are absence of trust, fear of conflict, lack of commitment, avoidance of accountability and inattention to results. For managing the team effectively, there are some strategies, these are:

- Be patient and kind with the team.
- Fix the problem instead of blaming.
- Establish regular, effective meetings.
- Allow time for teams to go through basic team building.
- Limit size of work teams to 3 to 7 members.
- Plan some team building activities.
- Emphasize team identity.
- Nurture team members and encourage them to help each other.
- Take additional actions with virtual team members.

- Control resources
  - Ensuring that resources are available, monitor the utilization and take corrective action wherever necessary.

Week 7

The general meaning of risk is the possibility of loss or injury. In project management, project risk is an uncertainty that can have a negative or positive effect on meeting project objective. Following is a few IT project risks:

- Market risk
- Financial risk
- Technology risk
- People risk
- Process/Structure risk

There are negative risks as well as positive risks. Negative risks are problems that might occur in the project and how they might obstruct project success. Positive risk on the other hand results in good things happening. These are sometimes called opportunities. The project risk management process follows the given steps:

- Planning risk management
  - Deciding how to approach and plan the risk management activities for the project.
- Identifying risks
  - Determining which risks are likely to affect a project and documenting the characteristics of each. Identifying risks is the process of understanding what potential events might hurt or enhance a particular project. Some risk identification tools and techniques are brainstorming, the Delphi technique, interviewing and SWOT analysis.
- Performing qualitative risk analysis
  - Prioritizing risks based on their probability and impact of occurrence.
- Performing quantitative risk analysis
  - Numerically estimating the effects of risks on project objectives.
- Planning risk responses
  - Taking steps to enhance opportunities and reduce threats to meeting project objectives.
- Controlling risk
  - Monitoring identified and residual risks, identifying new risks, carrying out risk response plans, and evaluating the effectiveness of risk strategies throughout the life of the project.

One can use many tools and techniques for risk analysis. For example, the probability and impact matrix, probability impact grid, sensitivity analysis to determine which risk has the most potential impact on the project, etc.

A risk register is a document that contains the results of various risk management processes and that is often displayed in a table or spreadsheet format. It is a tool for documenting potential risk events and related information. A risk register contains an id for each risk event, the rank, name, description, category, root cause, potential response, risk owner, probability and impact of each risk occurring and the status of each risk.

There are different response strategies of risks, even more so for negative risks and positive risks. Given below are the response strategies for negative risks:

- Risk avoidance: Eliminate its causes.
- Risk acceptance: Accepting the consequences.
- Risk transference: Shifting the consequence and responsibility to a third party.
- Risk mitigation: Reducing impact of risk by reducing probability of occurring.

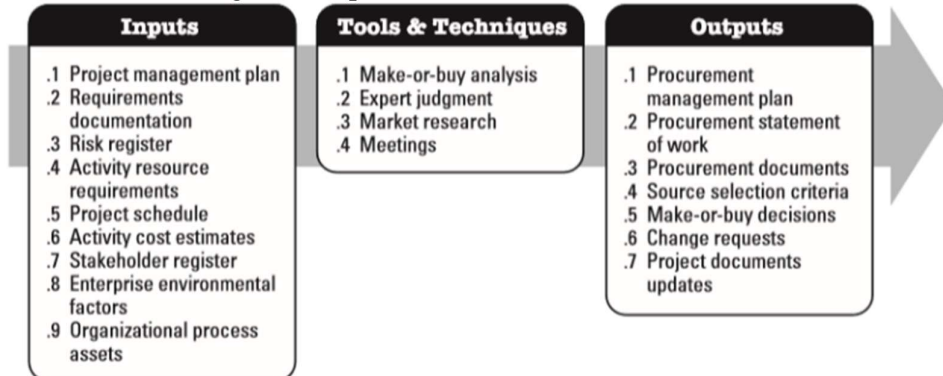Given below are the response strategies for positive risks:

- Risk exploitation: Do whatever need be for making positive risk happen.
- Risk sharing: Allocate ownership of risk to another party.
- Risk enhancement: Change size of risk by identifying and maximising key drivers.
- Risk acceptance: Applies to positive risk when team can't do anything for it.

There are 2 more types of risks, residual risk, and secondary risk. Residual risks are risks that remain after all the response strategies have been implemented. Secondary risks are a direct result of implementing a risk response.

Week 8

Procurement means acquiring goods and/or services from an outside source. In project management, project procurement means acquiring goods and/or services for a project from outside the performing organisation. The project procurement management process includes:
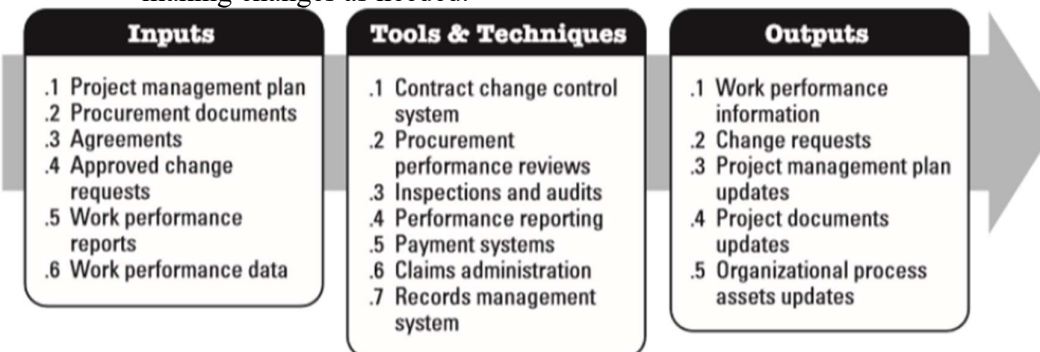
- Planning procurement management
    - Determining what to procure and when and how to do it.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Requirements documentation .3 Risk register .4 Activity resource requirements .5 Project schedule .6 Activity cost estimates .7 Stakeholder register .8 Enterprise environmental factors .9 Organizational process assets	.1 Make-or-buy analysis .2 Expert judgment .3 Market research .4 Meetings	.1 Procurement management plan .2 Procurement statement of work .3 Procurement documents .4 Source selection criteria .5 Make-or-buy decisions .6 Change requests .7 Project documents updates

- Conducting procurements
    - Obtaining seller responses, selecting sellers, and awarding contracts.

Inputs	Tools & Techniques	Outputs
.1 Procurement management plan .2 Procurement documents .3 Source selection criteria .4 Seller proposals .5 Project documents .6 Make-or-buy decisions .7 Procurement statement of work .8 Organizational process assets	.1 Bidder conference .2 Proposal evaluation techniques .3 Independent estimates .4 Expert judgment .5 Advertising .6 Analytical techniques .7 Procurement negotiations	.1 Selected sellers .2 Agreements .3 Resource calendars .4 Change requests .5 Project management plan updates .6 Project documents updates

- Controlling procurements
    - Managing relationships with sellers, monitoring contract performance, and making changes as needed.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Procurement documents .3 Agreements .4 Approved change requests .5 Work performance reports .6 Work performance data	.1 Contract change control system .2 Procurement performance reviews .3 Inspections and audits .4 Performance reporting .5 Payment systems .6 Claims administration .7 Records management system	.1 Work performance information .2 Change requests .3 Project management plan updates .4 Project documents updates .5 Organizational process assets updates

- Closing procurements
  - Completing and settling each contract or agreement.

Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Procurement documents	.1 Procurement audits .2 Procurement negotiations .3 Records management system	.1 Closed procurements .2 Organizational process assets updates

A contract is a mutually binding agreement that obligates the seller to provide the specified products or services and obligates the buyer to pay for them. Contracts are legally binding, there is more accountability for delivering the work as stated in the contract. There are different types of contracts such as:

- Fixed price (Lump sum): Involve a fixed total price for a well-defined product or service.
- Cost reimbursable: Involve payment to the seller for direct and indirect costs.
- Time and material: Hybrid of both fixed price and cost reimbursable costs.
- Unit price: Buyer pays seller a predetermined amount per unit of services.

A statement of work (SOW) is a description of work. If a SOW is used as part of a contract to describe only the work required for that particular contract, it is called a contract statement of work. Procurement documents are required for procurement of resources, these are:

- Request for proposals
  - Used to solicit proposals from prospective sellers. A proposal is a document prepared by a seller when there are different approaches for meeting buyer needs.
- Request for quotes
  - Used to solicit quotes or bids from prospective suppliers –A bid, also called a tender or quote (short for quotation), is a document prepared by sellers providing pricing for standard items that have been clearly defined by the buyer.

Source selection criteria:
- It's important to prepare some form of evaluation criteria, preferably before issuing a formal RFP or RFQ. Some possible source selection criteria are:

  - ✓ Understanding of need
  - ✓ Overall or life-cycle cost
  - ✓ Technical capability
  - ✓ Risk
  - ✓ Management approach
  - ✓ Technical approach
  - ✓ Warranty
  - ✓ Financial capacity
  - ✓ Production capacity and interest
  - ✓ Business size and type
  - ✓ Past performance of sellers
  - ✓ References

Procurement Proposal Evaluation

		Proposal 1		Proposal 2		Proposal 3, etc.	
Criteria	Weight	Rating	Score	Rating	Score	Rating	Score
Technical approach	30%						
Management approach	30%						
Past performance	20%						
Price	20%						
Total score	100%						

Rating Scale	
Point Value	Explanation
0	None. Not addressed or response of no value
.4	Fair. Limited applicability
.6	Good. Some applicability
.8	Very Good. Substantial applicability
1	Excellent. Total applicability

Seller selection

Seller Selection

- Organizations often do an initial evaluation of all proposals and bids and then develop a short list of potential sellers for further evaluation

- Sellers on the short list often prepare the best and final offer (BAFO)
- Finally, contract signed by the buyer and the selected seller

Week 9

Project leadership, most simply, is the act of leading a team towards the successful completion of a project. Projects often fall short of achieving their anticipated results, not due to a lack of project management, but rather from a lack of project leadership. □ Because project success is a direct reflection of the project manager, it is his/her responsibility not just to manage the details and report status of a project, but to go beyond and add value through providing leadership.

Effective project managers acquire a balance of technical, interpersonal, and conceptual skills that help them analyse situations and interact appropriately. The appropriate use of following interpersonal skills assists the project manager in effectively managing the project:

- Leadership
- Communication
- Political and cultural awareness
- Conflict Management
- Team building
- Influencing
- Negotiation
- Coaching
- Motivation
- Decision making
- Trust Building

A leader vs manager is aptly described in the following table:

	Leader	Manager
Style	Transformational	Transactional
Essence	Change	Stability
Approach	Sets direction	Plans detail
Horizon	Long-term	Short-term
Focus	People	Work
Has	Followers	Subordinates
Seeks	Vision	Objectives
Decisions	Facilitates	Makes
Culture	Shapes	Enacts
Persuasion	Sell	Tell
Motivation	Achievement	Results
Risk	Takes	Minimizes
Rules	Breaks	Makes

5 practices for having an exemplary leadership:
- Model the way
- Inspire a shared vision
- Challenge the process
- Enable others to act
- Encourage the heart

There are many types of leadership. Some of them are:
- Autocratic leadership: Centred on the person in charge.
- Democratic leadership: Everyone participates in decision making.
- Strategic leadership: Creates habits for high performance organisations.
- Transformational leadership: Specially geared towards inducing change.
- Cross-cultural leadership: Recognizes contemporary globalized organisations.
- Team leadership: Focuses on the future of the organisation.
- Facilitative leadership: dependent on measurements or outcomes.
- Laissez-Faire leadership: Gives authority to team members.
- Transactional leadership: Maintains or continues the status quo.
- Coaching leadership: Involves teaching or supervising breakfast.
- Charismatic leadership: Transforms follower's values and beliefs.
- Visionary leadership: Recognize that steps and processes of leadership are obtained through people.

Communication is the top skill required by an IT project manager. The following steps are followed for the project communication management:

- Plan communication management
    - Determining the information and communications needs of the stakeholders.
- Manage communications
    - Creating, distributing, storing, retrieving, and disposing of project communications based on the communications management plan.
- Control communications
    - Monitoring and controlling project communications to ensure that stakeholder communication needs are met.

Governance is the framework of authority and accountability that defines and controls the outputs, outcomes and benefits from projects, programmes, and portfolios. Governance provides confidence to the board of directors/trustees that investments in projects, programmes and portfolios are being well managed. Governance empowers project professionals to execute their responsibilities by defining delegated limits of authority and establishing effective escalation routes for issues and change requests. IT governance provides a structure for aligning IT strategy with business strategy. By following a formal framework, organizations can produce measurable results toward achieving their strategies and goals. A formal program also takes stakeholders' interests into account, as well as the needs of staff and the processes they follow.

Project governance is aligned with the organization's governance model and that encompasses the project life cycle. Project governance provides direction and defines decision-making procedures and metrics for validating impacts to the project. Project governance framework provides the project manager and team with structure, processes, decision-making models, and tools for managing the project, while supporting and controlling the project for successful delivery. Project governance is a critical element of any project, especially on complex and risky projects. It provides a comprehensive, consistent method of controlling the project and ensuring its success by defining and documenting and communicating reliable, repeatable project practices. Examples of the elements of a project governance framework include:
- Project success and deliverable acceptance criteria.
- Process to identify, escalate, and resolve issues that arise during projects.
- Relationship among all stakeholders.
- Project organisation chart that identifies the project roles.
- Processes and procedure for communication of information.
- Project decision making process.
- Project life cycle approach.
- Guidelines for aligning project governance and organisational strategy.
- Process for stage gate or phase review.
- Process for review and approval for changes in budget, scope, quality, and schedule beyond the authority of project manager.
- Process aligns to internal stakeholders with project process requirements.

Exam Paper Pattern

Date: 15/11/2022   **Time: 17:00 hrs**

Length: 2 hours 10 minutes

Types of Questions
- Short Answer Questions (SA) – 4 marks per question.
- Descriptive and Analytical based Questions (DA) – 10 points per question.