PROJECT MANAGEMENT FRAMEWORK

Definition of a Project :
- **Temporary** endeavour with a beginning and an end.
- Creates a **unique** product, service or result.
- Is **progressively** elaborated-distinguishing characteristics of each unique project will be progressively detailed as the project is better understood

How Temporary ?
- Has a **definite beginning and end** and not an ongoing effort.
- **Ceases** when objective has been attained.
- Team is **disbanded** upon project completion.

How Unique ?
- Product **characteristics** are progressively elaborated.
- The product or service is different in some way from other product or services.

Example
Building a road is an example of a project. The process of building a road takes a finite amount of time, and produces a unique product. Operations on the other hand are repetitive. Generating bills every month, and broadcasting news everyday are examples of operations.

Progressive elaboration
- is a characteristic of projects that accompanies the concepts of **temporary** and **unique**.
- means developing in **steps**, and **continuing by increments**.
- **should not be confused with scope creep**.
- needs to be carefully coordinated with proper project **Scope Definition**, particularly if the project is performed under contract.

For example, items might be described in broad terms at the start of the project but be defined in detailed terms by the conclusion of the project – from the Preliminary Project Scope Statement to the **verified** Project Scope Statement supported by a **detailed WBS**.

Managing a project includes 1) identifying requirements 2) establishing objectives 3) balancing scope, timing and cost 4) adapting the plan to different concerns of stakeholders.

Project managers or the organization can divide projects into above **phases** to provide better management control with appropriate links to the ongoing operations of the performing organization. Collectively, these phases are known as the **project life cycle.**

Product Life Cycle : A collection of generally **sequential, non-overlapping** product phases whose name and number are determined by the manufacturing and control needs of the organization. The last product life cycle phase for a product is generally the product's deterioration and death. Generally, a project life cycle is contained within one or more product life cycles.
The product life cycle is "above" the project life cycle – it includes **operations** & **development** (which occur **AFTER** the project has been completed) and include the business plan, which starts **BEFORE** the project begins.

Project Life Cycle : A collection of generally **sequential** project phases whose name and number are determined by the control needs of the organization or organizations involved in the project. A life cycle can be documented with a **methodology**. The project life cycle includes the phases necessary to work a project f**rom beginning to end**. The transition from one phase to another is generally recognized by some kind of a **deliverable** or **handoff**. These phases generally define 1) work to be done that phase 2) when deliverables are generated 3) resources used in each phase 4) control of each phase

Project Phase : A collection of logically **related project activities**, usually culminating in the completion of a major deliverable. Project phases (also called phases) are mainly **completed sequentially**, but can **overlap** in some project situations. Phases can be subdivided into sub-phases and then

- the reason for the risk process group is to **enhance opportunities** and **reduce threats** to the project objectives
- things that could negatively impact the project objectives, such as risk and stakeholders' influence should be **watched and tracked**
- projects often require trade-off between the project requirements and the project objectives
- project objectives are **determined in the Initiating** process group and **refined in the Planning** process group
- one of the purposes of the develop project management plan process is to **determine how work will be accomplished** to meet project objectives

Difference between **Projects and Operations**
- Operations are **ongoing** and **repetitive** where as Projects are unique and non-repetitive.
- Normal operations would produce **standard product** or service where as Projects would produce **unique product** or service
- Projects are **temporary** and have defined start and end where as operations are **indefinite** and don't have a defined start and end.
- **Projects are executed by a heterogeneous teams where as operations may be executed by homogeneous teams.**

Constraint or 'Triple Constraints'
Project constraints are time, cost, risk, scope, or any other factors that limit options. Triple constraints include cost, scope, time, quality, risk, & stakeholder satisfaction.

Project manager **sets the priority of each of the component** of Triple Constraints throughout the project. Quality, cost, schedule, scope, risk, & other factors may be prioritised **differently** on each project.

It is the project manager's **responsibility** to analyse the Change Requests from stakeholders, managers, & others, and identify the impacts to all components of the "triple constraint" through **Integrated Change Control**.

Area of Expertise
A key area of expertise for a project manager is **understanding the project environment**. This can involve knowing who the stakeholders are, why the project is being done and what is the strategic plan of the performing organization (the company or division of the company doing the project).

Stakeholder, Stakeholder Management
A stakeholder is someone whose interests may be **positively** or **negatively** impacted by the project. Key stakeholders include: the project manager, customer, performing organization, project team, project management team, sponsor, and the PMO.
What should we do with stakeholders :
- **identify** ALL of them, to help create a better organized project that meets all the stakeholders' interests.
- determine ALL of their **requirement, BEFORE** the work begins.
- determine their **expectation**, that can be converted into requirements.
- **communicate** with them
- managing their influence (**highest** in the **beginning** and progressively lower over time).

Stakeholders must be **involved** and their involvement must be **managed** by the project manager. Conflict of interests between stakeholder ? Must be resolved **in favour of the customer**.

Project stakeholders are individuals and organizations that are actively involved in the project or whose interests may be positively or negatively affected as a result of project execution or project completion. **Key stakeholders** on a project include:
- **Project Manager** - the individual responsible for managing the project
- **Customer** - the individual or organization that will use the project's product.
- **Project Team members** - the group that is performing the work of the project
- **Project management team** – those who are involved in project management activities.
- **Sponsor** - the individual or group within or external to the performing organization that provides the financial resources
- **Performing organisation**
- **Influencer** - People or groups that are not directly related to the acquisition or use of the project's product, but due to an individual's position in the customer organization or performing organization, can influence, positively or negatively, the course of the project, I.e. **CEO**.
- **PMO**

Organisational Structure

Functional
The organization is grouped by areas of **specialization** within different functional areas (e.g., accounting, marketing and manufacturing). The Project Manager has **least** power (**compare to strong / weak matrix**) and all management is taken care by **functional**

components; this hierarchy, if the project or portions of the project are divided into phases, is **contained in the WBS**. A project phase is a component of a project life cycle. **A project phase is not a project management process group.**

A project phase generally concludes with a **review** of the deliverable and to determine whether the deliverables are accepted or if more work needs to be done. After each phase is completed, authorization is generally needed to begin the next phase of the project (i.e. "**kill point**" , "**phase exit**", or "**phase gate**").

Definition of a Program : a group of projects

Program Management
A program consists of a **related** group of projects and Program Management is the process of managing multiple on going projects. An example would be that of designing, manufacturing and providing support infrastructure for an automobile maker.

In some cases Project Management is a **subset** of Program Management. The project manager may report to the program manager in such cases. A portfolio consists of **multiple programs**.

Portfolio Management
A portfolio is a **collection** of projects or programs and other work that are grouped together to **facilitate effective management** of that work to meet strategic **business objectives**. Organizations manage their portfolios based on specific goals. Senior managers or senior management teams typically take on the responsibility of portfolio management for an organization.

Project Mgmt Office (PMO or Program Office) : an organisational structure (a dept) that **centralise** the management of projects. Its role :
- providing the **policies**, **methodologies**, & **templates** for managing projects within the organisation.
- providing **support** and **guidance** to others in the organization on how to manage projects, training others in project management or project management software, and assisting with specific project management tools.
- providing project managers for different projects, and being **responsible** for the results of those projects (all projects, or projects of a certain size, type or influence, are managed by this office).
- defined by its parent organization, can vary from an **advisory capacity** to **full authority** over projects.

PMO may :
- **manage** the **interdependencies** between projects
- help **provide resources**
- **terminate** projects
- help gather lessons learned and make them available to other projects
- provide **templates** (i.e., for WBS) & **guidance**
- provide enterprise project management software
- be more **heavily involved** during project **Initiating** than later in the project

Project objectives :
- project objectives are contained in the **Preliminary Project Scope Statement** and **Project Scope Statement**
- projects are considered **complete** when the objectives have been **met**
- a reason for **terminating** a project before completion is that the project objectives **cannot** be met
- a more complete understanding of the objectives is achieved over the length of the project
- it is the project manager's role to accomplish the project objectives
- objectives should be clear and achievable
- the reason for **quality activities** is to make sure the project meets its objectives

manager (line manager) like marketing engineer, sales engineer.

Advantage	Disadvantages
Easier management of specialists. Team members report to only one supervisor. Similar resources are centralized, the company is grouped by specialities. Clearly defined career paths in areas of work specialization.	People place more emphasis on their functional speciality to the detriment of the project. No career path in project management . Project manager has little or no authority.

Projectised
All organization is by projects. The project manager has **total control** of projects, full authority to assign priorities, apply resources, and direct the work of persons assigned to the project. Personnel are assigned and report to a project manager.

Advantages	Disadvantages
Efficient project organisation. Loyalty to the project. More effective communications than functional.	No "home" when project is completed. Duplication of facilities and job functions. Less efficient use of resources.

Matrix
This form is an attempt to **maximize** the strengths and weaknesses of both the functional and project forms. The team members report to two bosses: the project manager and the functional manager (e.&., VP Engineering, etc.).

Advantages	Disadvantages
Highly visible project objectives Improved project manager control over resources More support from functional organisations Maximum utilization of scarce resources Better coordination Better horizontal and vertical dissemination of information than functional Team members maintain a "home"	Extra administration required More than one boss for project teams More complex to monitor and control Tougher problems with resource allocation Need extensive policies and procedures Functional managers may have different priorities than project managers Higher potential for conflict

In a **strong matrix**, power rests with the project manager. In a **weak matrix**, power rests with the functional manager. The power of the project manager is comparable to that of a coordinator or expediter. In a **balanced matrix**, the power is shared between the functional manager and the project manager.

In a weak matrix, the project manager's role might be more of a :
- **Project Expediter**, the project expediter acts primarily as a **staff assistant** and **communications coordinator**. The expediter **CANNOT** personally make or enforce decisions.
- **Project Coordinator,** similar to the project expediter except the coordinator has some power to **make decisions**, some **authority**, and reports to a higher-level manager.

Interpersonal Skills
The management of interpersonal relationships includes:
- **Effective communication** : The exchange of information
- **Influencing the organization** : The ability to "get things done"
- **Leadership** : Developing a vision and strategy, and motivating people to achieve that vision and strategy
- **Motivation** : Energizing people to achieve high levels of performance and to overcome barriers to change
- **Negotiation and conflict management** : Conferring with others to come to terms with them or to reach an agreement
- **Problem solving** : The combination of problem definition, alternatives identification and analysis, and decision-making.

MAPPING

	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
Integra	Develop Project Charter	Develop Project Mgmt Plan	Direct & Manage Project	Monitor & Control Project Work	Close Project

	Initiating	Planning	Executing	Monitoring & Controlling	Closing
tion	Develop Preliminary Project Scope Statement		Execution	Integrated Changed Control	
Scope		Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	
Time		Activity Definition Activity Sequencing Activity Resource Estimating Activity Duration Estimating Schedule Development		Schedule Control	
Cost		Cost Estimating Cost Budgeting		Cost Control	
Quality		QP	QA	QC	
HR		HR Planning	Acquire Project Team Develop Project Team	Manage Project Team	
Communications		Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	
Risk		Risk Mgmt Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning		Risk Monitoring & Control	
Procurement		Plan Purchases & Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

Project Integration Management :

- Making trade-off among competing objectives & alternatives
- Making **choices** about where to concentrate resources & effort, **anticipate** & **dealing** with potential issues, **coordinating** work for overall project
- **Managing expectation**
- Successfully **meeting** customer & stakeholder **requirements**
- Unify, consolidate, articulate, & integrate actions for project completion
- A group of processes required to ensure that the various elements of the project are properly **coordinated**.
- TT are same for all the processes (Project Management Method, Project MIS, & Expert Judgement), **except** Develop Project Charter has "**Project Selection Methods**" and Monitoring and Control Project Work has "**Earned Value Technique**".
- No **Expert Judgement** in **Direct & Manage Project Execution** (this is because we are **executing** the Project Management Plan).

This process involves **Project Management Plan development, Project Management Plan execution** and **Integrated Change Control**. In order to integrate the project components into a cohesive whole (integration), **communication** is key when one activity will interface with another, one team member will interface with another, and any other form of interfacing.

A project manager must manage a project. If **ALL** activities are **delegated** (he/she serves as an **occasional referee** & **coordinator** of activities), **chaos** ensues and team members will spend more time jockeying for position than completing activities.

A single **high-level executive can end an entire project** if he or she is not satisfied with the results, even if that person has, by choice, been only tangentially involved in the project. It is critical to ensure that **ALL** of the **final decision makers** have been identified early in a project in order to ensure that their concerns are addressed.

As the new project manager who take over a project from another project manager, the FIRST thing to do if to **develop the management strategy**.

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
Develop Project Charter Develop Preliminary Project Scope Statement	Develop Project Mgmt Plan	Direct & Manage Project Execution	Monitor & Control Project Work Integrated Changed Control	Close Project

Project Scope Management :

- Define & control **what is and is not included** in the project
- Constantly checking to make sure you are **COMPLETING ALL** the work
- Not letting people randomly add to the scope of the project **without** a structured **Change Control System**
- Making sure all changes fit within the **Project Charter**
- **Preventing** extra work or gold plating
- Scope Definition TT is APES (Alternatives Identification, Product Analysis, Expert Judgement and Stakeholder Analysis)
- Scope Verification has only one TT which is **Inspection**. The only other place where you will find Inspection as TT is in **Quality Control** process.

Product scope :
- the **features** & **functions** that **characterise** a product. service, or result
- its completion is measured against the **product requirements**
- may be supplied as a result of a **previous project** to determine requirements, or may be created as part of the project.

- results in a single product, but that product can include subsidiary components, each with its own separate, but interdependent, product scope. For example, a new telephone system would generally include four subsidiary components—hardware, software, training, and implementation

Project scope :
- the **work** that needs to be accomplished to **deliver** a product, service, or result with the specified features & functions
- its completion is measured against the **Project Management Plan (meetings, reports, analysis)**, the **Project Scope Statement**, & its associated **WBS** and **WBS Dictionary**.

Scope Baseline (output of Create WBS) , is the **Project Scope Statement, the WBS and the WBS dictionary**.

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
	Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	

Project Time Management :
- Accomplish timely completion of the project
- Documented in the Schedule Management Plan, which is contained in, or is a subsidiary plan of, Project Management Plan.
- Activity Attributes is updated in all the process except in **Activity Definition** where it is created.
- Memorize TT for Schedule Development
- Activity Definition TT are PERTD (Planning component, Expert Judgement, Rolling wave planning, Templates, Decomposition)
- Schedule Control TT are PS PS PV (Progress reporting, Schedule Change control System, Performance Measurement, Schedule comparison Bar charts, PM software Variance analysis)

Things about Estimating :
- Estimating should be **based on a WBS** to improve accuracy and should be **done by the person doing the work** whenever possible
- Time estimates for the activities should be **created by the team** and **should not be added** (**some activities may take place concurrently**)
- **Historical information** from past projects is a key to **improving** estimates
- A schedule baseline (and time, scope, quality, & resource baselines) should be kept and not changed except for **approved** project changes
- The schedule should be managed to the schedule baseline for the project
- Changes are approved in the **Integrated Changed Contro**l
- Estimates are more accurate if **smaller sized work components are estimated**
- **Corrective & Preventive Actions** should be **recommended** when schedule problems (and cost, scope, quality, & resource problems) occur
- A project manger should never just accept requirements from management, but rather **analyse** the needs of the project, come up with his/her own **estimates** and **reconcile** any differences to produce realistic objectives
- A project manager may continually calculate the estimate to complete for the project in order to make sure there is adequate time (and cost ,etc.) available for the project
- Plans should be revised **during** completion of the work
- Padding (adding some time to the project estimate) is not an acceptable project manager practice
- Project manager must meet any agreed upon estimates

Schedule Management Plan
This plan includes:
- Establishment of a **schedule baseline** for measuring against during the Monitoring & Controlling process group.
- Identification of **performance measures**, to identify variances early and identification of **schedule change control** procedures.
- Planning for how **schedule variances** will be managed.

This plan can help to :
- make the schedule estimating process **faster** by providing **guidelines** on how estimates should be made (hourly / daily estimation).
- determine if a variance is over the allowable threshold and therefore must be acted upon (during Direct & Manage Project Execution process)
- determine the **types of reports** required on the project relating to schedule.

Schedule baseline : the approved project schedule. Output of Schedule Development

The role of project manager in estimating is to :
- provide the team with **enough info** to properly estimate each activity
- let those doing the estimating know how refined their estimates must be
- complete a sanity check of the estimates
- **formulate a reserve** (Contingency and Management)
- make sure **assumptions** made during estimating are **recorded** for later review

Resource Calendars - holiday, vacation, normal shift, etc.
- Input for Activity Duration Estimates, Schedule Development and Cost Budgeting
- Activity Resource Estimates have Resource Calendars as outputs.

Project Calendar - it may not be possible to work on the site during certain periods of the year because of weather.
- is updated in Schedule Development.

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
	Activity Definition Activity Sequencing		Schedule Control	

	Activity Resource Estimating Activity Duration Estimating Schedule Development			

Project Cost Management :
- Plan, estimate, budget, & control costs so that the project can be completed **within the approved budget**.
- Mainly concerned with the **cost of the resources needed** to complete schedule activity.
- Should consider the effect of project decision on the cost of **using, maintaining, and supporting** the product, service, or result of the project.
- Considers the info requirement of the **project stakeholder**, which measure the project costs in different ways and at different times.
- On a smaller scope project, Cost Estimating & Cost Budgeting are so tightly **linked** that they're viewed as a **single process**. The ability to influence cost is **greatest** at the early stages of the project, and this is why **early scope definition** is critical.
- Memorize TT For Cost Estimating. Remember that this **overlaps** with Activity Duration Estimate process.
- Cost Budgeting has Funding Limit Reconciliation as TT which produces output Project Funding Requirements
- Cost Management Plan is updated in **Cost Estimating** process

The Time chapter talked about the creation of **activities** (or **schedule activities**) as smaller components of work packages. Generally, it is these that are **cost estimated**. However, in a larger project, costs might be more practical to estimate and control at a higher level. This is called a **control account** and is one level higher than the work package in the WBS.

Cost baseline: a time-phased budget. Output of Cost Budgeting.

Things about Estimating :
- Estimating should be **based on a WBS** to improve accuracy and should be **done by the person doing the work** whenever possible
- **Historical information** from past projects is a key to **improving** estimates
- A cost baseline (and schedule, scope, quality, & resource baselines) should be kept and not changed except for **approved** project changes
- Budget should be managed to the cost baseline for the project
- Changes are approved in the **Integrated Changed Control**
- Estimates are more accurate if **smaller sized work components are estimated**
- **Corrective & Preventive Actions** should be **recommended** when cost problems (and time, scope, quality, & resource problems) occur
- A project manger should never just accept requirements from management, but rather **analyse** the needs of the project, come up with his/her own **estimates** and **reconcile** any differences to produce realistic objectives
- A project manager may continually calculate the estimate to complete for the project in order to make sure there are adequate funds (and time ,etc) available for the project
- Plans should be revised **during** completion of the work
- Padding is not an acceptable project manager practice
- Project manager must meet any agreed upon estimates
- If the cost estimates is **too high** and need to be **decreased**, the project manager can look to **cut quality, decrease risk, cut scope or use cheaper resources** , and at the same time closely monitoring the impact of changes on the project **schedule**.

Input to Estimating :
- **Project Scope Statement**, including any cost constraints
- **WBS & WBS dictionary** (the work to be done)
- **Network diagram** (costs cannot be estimated until it is known how the project will flow from beginning to end)
- **Schedule Management Plan** (as it contains the type and quantity of resources needed to complete the work)
- **OPA** (policies on estimating, templates, processes, procedures, lessons learned, & historical information)
- **EEF** (company culture & existing systems, marketplace conditions, commercial cost databases)
- **Project Management** costs
- **Staffing Management Plan / Resource Pool**
- **Risk Management Plan**, because it includes a budget for risk
- **Risk register**, a list of risks uncovered to date [A full risk analysis of the details of the project will not have been completed before costs are estimated]

Cost Management Plan :
- Primarily concerned with the **cost of the resources** needed to complete schedule activities
- Should also consider the effect of project decisions on the cost of **using**, **maintaining**, & **supporting** the product, service, or result of the project -> life cycle cost [**looking at the cost of the whole life of the product, not just the cost of the project**]. **Life Cycle Costing** & **Value Engineering** can :
  - o improve **decision-making**
  - o used to **reduce cost** and **execution time**
  - o improve the **quality** & **performance** of the project deliverable
- Help make the cost estimating process faster by specifying :
  - o how estimates **should be stated**, i.e. hours, days
  - o what **level of the WBS** estimates will be made, i.e. Control Account
- Help determine if a variance is over the allowable threshold & the ways Earned Value can be calculated
- **Value Analysis / Value Engineering** : find a **cheapest** way to do the **same work**. It requires the **systematic** use of techniques to identify the required project functions, assign values to these functions and provide functions at the lowest overall cost without loss of performance. If a team is looking at **decreasing project cost** but **maintaining the same scope**, they are performing Value Analysis.
- Cost Risk

Cost Management Plan can establish :
- **Precision level**
- **Units of measure,** such as staff hours / days, weeks, etc. for each of the resources.
- **Organisational procedures links** [the WBS component used for the project cost accounting is called **Control Account** (CA). Each CA is assigned a code / account number that is linked directly to the performing organisation's accounting system. If the cost estimates for planning package are **included** in the CA, then the method for budgeting planning package is **included**.].
- **Control thresholds** [variance thresholds, such as person-days, volume of product, at designated time points over the duration of the project can be defined to **indicate the agreed amount of variation allowed**.

- **Earned Value rules**, for example :
  - o Earned Value Management computation formulas, to **determine the estimate** to complete are defined
  - o Earned Value Credit criteria are **established**
  - o Define the WBS level at which Earned Value technique analysis will be performed
- **Reporting formats**
- **Process descriptions**

The Cost Management planning effort occurs **early** in the project planning and sets the framework for each of the Cost Management process, so that performance of the process will be **efficient** and **coordinated**.

Types of Cost :
- Variables Costs [costs that **change** with the amount of production or work, i.e. costs of material, supplies, wages].
- Fixed Costs [costs that **do not change** as production changes, i.e. set-up, rental, etc].
- Direct Costs [costs that are directly attributable to the **work on the project**, i.e. team travel, team wages, recognition].
- Indirect Costs [overhead items / costs incurred for the **benefit of more than one project**, i.e. taxes, fringe benefits & janitorial services].

Variable Costs & Direct Costs allows the project manager to **DECREASE** costs.

Cost Benefit
The comparison of the cost versus the benefit expected (of a project) usually for purposes of evaluating alternative forms of investment

Contingency Reserve
A provision held by **the project sponsor** for possible changes in **Project Scope** or **Quality**. Scope and Quality changes constitute changes in the project manager's mandate and will affect the project's cost and schedule.

Net Present Value (**NPV**)
NPV is an indicator of how much value an investment or project adds to the value of the firm. You would choose the project that provides the most value.
NPV = EPV (Expected Present Value) of all the benefits (cash inflow) over time – EPV of all the cost (cash outflow) over time.

If	It means	Then
NPV > 0	the investment would add value to the firm	the project may be accepted
NPV < 0	the investment would subtract value from the firm	the project should be rejected
NPV = 0	the investment would neither gain nor lose value for the firm	We should be indifferent in the decision whether to accept or reject the project. This project adds no monetary value. Decision should be based on other criteria, e.g. strategic positioning or other factors not explicitly included in the calculation.

Internal Rate of Return (**IRR**)
It is similar to the interest rate you get from the bank. The higher the rate is, the better the return.

Payback Period
The payback period is how long it will take the company to recoup the investment in the project.

Benefit Cost Ratio
The lowest benefit cost ratio should be selected for termination.

Opportunity Cost
The cost of investing in a particular project and, therefore, forgoing the potential benefits of other projects.

Sunk Cost

Contingency Reserve [Output/Input] : The amount of funds, budget, or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable to the organization.

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
	Cost Estimating Cost Budgeting		Cost Control	

Project Quality Management :

- Perform organization's quality policies, objectives, and responsibilities
- Quality is the **degree to which the project fulfils requirements**.
- Grade is a **category** assigned to products or services having the same functional use but **different technical characteristic** (low grade = a limited number of features, high grade = numerous features).
- Quality Management includes **creating** & **following** policies & procedures and processes of **QP, QA, & QC**, in order to ensure that a project meets the defined needs it was intended to meet.
- Quality Management means **completing** the project with no deviations from the project requirements.
- A critical element of Quality Management is to turn stakeholder needs, wants, & expectations into **requirements** through **Stakeholder Analysis**, performed during **Project Scope Management**.
- Quality Planning creates 3 plans in output and 3 other outputs which start with Quality.
- TT for Quality Planning is ABCDC
- QC has all the outputs of QA + 6 more outputs.
- There are 10 TT for QC. Out of which there are 7 Tools for QC. Remember **Inspection** appears as TT here and only other place it appears is in **Scope Verification**

Quality baseline : the quality objectives of the project. Output of Quality Planning.

The following are PMI-isms related to quality :
- the project manager should **recommend improvements** to the performing organization's standards, policies and processes. Such recommendations are expected and welcomed by management.
- quality should be considered **whenever there is a change** to any component of the "t**riple constraint**."
- quality should be checked **BEFORE** an activity or work package is completed.
- the project manager must spend time trying to improve quality.
- the project manager must determine **metrics** to be used to measure quality **BEFORE** the project work begins.
- the project manager must put in place a plan for **continually improving processes**.
- the project manager must make sure **authorized approaches and processes** are followed.
- some of the quality activities could be done by a Quality Assurance or Quality Control department

Precision is consistency that the value of **repeated measurements** are clustered and have little scatter. **Accuracy** is correctness that the measured value is very close to the **true value**. Precise measurements are not necessarily accurate. A very accurate measurement is not necessarily precise.

Modern Quality Management **complement** Project Management, that recognise the importance of :
- **customer satisfaction** : understanding, evaluating, defining, & managing expectations so that customer requirements are met. This requires a combination of **conformance to requirements** (the project must **produce what it said it would produce**) and **fitness for use** (the product or service must **satisfy real needs**).
- **prevention over inspection** : the cost of preventing mistakes is less than the cost of correcting them. **QUALITY MUST BE PLANNED IN, NOT INSPECTED IN!**
- **management responsibility** : it's the management's responsibility to provide the resource needed to succeed.
- **continuous improvement** : the **Plan-Do-Check-Act cycle is the basis for quality improvement**.

The Cost Of Quality (COQ)
Refers to the **TOTAL cost of all efforts related to quality**. It includes the testing, time spent writing standards, reviewing documents, meeting to analyse the root causes of defects, rework to fix the defects once they're found by the team.

Cost of Conformance (COC)
The total cost of ensuring that a product is of good *Quality*. It includes costs of ***Quality Assurance*** activities such as **standards**, **training**, and **processes**; and costs of ***Quality Control*** activities such as **reviews**, **audits**, **inspections**, and **testing**.

Cost of Non-Conformance (CONC)
The total cost to the organisation of **failure** to achieve a good *Quality* product. CONC includes both in-process costs generated by quality failures, particularly the cost of *Rework*; and post-delivery costs including further *Rework*, re-performance of lost work (for products used internally), possible loss of business, possible legal redress, and other potential costs.

Gold Plating
It refers to **giving** the customer **extras** (e.g., extra functionality, **higher-quality components**, and extra scope or better performance), that was **not requested** by the sponsor or client. **Not recommended.**

Continuous Improvement (or Kaizen)
Small improvements in products or processes to reduce costs and ensure consistency of performance of products or services.

Just In Time (JIT)
Many companies are finding that holding goods in inventory is too expensive and unnecessary. Instead, they have their suppliers deliver materials just when they are needed or just before they are needed, thus decreasing inventory to close to zero. A company using JIT must have **high quality**, otherwise there will not be enough supplies or raw material to meet production requirements. A JIT system forces attention on quality.

Total Quality Management (TQM)
A philosophy that encourages companies and their employees to **focus on finding ways to continuously improve the quality** of their business practices and products.

Responsibility for Quality
The **entire organization** has responsibilities relating to quality. The project manager has the **ultimate responsibility for the quality of the product of the project**, but each team member must check his or her **work**-**self**-**inspection**. Senior management has the **ultimate responsibility for quality in the organization as a whole**. Work should meet the project requirements and testing should be done whenever appropriate before submission.

Impact of Poor Quality :
- rework, increased costs, schedule, and risk
- low morale and low customer satisfaction

Increases in quality can result in **:**
- **less rework & decreased cost risk.**
- **increased productivity and cost effectiveness**

Quality Planning	Quality Assurance	Quality Control
Determine a plan for quality	Determine if the project is **complying** with organizational and project policies and processes	**Measure** specific project results against **standards**
- Find existing **quality standards** for product and project management - Create additional project-specific standards - Determine what work you will do to meet the standards - Determine how you will measure to make sure you meet the standards - Balance the needs of quality with scope, cost, time, risk and satisfaction - Create a **Quality Management Plan** and add it to the Project Management Plan	- Perform **Continuous Improvement** - Determine if project activities comply with organization and project policies, processes and procedures - **quality audit** **Correct deficiencies** - Identify improvements the company needs to make **Recommend Changes** and **Corrective Actions** to **Integrated Change Control**	- Measure specific project results against **quality standards** - Implement Approved Changes to the **quality baseline** - Identify **quality improvements** **Repair defects** **Recommend Changes, Corrective** and **Preventive Actions** and **Defect Repair** to **Integrated Change Control**

Mostly done during **Project Planning**	Mostly done during **Project Execution**	Mostly done during **Project Monitoring & Controlling**

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
	Quality Planning (QP)	Perform Quality Assurance (QA)	Perform Quality Control (QC)	

Project HR Management :
- Organize & manage the project team to make the most effective use of the people involved with the project
- Project Management team (core, executive, or leadership team) is responsible for planning, controlling, & closing
- Project sponsor assists project **funding**, **clarify** scope questions, **influencing** others for the benefit of the project, **prevent unnecessary changes** (**reassignment** of a team member)

Interaction with other process that require **additional planning**
- after initial team members create a WBS, additional team members may need to be **acquired**.
- as additional team members are acquired, their experience level could increase / decrease project risk, creating the need for additional **risk planning**.
- when Activity Durations are estimated before all project team members are known, actual competency levels of the acquired team members can cause the **Activity Durations** and schedule to **change**.

The Role of the Project Sponsor / Initiator : one who provides the financial resources for the project.
1. During or prior to **Project Initiating**
   - Has requirements that must be met
   - Is a project stakeholder
   - Provide **funding**, **SOW**, and information for **Preliminary Project Scope Statement**
   - May **dictate** milestones, key events, or project end date
   - Issue the **Project Charter**
   - Give the project manager **authority** as outlined in the **Project Charter**
   - Help organise work into appropriate projects
   - Set **priorities** between projects
   - Determine the **priorities** between the "**triple constraint**" components
   - Encourage the finalisation of requirements and scope by the stakeholders
2. During **Project Planning**
   - Provide the project team with time to plan
   - May **review** the WBS
   - Supply **lists of risks**
   - Determine the reports needed by management to oversee the project
   - Provide **Expert Judgement**
   - Help evaluate tradeoffs during **crashing**, **fast tracking, & re-estimating**
   - **Approve the final Project Management Plan**
3. During **Project Executing and Project Monitoring & Controlling**
   - **Approve changes to the Project Charter**
   - Protect the project from outside influences and changes
   - **Enforce** quality policies
   - Provide **Expert Judgement**
   - Help evaluate tradeoffs during **crashing, fast tracking, & re-estimating**
   - Resolve **conflicts** that extend beyond the project manager's control
   - May direct that a QA review be performed
   - Approve or reject changes or authorise someone representing them to do so (**Change Control Board**)
   - **Clarify** scope questions
4. During **Project Closing**
   - Provide **formal acceptance** of the deliverables
   - **Support** the collection of historical records from past projects

The Role of the Team : a group of people who will complete work on the project, and may have some project management responsibilities.
- Help plan to create **WBS** and **time estimates** for their work packages or activities.
- Complete work packages or activities (during **Project Executing and Monitoring & Controlling**)
- Help look for **deviations** from **Project Management Plan**
- Identify and involve stakeholders
- Execute the **Project Management Plan** to accomplish work defined in the **Project Scope Statement**
- Attend project team meetings & **enforce Ground Rules**
- Process **improvement**
- Comply with **Quality and Communications Plans**

The following may help the project manager to :
- Define the product of the project & requirements
- Identify & analyse **Constraints & Assumptions**
- Determine the **definition of quality** on the project and how it will be met
- Decompose work package they are responsible for into **schedule activities**
- Identify **dependencies** and create the **network diagram**, as well as **identify risks**
- Provide **time** and **cost estimates**
- Perform **Qualitative & Quantitative Risk Analysis, and Risk Response Planning**
- Determine time and cost reserve for the project

- Produce **Project Performance Reports** & measure **Project Performance**
- Determine the need for **Corrective Action**
- Close out phases of the project
- Select appropriate processes

The Role of the Stakeholders : anyone who can positively or negatively influence the project.
- May be involved in the creation of the **Project Charter** and the **Preliminary** and the **Project Scope Statements**
- Become **risk response owner**
- Involved in :
  - o **Project Management Plan** development
  - o Approving project changes and being on the **Change Control Board**
  - o Scope Verification
  - o Identify constraints
  - o Risk management

The Role of the Functional Manager : who manages and "owns" the resources in a specific department, i.e. IT, marketing, etc.
In **matrix** organisation, the responsibility to direct the work of individuals is **shared** with the project manager. In **projectised** organisation, the project manager does **all of the directing**. The role MAY include :
- Assign specific individuals to the team and negotiate with the project manager regarding resources
- Let the project manager know of other projects that may impact the project
- Participate in the Initial Planning until work packages or activities are assigned
- Approve the final Project Management Plan during Project Management Plan development & the final schedule during Schedule Development
- Recommend corrective actions
- Assist with problems related to team member performance & improve staff utilisation

The Role of the Project Manager
The project manager :
- Is assigned to the project **no later** than **Project Initiating**
- Is in charge of the project, but not necessarily the resources
- **Leads** and **directs** during the **project Planning** efforts
- Must realise that unrealistic schedule is his fault, and know how to handle those situations
- Understand and enforces professional and social responsibility
- Determine & delivers required levels of quality
- Assist the team (**coaching**) and other stakeholders during **Project Executing**
- **Create a Change Control System**
- Maintains control over the project by **measuring performance**, determining if Corrective Action is needed, recommending corrective actions, preventive actions and defect repair
- Must have the **authority** and **accountability** to accomplish the project management work & must say 'NO' when necessary
- Is the only one who can **integrate** the project components into a cohesive whole that meets the customer's needs
- Spend more time being proactive than in dealing with problem (reacting)
- Is accountable for project failure
- Performs or delegates most of the activities

The list of responsibilities :
- Create a project team directory
- Negotiate with resource managers for the best available resources
- Create project **job descriptions** for team members and other stakeholders
- Understand the team member's needs for training and make sure they get it
- Create a formal plan covering such topics as how the team will be involved in the project and what role they will perform (**Staffing Management Plan**)
- Insert reports of team member's performance into their official company employment record
- Send out **letters of commendation** to team members and their bosses
- Make sure team member's needs are taken care of
- **Create reward systems** :
  - o Say "Thank you" more often & award prices or cash prices for performance
  - o Send notes to their managers about great performance
  - o Plan milestone parties or celebrities
  - o Acquire training paid from the project budget for team members
  - o Adjust the project to assign people to requested activities or to remove them from disliked activities
  - o Work with the boss to have a team member removed from the project if they request it, and it is possible
  - o Assign a team member to a non-critical path activity so that he can gain more knowledge in that area

Leaders Focus On	Manager Focus On
Vision	Objectives
Selling what and why	Telling how and when
Longer range	Shorter range
People	Organization and structure
Democracy	Autocracy
Enabling	Restraining
Developing	Maintaining
Challenging	Conforming
Originating	Imitating

Innovating	Administrating
Directing	Controlling
Policy	Procedures
Flexibility	Consistency
Risk (opportunity)	Risk (avoidance)
Top line	Bottom line
Good Leaders : **do the right things**	Good Managers : **do things right**

Authority : The right to apply project resources, expend funds, make decisions, or give approvals.

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
	HR Planning	Acquire Project Team Develop Project Team	Manage Project Team	

Project Communication Management :

- Ensure timely & appropriate generation, **collection**, **distribution**, storage, retrieval, & ultimate disposition of project information
- Provide a link among people and information
- Project managers communicate with **project team, stakeholders, customer, & sponso**r

The **art of communication** includes :
- sender-receiver models – feedback loops & barriers to communication.
- choice of media – writing vs. oral, informal memo vs. formal report, face-to-face vs. e-mail
- writing style – active vs passive voice, sentence / word choice.
- presentation techniques – design of visual aids
- meeting management techniques (preparing an agenda and dealing with conflict)

A basic model of communication :
- encode / decode
- message
- medium
- noise – anything that interferes, i.e. distance, may **compromise** the original meaning of the message [a breakdown in communications can negatively **impact** the project].

Communications Methods
In order to have clear, concise communications, the project manager must handle communications in a **structured manner** by selecting the form of communication that is best for the situation. Communications occur **internally** and **externally** to the core project team and vertically and horizontally within the organization.

Type of Communications Methods :
- formal written   : Project Charter, Management Plan (this is the best type of communication method to use when there are **cultural differences** and **distance** between team members), project status reports.
- informal written   : notes, memos, e-mails
- formal verbal   : presentations, speeches
- informal verbal   : conversations, meetings

Effective Communication
The sender should encode a message **carefully**, determine the **communications method** used to send it, and **confirm** that the message is **understood** :
- **nonverbal** – a major importance
- **paralingual** - pitch and tone of voice also helps to convey a message.
- **feedback** - saying things like, "Do you understand what I have explained?"

Effective Listening
The receiver should decode the message carefully and **confirm** the message is understood. This includes watching the speaker to pick up physical gestures and facial expressions, thinking about what you want to say before responding, asking questions, repeating and providing feedback :
- **feedback** - saying things like, "I am not sure I understand, can you repeat what you have said?"
- **active listening** - the receiver confirms she is listening, confirms agreement or asks for clarification.
- **paralingual**

Active Listening in a nutshell :
- Attention (reduce distractions)
- Concern (for the person, the process, and project objectives
- Appropriate timing (choose a time when neither party is preoccupied)
- Involvement (mental and emotional)
- Vocal tones (represent 38 percent of message)
- Eye contact (shows that you are paying attention)
- Look (observe body language)
- Interest (take interest in other person as a human being)
- Summarize (play back to confirm and verify real meaning of the message)
- Territory (manage the space appropriately; lean forward to reduce distance)
- Empathy (listen "between the words" to understand feelings)

- Nod (to show that you understand)
- Stop talking
- Show the speaker that you're ready to listen
- Silence
- Few distractions
- A receptive attitude

The **WBS** allows communication **vertically** and **horizontally** within the **organization** as well as **outside** the project.

The major result of communication blockers and miscommunication as a whole is **conflict**.

Lessons Learned :
- **created throughout** the project and then **finalized** during Project Closing or Project Phase Closing.
- might be sent out **as they are created**, as part of **Information Distribution** activities on the project.
- the project managers have an obligation to **conduct** lessons learned sessions for all projects with key **internal** & **external stakeholders**.
- a project **cannot be considered complete** unless the lessons learned are **completed**. Continuous improvement of the project management process cannot occur **without** lessons learned.
- one should not wait until the project is over to share lessons learned with other projects.
- to be as valuable as possible, lessons learned should cover three areas:
  - o **Technical aspects** of the project
  - o **Project Management** (How did we do with WBS creation, risk, etc.?)
  - o **Management** (How did I do with communications and leadership as a project manager?)

Objectives of a Kickoff Meeting
- Get to know each other, discuss **Ground Rules**, set team goals & objectives , and obtain commitments
- Review project status & project plans
- Identify problem areas & establish responsibilities and accountabilities

Rules for meetings :

• Set a time limit and keep to it.	• Stick to the agenda, **not a random discussions**
• Schedule recurring meetings in advance.	• Let people know their **responsibilities** in advance.
• Meet with the team regularly, but not too often.	• Bring the right people together.
• Have a **purpose** for each meeting.	• Chair and lead the meeting with a set of rules.
• Create an **agenda** with team input.	• Assign deliverables and time limits for all work that results from meetings.
• Distribute the agenda beforehand.	• Document and publish meeting minutes.

Barriers to Communications (which lead to conflict)
- Lack of clear communication channels
- Physical or temporal distance
- Difficulties with technical language
- Distracting environmental factors
- Detrimental attitudes

Building Effective Team Communications
- Be an effective communicator and be a communications expediter
- Avoid communication blockers
- Use a "tight matrix" (single office space)
- Make meetings effective (meeting during execution is the best format to communicate)

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
	Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	

Project Risk Management :
- Concerned with conducting risk management planning, identification, analysis, responses, & monitoring and control
- Concerned with identifying, analysing, and responding to **uncertainty**. The most likely cause of poor risk management is **lack of prioritised list of risks**.
- To **increase** probability & impact of **positive** events
- To **decrease** probability & impact of **negative** events
- Analyse the problem **BEFORE** you alert the sponsor of potential impacts to costs, scope, or schedule.
- First 4 processes have only one output.
- Risk Register is updated in all the processes after it's created.

Risk Management
The process whereby decisions are made to accept known or assessed risks and /or the implementation of actions to reduce the consequences or probability of occurrence. The project manager to spend more time on risk management, such as **Risk Identification**, for project that he has **never been done before** and there will be a large cost outlay.

Risk Matrix
The presentation of information about risks in a matrix format, enabling each risk to be presented as the cell of a matrix whose rows are usually the stages in the investment life-cycle and whose columns are different causes of risk . A risk matrix is useful as a **checklist** of different types of risk which might arise over the life of a project but it must always be supplemented by other ways of discovering risks.

Origin of risks : uncertainty in the project, i.e. work that needs to be done, the cost, the time, the quality needs, communications needs, etc. Uncertainty is a lack of knowledge about an event that reduces confidence in conclusion drawn from the data. The investigation of uncertainties may help to **identify** risks

Known risks : those that have been identified, analysed, & planned.

Unknown risks : cannot be managed proactively.

- Bad risks = threat ; Good risk = opportunity
- Threshold is an amount of risk that is acceptable

- **Risk factors** :
  - o Risk probability - the probability that it'll occur (what)
  - o The range of possible outcomes (impact or amount at stake)
  - o Risk event - expected timing in the project life (when) - A discrete occurrence that may affect the project for **better** or **worse**. After a risk event, the project manager's role is to **reassess the risk ranking**. The risk owner is **responsible** to take action when an identified risk occurs.
  - o Anticipated frequency of risk events from that source (how often)
- Risk averse is someone who doesn't want to take risks
- Risk Portfolio - **risk data assembled** for the management of the project
- Workaround - **unplanned** response to negative risk events (requires to be impacted by the risk first)
- Expected Monetary Value = Probability * Monetary Impact (used in Decision Tree Analysis)

To be successful, the organisation should be committed to addressing the management of risk **proactively** and **consistently** throughout the project.

Risk Tolerances

Tolerance is an area of risk that is (un)acceptable. If we know the tolerances of the stakeholders, we can determine how they might react to different situations and risk events. We use this information to help **assign levels of risk (rank of risk) on each work package or activity**.

Risk Trigger

A symptom of risk; indirect manifestation of actual risk event; output of **Risk Identification**; example is poor morale.

Something that happens that implies that a risk event might happen. Just because a trigger occurs, it doesn't automatically assume that a risk will happen.

Common Risk Management Error

- Risk Identification is completed **without** knowing enough about the project (see inputs to Risk Management).
- Project Risk is evaluated using only a questionnaire, interview, or Monte Carlo analysis, so **does not provide specific risks**.
- Risk Identification ends **too soon**, so it produces only **a few lists**
- Risk Identification through Qn Risk Analysis are blended, resulting in risks that are evaluated or judged as they come to light. This decrease the number of total risks identified and causes people to stop participating in Risk Identification.
- Risk Identification is general rather than **specific**.
- **Whole categories** of risks are missed, such as technology, cultural, or marketplace.
- Risk Identification using only by one method instead of a **combination of methods**.
- The first risk response strategy identified is selected without looking at other options and finding the best option or **combination of options.**
- Risk Management is not given enough attention during **Project Executing**.
- Project managers do not explain the **Risk Management** to their team during **Project Planning**.
- Contracts are usually signed long **BEFORE** Project Risks are discussed.
- The project manager is not dealing with reserves in the actions he is taking, and is working to make a positive impact (opportunities) on the project more likely to occur.

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
	Risk Management Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning		Risk Monitoring & Control	

Project Procurement Management :

- Buy / sell the product, service, or results under a contract (a legal documents, mutually binding agreement, between the buyer & the seller)
- Buy 3rd party product
- Contract management and change control process required to administer contracts or purchase orders issued by authorized project team member
- Administering any contract issued by the buyer that buy the seller product
- Administering contractual obligations placed on the project team by the contract
- It is the **project management team's** responsibility to help **tailor** the contract to the specific needs of the project.

Remember :
- **Contracts are legally binding, thus requires formality**
- All product and project management requirements should be specifically stated in the contract
- **If it is not in the contract, it can only be done if a change is issued**
- **If it is in the contract, it must be done or a change order, signed by both parties issued**
- Changes must be in writing
- Contracts should help **diminish project risk** or **mitigated**
- Most governments back all contracts by providing a court system for dispute resolution
- A contract is one method of **allocating the responsibility for managing** or **assuming potential risks**.
- Contracts should include procedures to accommodate changes.
- Reasons to terminate a contract : breach & material breach.

Project Manager's Role in Procurement

The project manager must be involved in the **creation** of **contracts** and **fulfils** the following key roles:

- Know the procurement process
- Understand contract terms and conditions
- Make sure the contract contains all the project management requirements such as attendance at meetings, reports, actions and communications deemed necessary
- Identify risks and incorporate mitigation and allocation of risks into the contract
- Help tailor the contract to the unique needs of the project
- Fit the schedule for completion of the procurement process into the schedule for the project
- Be involved during Contract Negotiation to protect the relationship with the seller
- Protect the integrity of the project and the ability to get the work done
- Uphold the entire contract, not just the contract SOW
- Work with the Contract Manager to manage changes to the contract

The project manager must be assigned **before** a contract is signed! This allows the project manager to **complete a risk analysis before a contract is signed**

INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
	Plan Purchases & Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

INITIATING

	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
Integration	Develop Project Charter Develop Preliminary Project Scope Statement	Develop Project Mgmt Plan	Direct & Manage Project Execution	Monitor & Control Project Work Integrated Changed Control	Close Project
Scope		Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	
Time		Activity Definition Activity Sequencing Activity Resource Estimating Activity Duration Estimating Schedule Development		Schedule Control	
Cost		Cost Estimating Cost Budgeting		Cost Control	
Quality		QP	QA	QC	
HR		HR Planning	Acquire Project Team Develop Project Team	Manage Project Team	
Communications		Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	
Risk		Risk Mgmt Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning		Risk Monitoring & Control	
Procurement		Plan Purchases & Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

Essentially, the initiating processes formally start a new project or project phase by incorporating all the needs of the organization into the **Project Charter** and **Preliminary Project Scope Statement**.

Main Inputs :
- Business need
- Product description or product scope description describes the product requirements as they are known up to this point. In other words, what is the project being asked to do?
- How the project fits into or supports the company's strategic plan
- Who are likely to be stakeholders
- Contracts, if the work is done under a contract

- Industry standards
- Company change process
- How the company does business; defined processes and procedures
- Past relationships with the sponsor of the project, likely stakeholders and team
- Templates from past projects
- Historical WBS & Historical estimates
- What is going on in the company today? What are the major projects? What might their impact be on this project?
- The company's future & culture
- People who may be good team members

Develop Project Charter :
- Formally **authorize** / **recognise** a project (**a project does not exist without a Project Charter**)
- Issued by **Project Initiator** or **Sponsor**
- Provide the Project Manager with the **authority** to **spend money** and to apply organizational **resources** to project activities
- A project is not formally chartered & initiated until **completion of a needs assessment, feasibility study, preliminary plan**, etc.
- is primarily concerned with **documenting** the business needs, project justification, current understanding of the customer's requirements, and the new product, service, or result that is intended to satisfy those requirements
- Provides the **high-level requirements** for the project.
- **Links** the project to the ongoing work of the organization.
- Any change to the Project Charter should call into question **whether or not** the project should continue.
- **Project Charter** is input for only following:
  - o Preliminary Scope Statement
  - o Scope Planning & Scope Definition.

Statement Of Work
- for internal projects, the project **Initiator** or **Sponsor** provides the SOW based on business needs, product, or service requirements.
- for external projects, the statement of work can be received from the customer as part of a **bid document**, for example, request for proposal, request for information, request for bid, or as part of a **contract**.
- **may not be complete** when received as an input to develop Project Charter. It is further defined in the **Preliminary Project Scope Statement** and **Project Scope Statement**
- it indicates (**BPS**) :
  - o **Business need** (training, market demand, technological advance, legal requirement, or governmental standard)
  - o **Product scope description** (documents the product requirements and characteristics of the product or service that the project will be undertaken to create)
  - o **Strategic plan**

EEF (Enterprise Environmental Factors) : company structure, company standards & regulations, company **work authorisation system**, stakeholder risk tolerance, web interface, personnel administration, market conditions, project management software, etc => "Company culture and existing systems that the project will have to deal with or can make use of.").

OPA (Organizational Process Assets)
It's : "processes, procedures and historical information." :
- Processes, Procedures and Policies
- Corporate Knowledge Base the creation of a corporate knowledge database of historical information and lessons learned is an organizational responsibility that can result in continuous improvement.
- Historical Information - historical information (or data) is a record of past projects. It is used to plan and manage future projects, thereby improving the process of project management. Historical information can include:
  - o Activities
  - o Lessons learned
  - o WBS
  - o Benchmarks
  - o Reports
  - o Risks
  - o Estimates
  - o Resources needed
  - o Project management plans
  - o Correspondence

Project Selection Methods
There are two broad categories :
- Benefit measurement methods (**Comparative approach**) :
  - o Murder board - a panel of people who try to shoot down a new project idea
  - o Peer review
  - o Scoring models - different projects are given scores based on certain defined criteria. Project with higher score is selected.
  - o Economic models
  - o Benefit Cost Ratio - this technique involves computing benefits to cost ratio (BCR) for a project. Project with higher BCR is selected. A BCR of 2.1 means the payback is 2.1 times the costs.
  - o Discounted Cash Flow - this technique takes into account the interest earned on the money. The Future Value (FV) of projects is compared.
    $FV=PV(1+i)n$
    PV is the present value of the project. A project with higher present value is better.
  - o Internal Rate of Return (IRR) - a project that has higher IRR is better, as it is giving higher return on money.
  - o Payback period - this technique involves considering how long it takes back to "pay back" the cost of the project. Inflation or interest earned in not considered in this technique. A project with lower pay back period is better.
- Constrained optimization methods (**Mathematical approach**) :
  - o Linear programming
  - o Integer programming
  - o Dynamic programming
  - o Multi-objective programming

Constraints and assumptions are **identified** and then **managed**. The sponsor, the team and other stakeholders can identify **Constraints and Assumptions** in the **Initiating Process** group and **throughout** the project. **Constraints and Assumptions** are also reviewed for validity throughout the life of the project. **If the Constraints change or the Assumptions are proven wrong**, the **Project Management Plan may need to change**. **Assumptions analysis is part of the Risk Management process**.

The Project Charter :
- the **project management team** may help to write it
- the approval and funding are handled **external** to the project boundaries.
- authorized **external** to the project by the organization, a program or portfolio management body, a government agency, a company.
- issued by a project **initiator** or **sponsor** external to the project organisation, at a level that is appropriate to **funding the project**.

- may include some **staff assignments**
- should have the following informations :
  - o Requirements that satisfy customer, sponsor, and other stakeholder needs, wants and expectations
  - o Business needs, high-level project description, or product requirements that the project is undertaken to address
  - o Project purpose or justification
  - o Assigned Project Manager and authority level
  - o **Summary budget & milestone schedule**
  - o Stakeholder influences
  - o Functional organizations and their participation
  - o Organizational, environmental and external **Assumptions & Constraints**
  - o **Business case & feasibility studies** justifying the project, including **Return On Investment**

Constraint [Input] : The state, quality, or sense of being **restricted** to a given course of (in)action. An **applicable restriction** or **limitation**, either internal or external to the project, that will **affect** the **performance** of the project or a process. For example, a schedule constraint is any limitation or restraint placed on the project schedule that affects when a schedule activity can be scheduled and is usually in the form of fixed imposed dates. A cost constraint is any limitation or restraint placed on the project budget such as funds available over time. A project resource constraint is any limitation or restraint placed on resource usage, such as what resource skills or disciplines are available and the amount of a given resource available during a specified time frame. And even **union contracts** (if the project involves union).

Assumptions [Output/Input] : Assumptions are factors that, for planning purposes, are considered to be true, real, or certain without proof or demonstration. Assumptions affect all aspects of project Planning, and are part of the Progressive Elaboration of the project. Project teams frequently identify, document, and validate assumptions as part of their planning process. Assumptions generally involve a degree of risk. Assumptions are educated guesses made on the project about items that are not known.

I	TT	O
Contract (if applicable) SOW EEF OPA	**Project Selection Methods** Project Management Methodology Project MIS : • Configuration Management System : Jira • Change Control System : PVCS, log Expert Judgement (Consultants, Stakeholders, technical associations, etc)	**Project Charter**

Develop Preliminary Project Scope Statement :
- Document **what must be done** to accomplish the project objectives.
- Developed from information provided by the **Initiator** or **Sponsor**.
- Making sure the project manager and the sponsor have a **similar understanding** or a meeting of the minds about project scope **BEFORE** planning begins.
- Interviewing the sponsor, for the purposes of obtaining a clearer understanding of what needs to be done to accomplish the requirements [**more detail on the requirements, how success will be measured, and any information from the sponsor regarding risks, budgets and schedules**]
- The project management team in the **Scope Definition** process further **refines** the **Preliminary Project Scope Statement** into the **Project Scope Statement.**

Preliminary Project Scope Statement, produce:
- Project & product objectives
- Product / service requirements
- Product Acceptance Criteria
- Project requirements and deliverables
- Project **boundaries, Constraints, & Assumptions**
- Initial project organization
- Initial defined risks
- Schedule milestones
- Initial (high level) WBS
- Cost estimates
- Project Configuration Management requirements
- Approval requirements

I	TT	O
Project Charter SOW EEF OPA	PMM Project MIS Expert Judgement	**Preliminary Project Scope Statement**

PLANNING

	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
Integration	Develop Project Charter Develop Preliminary Project Scope Statement	Develop Project Mgmt Plan	Direct & Manage Project Execution	Monitor & Control Project Work Integrated Changed Control	Close Project
Scope		Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	
Time		Activity Definition Activity Sequencing Activity Resource Estimating Activity Duration Estimating Schedule Development		Schedule Control	
Cost		Cost Estimating Cost Budgeting		Cost Control	
Quality		QP	QA	QC	
HR		HR Planning	Acquire Project Team Develop Project Team	Manage Project Team	
Communications		Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	
Risk		Risk Mgmt Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning		Risk Monitoring & Control	
Procurement		Plan Purchases & Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

It entails walking through the project and getting it organized before it is actually done. It is during Project Planning, in addition to when the work is being done, that resources, time and money **can be saved**.

Project Planning determines if the Project Charter **can or cannot** be done, as well as how the project will be accomplished; addressing all appropriate project management processes and knowledge areas.

This means that the project manager and the project team will determine what processes in the PMBOK" Guide are appropriate for the needs of the project, to avoid wasting project resources on activities that are not relevant to the particular project.

The result of the planning processes is a **Project Management Plan**. Project planning is **iterative**. Each process above may use the results of the previous process, and each process may affect or cause changes to the previous processes. The idea, in the real world, is to follow these processes in the planning process group, attempting to complete each one as fully as possible. Then, after **Risk Identification**, **Qualitative** and **Quantitative Risk Analysis** , and **Risk Response Planning**, go back to finalize all the components of the Project Management Plan.

This process of planning saves time and is efficient. Can you guess why iterations start after **Risk Management** ? Because it is only **after Risk Management is completed that the final Cost and Schedule can be determined**. Risk Management could also result in changes to the resources, when they are used, in what sequence activities are performed, and almost all other parts of the planning process group.

Another important aspect of planning is that the amount of time spent in the planning process group should be related to the needs of the project. A project where the schedule needs to have a high level of confidence will require more planning. A project with a low priority will require less planning.

Imagine that you have chosen to organize the project by phases (test phase, install phase, etc.) **It might not be possible to plan each phase to a detailed degree until the phase before is almost completed**. This is called "**rolling wave planning**." Even though each part of the "project" is called a phase, each phase could be, and maybe should be, planned as a project with its own charter, scope statement, WBS, etc.

Everyone is involved in the planning processes !
The Project Management Plan is compiled by the project manager with input from stakeholders. Historical records from previous projects, company policies, magazine articles about projects and other such information may also be utilized in planning the project.

Develop Project Management Plan :
- Actions necessary to **define**, **integrate**, and **coordinate** all subsidiary plans into Project Management Plan.
- It contains all the management plans and the **Performance Measurement Baselines** that will be used to measure the progress and completion of the project.
- Is the process of creating a Project Management Plan that is agreed to by everyone, formally approved, everyone believes it can be done according to plan (realistic) and remains a formal document that is controlled and used throughout the project.

Project MIS, an automated system that is used by the project management team to :
- support generation of the Project Management Plan
- facilitate feedback the as doc is developed
- control changes to the Project Management Plan
- released the approved document

[Examples of MIS :

Configuration Management System, a process for **submitting** proposed changes, tracking systems fro reviewing & approving proposed changes, defining approval levels for **authorising** changes, & providing a method to validate approved changes.

Change Control System, a **collection** of formal, documented procedures, paperwork, **tracking systems** and approval levels for **authorising** changes. This may includes ;
- A change control plan included in the Project Management Plan outlining how changes will be managed
- Creation of a Change Control Board to approve **ALL** changes
- Change control procedures (how, who)
- Performance statistics (e.g., time/system, time/drawing)
- Reports (e.g., software output, milestone charts, resource usage)
- Change forms
]

Work Authorisation System
A subsystem of the overall Project Management System. It's a collection of formal documented procedures that define how project work will be authorised (committed) to ensure that the work is done by the identified organisation, a**t the right time** and **in the proper sequence (notifying team members or contractors that they may begin work on a project work package.)** . It includes the steps, documents, tracking system, and defined **approval levels** needed to **issue** work authorisation. A Work Authorization System is used to **coordinate when** and in **what order** the work is performed so that work and people may properly interface with other work and other people.

Project Baseline
A way to track project progress by **comparing original** plan estimates against **actual** progress. A baseline contains original **Scheduling**, **Resource** and **Cost** estimates. Baselines are used during Project **Executing** to measure performance and to help control the project. Forecasts of final cost and schedule should be compared to the baselines. Projects that deviate far from their baselines should have their risk management process reviewed. Project baselines may be changed by formally approved changes, but the evolution of the baselines should be documented.

Project Management Plan Approval
The Project Management Plan, **created by the team**, must receive **formal approval (sign-off or signatures)** by **management**, the **sponsor** the project team and other **stakeholders**.

Kickoff meeting is held at the end of the Planning process group just **BEFORE** beginning work on the project or each phase.

Project Management Plan
A formal, approved document that defines how the projected is executed, monitored and controlled, may be summary or detailed and may be composed of one or more subsidiary management plans and other planning documents, which include :
- Project Scope Management Plan
- Schedule Management Plan
- Cost Management Plan
- Quality Management Plan
- Process Improvement Plan
- Staffing Management Plan
- Communication Management Plan
- Risk Management Plan
- Procurement Management Plan
- Milestone list
- Resource calendar
- Schedule, Cost, & Quality baseline
- Risk register

Performance Measurement Baseline : An **approved plan** for the project work against which project execution is compared and deviations are measured for management control. The performance measurement baseline typically integrates **scope**, **schedule**, and **cost** parameters of a project, but may also include **technical** and **quality parameters**.

I	TT	O
Preliminary Project Scope Statement Project Management Processes EEF OPA	PMM Project MIS Expert Judgement	**Project Management Plan**

Scope Planning :
"How will I do this ?" Creating a **Project Scope Management Plan** that documents how the project scope will be **defined**, **verified**, **controlled**, & how the **WBS will be created & defined**.

Project Scope Management Plan :
- guidance on how project scope will be defined, documented, **verified**, managed, & controlled **by the project management team**, based on **Preliminary Project Scope Statemen**t
- how WBS will be created & defined
- for each project will be **unique** but may cover topics that for the company or the type of project can be standardized.
- once completed, it becomes **part of the Project Management Plan** and is used to guide and measure the project until the **Closing Process** group.
- is contained in or is subsidiary of Project Management Plan

Its component includes process :
- to prepare a detailed **Project Scope Statement** based on the **Preliminary Project Scope Statement**
- to create **WBS** from Project Scope Statement, & establishes how the WBS will be **maintained** and **approved**
- that specifies how **formal verification** & **acceptance** of the completed project deliverables will be **obtained**
- to control how Request Changes will be processed (this is linked to the Integration Change Control).

I	TT	O
EEF OPA ***Project Charter*** ***Preliminary Project Scope Statement*** ***Project Management Plan***	Expert Judgement Templates, Forms, & Standards	**Project Scope Management Plan**

Scope Definition :

- Primarily concerned with **what is and is not included** in the project.
- Developing a **detailed** Project Scope Statement as the **basis** for future **project decisions**.
- **Stakeholder needs, wants, & expectations are analysed & converted into requirements.**
- The Constraints & Assumptions are analysed for **completeness**..

Product Analysis : to analyse (by using techniques such as product breakdown, systems analysis, systems engineering, Value Engineering / Value Analysis) the **objectives** stated by the customer or sponsor and turn them into tangible **requirements**
Stakeholder Analysis : **selects**, **prioritises**, & **quantifies** the stakeholder needs, wants, & expectations to create requirements.

Project Scope Statement
A narrative description which includes :
- Project objectives :
  - o   Measurable success criteria
  - o   Business, cost, schedule objectivity
  - o   Cost & quality targets
- Product scope description (the characteristics of the product, service, or result)
- Project requirements (from **Stakeholder Analysis**)
- Project boundaries (what is included or excluded within the project)
- Project deliverables
- Product Acceptance Criteria
- Project Constraints & Assumptions (more detailed than those listed in the Project Charter)
- Identify project team members, organization, & known risks
- Schedule milestones
- Fund limitation & Cost estimate
- Project configuration management requirements
- Project specification
- Approval requirements

Scope Statement - is input to **ALL THE PLANNING PROCESSES** after it's created **except**
- Activity Resources Estimating
- HR Planning
- Risk Response Planning
- Plan Contracting
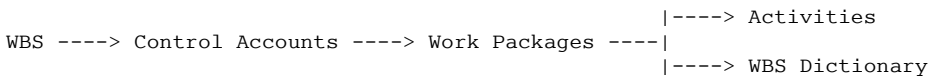- **updated** in **Integrated Change Control, Create WBS** and **Scope Control**

I	TT	O
OPA ***Project Charter*** ***Preliminary Project Scope Statement*** ***Project Management Plan*** Approved Change Requests (may cause a change to Project Scope, Project Quality, estimated Costs, or Project Schedule)	**Product Analysis** **Stakeholder Analysis** Alternative Identification (brainstorming and lateral thinking) Expert Judgement	**Project Scope Statement** Requested Changes Project Scope Management Plan (Updates)

Create WBS
WBS :
- is a **deliverable-oriented hierarchical decomposition** of the work, into **work packages**, to be executed by the **team**
- organises and defines the **total scope** of the project
- represents the work specified in the current **approved Project Scope Statement**
- its component assists stakeholders in viewing the deliverables of the project
- where the top level is the **project title**
- Is a graphical picture of the **hierarchy** of the project .
- Identifies **all the work to be performed, all deliverables to be included** - if it is not in the WBS, **it is not part of the projec**t
- Is the **foundation** upon which the project is built
- Can be **reused** for other projects
- Does **NOT** show dependencies
- Should not be confused with :
  - o   Organizational Breakdown Structure (OBS)
  - o   Bill of Material - a documented formal hierarchical tabulation of the physical assemblies, subassemblies, and components needed to fabricate a product.
  - o   Risk Breakdown Structure

- o   Resource Breakdown Structure
- When completed, the WBS can be used any time the project needs to **re-evaluate the scope of the project**, for example:
    - o   when there is a scope change to the project
    - o   as part of **Integrated Change Control** to evaluate any **impacts** of other changes on scope
    - o   as a way **to control scope creep** by reminding everyone **what work is to be done**
    - o   as a communications tool to help new team members see their **roles**

```
                                          |----> Activities
WBS ----> Control Accounts ----> Work Packages ----|
                                          |----> WBS Dictionary
```

The benefits of WBS :
- Helps prevent work from slipping through the cracks
- Provides the project team with an understanding of **where their pieces fit into the overall** Project Management Plan and gives them an indication of the impact of their work on the project as a whole
- Facilitates **communication** and **cooperation** between and among the **project team** and other **stakeholders**
- Helps **prevent changes**
- Focuses the team's experience on **what needs to be done**, resulting in higher quality and a project that is easier to manage
- Provides a **basis for estimating** Resource, Cost, and Time, and **PROOF** of need for staff, cost and time
- Gets team buy-in and builds the team
- Helps people **get their minds** around the project

WBS Dictionary, a companion document to the WBS :
- can be used as part of a **Work Authorization System** to inform team members of **when their work package is going to start**, schedule milestones and other information
- can be used to control **what work is done when**, to prevent **scope creep** and to increase understanding of the effort for each work package.
- contains:
    - o   A Code of Account identifier
    - o   Related Control Account (for cost)
    - o   A **Statement Of Work** to be done
    - o   Who is **responsible** for doing the work
    - o   Any **schedule milestones**

WBS and WBS dictionary are inputs to
- Scope Control
- Activity Definition
- Cost Estimating
- Cost Budgeting
- Plan Purchases and Acquisitions

Decomposition :
- Involves the following activities :
    - o   Identify the deliverables & related work (requires a degree of **Expert Judgement** to analyse the detailed Project Scope Statement)
    - o   Structuring & organizing the WBS (by means of **WBS templates**)
    - o   Decomposing the upper WBS levels into lower level detailed components, which represent **verifiable** products, services, or results
    - o   Developing and assigning identification codes to the WBS components
    - o   Verifying that the degree of decomposition of the work is necessary and sufficient
- Build a **work package** (in which where the **cost** & **schedule** for the work can be **reliably estimated** and **risk identified** - work packages are divided further into **schedule activities**)
- Is impossible if the deliverable or sub-project is not clarified (**rolling wave planning**)
- Too much detail can lead to non-productive management effort, inefficient use of resources, & decreased efficiency in the performing the work.

One can decompose the project using a WBS.

Activity : A component of work performed during the course of a project.

Schedule Activity : A discrete scheduled component of work performed during the course of a project. A schedule activity normally has an estimated duration, an estimated cost, and estimated resource requirements. Schedule activities are connected to other schedule activities or schedule milestones with logical relationships, and are decomposed from work packages.

Deliverable [Output/Input] : Any **unique** and **verifiable** product, result, or capability to perform a service that must be produced to complete a process, phase, or project. Often used more narrowly in reference to an external deliverable, which is a deliverable that is subject to approval by the project sponsor or customer.

Work Package : A deliverable or project work component at **the lowest level of each branch of the WBS**. The work package includes the schedule activities and schedule milestones required to complete the work package deliverable or project work component.

I	TT	O
OPA	WBS Templates (from previous project)	Project Scope Statement (Updates) Project Scope Management Plan (Updates)
Project Scope Statement ***Project Scope Management Plan***	Decomposition	
		WBS& WBS Dictionary
Approved Change Requests		**Scope Baseline**
		Requested Changes

Activity Definition :

Identify the specific **schedule activities,** by **decomposing** the WBS, to provide a **basis** for **estimating**, scheduling, executing, and monitoring & controlling the project work. These activities are **sequenced into the network diagram**.

Rolling Wave Planning
Cost and Schedule planning where details are developed for the near term and general allocations are made for the out periods. Detail is developed for the out periods as information becomes available to do so. In the early strategic planning, the information is less defined, activities might be kept at the milestones level.

Activity List
Is used in the **Schedule Model** & is a component of the Project Management Plan, includes :
* all schedule activities that are planned to be performed
* the activity identifier & a scope of work description for each schedule activity in sufficient detail

Activity Attributes
Includes activity identifier, activity codes, activity description, predecessor & successor activities, leads & lags, imposed dates, **Constraint** & **Assumption**, person responsible for executing the work, geographic area or place of the workplace. These are used for project schedule development and for selecting, **ordering, and sorting the planned schedule activities within reports**.

Progressive Elaboration [Technique] : **Continuously improving** and **detailing a PLAN** as more detailed and specific information and more accurate estimates become available as the project progresses, and thereby producing more accurate and complete plans that result from the successive **iterations** of the **planning process.**

Rolling Wave Planning [Technique] : A form of *Progressive Elaboration* planning where the work to be accomplished in the **near term** is planned in detail at a **low level of the WBS**, while the work far in the **future** is planned at a relatively **high level of the WBS**, but the detailed planning of the work to be performed within another one or two periods in the near future is done as work is being completed during the current period.

I	TT	O
EEF, i.e. Project Management Info System & scheduling software. OPA **Project Scope Statement** (Constraints & Assumptions, and input from the **sponsor**) **WBS & WBS Dictionary,** the **main** input to schedule activities **Project Management Plan**	Decomposition Templates (from previous project, & can be used to identify typical schedule milestones) Rolling Wave Planning Expert Judgement Planning Component	**Activity List** **Activity Attributes** **Milestones List** Requested Changes

Activity Sequencing :

Identify & document **dependencies** among schedule activities (**put into sequence the schedule activities**) into how the work will be **performed**.
The result is a **network diagram** (or **project schedule network diagram**).

If **Activity Duration Estimates** (estimates) are added, the network diagram could also show the **Critical Path**.
If plotted out against **time** (or placed against a calendar-based scale), the network diagram would be a **time**-**scaled schedule network diagram.**

Project Scope Statement is an input for this process as it contains the **product scope description**, which includes **product characteristics** that might affect activity sequencing. While these effects are often apparent in the **activity list**, the product scope description is generally **reviewed** to ensure accuracy.

Precedence Diagramming Method (PDM) or **Activity-on-Node** (AON) is a method of constructing a project schedule network diagram that uses **rectangles** (nodes) to represent activities and arrows show activities dependencies.
There are 4 types of dependencies between activities :
* finish-to-start, an activity MUST finish before the successor can start (most common).
* start-to-start, an activity MUST start before the successor can start.
* finish-to-finish, an activity MUST finish before the successor can finish.
* start-to-finish, an activity MUST start before the successor can finish (rarely used).

Arrow Diagramming Method (ADM) or **Activity-on-Arrow** (AOA) is a method of constructing a project schedule network diagram that uses **circles** (nodes) to represent activities and arrows show activities dependencies. This method :
* uses only **finish-to-start**.
* may use **dummy activities**, represented by a dotted line.

Type of Dependencies (**Dependencies Determination**) :
* Mandatory dependencies (hard logic), i.e. you **MUST** design before you can construct.
* Discretionary dependencies (Preferred, Preferential, or Soft Logic), based on knowledge of **best practice** or previous experience.
* External dependencies, based on the needs of a party outside the project, i.e. gov, supplier, etc.

Milestones are significant events within the Project Schedule. Milestones can be **imposed** by the sponsor in the **Project Charter** and **Preliminary Project Scope Statement**. Additional milestones can be **imposed** by the project manager during **Activity Sequencing** or **Schedule Development**, as **checkpoints** to help control the project. If the checkpoint in the schedule arrives and all the work planned has been completed, then the project manager has a measure that the project may be progressing as planned. A list of milestones becomes **part of** the Project Management Plan and is **included** in the **Project Scope Statement** and **WBS Dictionary**.

Leads & Lags : A lead may be **added** to start an activity before the predecessor activity is completed, i.e. coding might be able to start 5 days before the design is finished. A lag is inserted **waiting time** between activities, i.e. you must wait 3 days after pouring the concrete before you can construct the frame of the house.

The purpose of network diagrams is to :
- Show **interdependencies** of **ALL** activities (a decomposition of WBS)
- Show work flow so the team will know what activities **need** to happen in a specific sequence
- Aid in effectively planning, organizing and controlling the project
- **Compress** the schedule in planning and throughout the life of the project
- Show project **progress** if used for schedule control and reporting
- Help **justify** your time estimate for the project

I	TT	O
__Project Scope Statement__ *__Activity List__* **__Activity Attributes__** *__Milestones List__* Approved Changes Requests	Precedence Diagramming Method (PDM) Arrow Diagramming Method (ADM) Schedule Network Templates Dependency Determination Applying Leads & Lags	**Project Schedule Network Diagrams** Activity List (Updates) Activity Attributes (Updates) Requested Changes

Activity Resource Estimating :

Estimating the **type** & **quantities** of **resources** (persons, equipment, or material) required to perform **each schedule activities**. This activity is closely coordinated with the **Cost Estimating** process.

Alternatives Analysis, i.e. various levels of resource capability or skills, different size or type of machines, different tools (hand vs. automated), make-or-buy decisions regarding the resource.

Activity Resource Requirements, i.e. types of resources are applied, their availability, & what quantity are used.

Resource Breakdown Structure is a hierarchical structure of resources by resource category and resource type used in **Resource Levelling** schedules and to develop resource-limited schedules, and which may be used to identify and analyse project human resource assignments

I	TT	O
EEF OPA, i.e. policies regarding staffing, rental/purchase of supplies, & equipment. *__Activity List__* *__Activity Attributes__* Resource Availability, i.e. where and when *__Project Management Plan__*	Expert Judgement, i.e. consultants **Alternatives Analysis** Published Estimating Data, mostly in media Project Management Software **Bottom-up Estimating**	**Activity Resource Requirements** Activity Attributes (Updates) **Resource Breakdown Structure (RBS)** Resource Calendar (Updates) [working & non-working days, holidays & availability periods]. Requested Changes

Activity Duration Estimating :

Estimating the number (**quantitative assessment**) of **work periods** that will be needed to complete **each schedule activities**.
This process uses information on :
- schedule activity scope of work
- required resources types
- estimated resource quantities
- resource calendars with resource availability

This process requires that the :
- amount of work effort required to complete the schedule activity is **estimated**.
- assumed amount of resource to complete the schedule activity is **estimated**.
- number of work periods needed to complete the schedule activity is **determined**.

The accuracy can be improved by **considering the amount of risk in the original estimate**.

Analogous Estimating :
- uses the actual duration of a **previous** & **similar** schedule activity as the basis.
- is used when there is a **limited amount** of detailed information, in the early phases of a project.
- uses **historical information**
- a form of **Expert Judgement**.

Parametric Estimating, uses mathematical model to calculate projected times for an activity based on historical records and other information :
- Regression analysis (scatter diagram)
- Learning curve

Parametric Estimating [Technique] : An estimating technique that uses a **statistical relationship** between **historical data** and **other variables** (e.g., square footage in construction, lines of code in software development) to calculate an estimate for activity parameters, such as **scope**, **cost**, **budget**, and **duration**. This technique can produce **higher levels** of **accuracy** depending upon the sophistication and the underlying data built into the model. An example for the cost parameter is multiplying the planned quantity of work to be performed by the historical cost per unit to obtain the estimated cost.

Three-Point Estimate [Technique] (**risk related**) : An analytical technique that uses three cost or duration estimates to represent the **Optimistic**, **Most likely**, and **Pessimistic** scenarios. This technique is applied to improve the accuracy of the estimates of cost or duration when the underlying activity or cost component is **uncertain**.

I	TT	O
EEF, i.e. historical reference data or commercial data. OPA, i.e. previous project results ***Project Scope Statement*** ***Activity List*** ***Activity Attributes*** ***Activity Resource Requirements***, because the resources assigned to the schedule activity & the availability of those resources, will influence the duration of most activities. ***Resource Calendar***, which includes the availability, capabilities, & skills of HR, as well as the type, qty, availability, & capability of both equipment & material resources. ***Project Management Plan*** : • Risk Register • Activity Cost Estimates	**One-Time (Expert Judgement) + Analogous + Parametric + 3-Point Estimating** Reserve Analysis : • **Contingency** reserves, times reserves, or buffers, which is documented along with other data and assumptions. • **Management** reserves, is any extra amount of funds to be set aside to cover unforeseen risks.	**Activity Duration Estimates** Activity Attributes (Update), which include the assumption made in developing the Activity Duration Estimates and any contingency reserves.

Schedule Development :

•   Analysing activity sequences, durations, resource requirements, & schedule constraints to **create the project schedule.**
•   **An iterative process**, determines planned start & finish dates for project activities (**calendar-based**).

It can require that duration estimates & resource estimates are **reviewed and revised** to create an **approved project schedule** that can be served as a **baseline** against which progresses can be tracked.

In order to develop a schedule, you need to have:
•   An understanding of the work required on the project (**Project Scope Statement**)
•   Defined activities (**WBS**, **WBS Dictionary**, and **Activity List**)
•   The order of how the work will be done (**Activity Sequencing**)
•   An estimate of the resources needed (**Activity Resource Estimating**)
•   An estimate of the duration of each activity (**Activity Duration Estimating**)
•   A company calendar identifying what are working and non-working days
•   Imposed dates & milestones
•   Assumptions & Constraints
•   Risk management plan-because it includes a schedule and budget for performing Risk Identification, Qualitative Risk Analysis and other risk management activities
•   Risk register-because it includes risks known to date
•   Leads and lags

There are 2 major categories of time constraints (**Project Scope Statement**) during this development :
•   **imposed dates on activity starts or finishes**
•   the project **sponsor**, project **customer**, or other **stakeholders** often dictate key events or major milestones affecting the completion

PERT
A method to analyse the tasks involved in completing a given project, especially the time needed to complete each task, and identifying the minimum time needed to complete the total project.
Formula : (P + 4M + O) / 6
Standard Deviation of an activity : (P – O) / 6 [shows the amount of uncertainty or risks involved in the estimate for the activity]
Variances of an activity : [Standard Deviation] ^{2}

Critical Chain Method
This TT modifies the project schedule to account for **limited resources**, mixes **deterministic** and **probabilistic** approaches, & puts more emphasis on the **resources**. If resources are always available in unlimited quantities, then a project's Critical Chain is identical to its Critical Path. This technique involves **adding duration buffers, which are not actual activities**.

Critical Path
Generally, but not always, the sequence of schedule activities that determines the duration of the project. Generally, it is the longest path through the project. However, a critical path can end, as an example, on a schedule milestone that is in the middle of the project schedule and that has a finish-no-later-than imposed date schedule constraint.

Critical Path Method
The essential technique for using CPM is to construct a model of the project that includes the following:
•   a list of **ALL activities** required to complete the project (WBS)
•   the time (**duration**) that **each activity** will take to completion
•   the **dependencies between** the **activities**

Using these values, CPM calculates **the longest path of planned activities to the end of the project**, **without** regard to resource limitations, and the earliest and latest that each activity can start and finish without making the project longer. This process determines which activities are "**critical**" (i.e., **on the longest path**) and which have "**total float**" (i.e., **can be delayed without making the project longer**). The Critical Path is the longest duration path through a network diagram and determines the shortest time to complete the project, which :
•   Helps prove how long the project will take
•   Helps the project manager determine where best to focus her project management efforts (**prioritise**)
•   Helps determine if an issue needs **immediate attention**
•   Provides a vehicle to **compress** the schedule during project planning and whenever there are changes
•   Provides a vehicle to determine which activities have **float** and can therefore be **delayed without delaying the project**

Float (Slack)
Activities on the critical path almost always have **zero float**. Critical path activities that are delayed or have dictated dates can result in **negative float**.
- Total float (slack) - The amount of time an **activity** can be delayed **without delaying** the project **end date** or and intermediary milestone.
- Free float (slack) - The amount of time an **activity** can be delayed **without delaying** the early **start date** of its successor(s).
- Project float (slack) - The amount of time a **project** can be delayed **without delaying** the externally imposed project **completion date** required by the customer, management, or previously committed to by the project manager.

Remember :
- there can be more than one Critical Path, which **increase the risks**.
- a Critical Path can change.
- the network diagram does not change when the end date changes, but the project manager should investigate options, such as **fast tracking** and **crashing** the schedule, to meet the new date and then, with approved changes, change the network diagram accordingly.
- when a project has a **negative float**, the project manager should consider to **compress the schedule**.

Schedule Compression : ,shorten the project schedule **without** changing scope.
It is done :
- during Project Planning to see if the desired completion date can be met, and what will have to change to make that date
- during Integrated Change Control to look at the schedule impacts of changes to time, cost, scope, and risk
- before finalizing the schedule

The impacts of different schedule shortening options :

Fast track	Add **risks** and may add management time for the project manager Involves **re-sequencing of activities** (**put activities in parallel**) on the network diagram
Crash	Add **costs** and may add management time for the project manager Involves putting **more resources** on the Critical Path (no changes in the network diagram)
Reduce scope	Could save cost & time and may negatively impact customer satisfaction
Cut quality	Could save cost & resource, may increase risk, and requires good metrics

Monte Carlo Analysis
- a technique that **computes** or **iterates**, the project **cost** or project **schedule** many times using input values selected at random from **probability distributions of possible costs or durations**, to calculate a distribution of possible **total project cost or completion dates**.
- is a method of estimating uses a computer to **simulate the outcome** of a project making use of the three time estimates (**Optimistic**, **Pessimistic** and **Most likely**) for each activity and the network diagram. The simulation can tell you:
  - o the **overall** project risk
  - o that an estimate for an activity **needs to change**, but not what the activity estimates should be
  - o the probability of completing the project on **any specific day and any specific amount of cost**
  - o the probability of any activity actually being on the **Critical Path**
- help deal with "path convergence", places in the network diagram where multiple paths convergence into one or more activities, thus adding risk.

Resource Levelling
Refers to maintaining the **same number of resources** on the project for each time period, and has nothing to do with assigning activities or managing meeting. Levelling let schedule slip and cost increase in order to deal with a **limited amount** of **resource**, **resource availability**, and other **resource constraints**.

Milestone charts
- only shows major events (less detail)
- have no duration, only the completion of activities.
- part of the inputs to Activity Sequencing
- good tools for reporting to management & customer (because less detail)

Bar / Gantt charts
- **it is not a Project Management Plans**.
- it is completed **AFTER** a WBS & network diagram in the project management process.
- weak planning tools, but effective tools for **progress reporting** and **control**.
- it is designed to show a relationship of **activities to time**. This is best used when demonstrating **progress** or **status as a factor of time**.
- more comprehensive summary activity, sometimes referred to as a **Hammock** activity, is used between **milestones** or **across multiple interdependent work packages**
- only represent part of the triple constraints of projects, because they focus primarily on **schedule** management.
- **do not represent the size of a project or the relative size of work elements**, therefore the magnitude of a behind-schedule condition is easily miscommunicated. If two projects are the same number of days behind schedule, the larger project has a larger impact on resource utilization, yet the Gantt does not represent this difference.
- because the horizontal bars of a Gantt chart have a fixed height, they can misrepresent the time-phased workload (resource requirements) of a project.

A common error made by those who equate Gantt chart design with project design is that they attempt to define the project WBS **at the same time** that they define schedule activities.

A related criticism is that all activities of a Gantt chart show planned workload as constant. In practice, many activities (especially summary elements) have front-loaded or back-loaded work plans, so a Gantt chart with percent-complete shading may actually miscommunicate the true schedule performance status.

Requested Changes
The process of creating a final schedule could cause changes to the WBS, Project **Scope** Statement and other parts of the developing Project Management Plan. For example, the scheduling process determines that the desired project completion date cannot be met. The best option for that particular project is to **cut scope**. That scope change would likely affect the WBS.

Project Schedule, produces :
- A start & end date for each schedule activity
- Can be in the following graphic format :
  - Network diagrams
  - Bar charts, i.e. Gantt Chart
  - Milestone charts

Schedule Baseline, specific version of the project schedule, accepted & approved by the project management team as the project's schedule baseline.

I	TT	O
OPA, i.e. **project calendar**. ***Project Scope Statement***, ***Activity List*** ***Activity Attributes*** ***Project Schedule Network Diagrams*** ***Activity Resource Requirements*** ***Resource Calendar*** ***Activity Duration Estimates*** ***Project Management Plan***, mainly Risk Register.	Schedule Network Analysis, a technique that generates the project schedule, employs various schedule models. Critical Path Method Schedule Compression What-If Scenario Analysis, explore various scenarios using simulation tools (Monte Carlo) Resource Levelling Critical Chain Method Project Management Software Applying project & resource Calendars Adjusting Leads & Lags Schedule Model	**Project Schedule** Schedule Model Data, includes : • schedule milestones • schedule activities • activity attributes • Assumptions & Constraints **Schedule Baseline** Resource Requirements (Update) Activity Attributes (Update) Project Calendar (Update) Requested Changes Project Management Plan (Update)

Cost Estimating :
- Developing an **approximation** of the costs of the resources needed to complete project activities.
- Includes **identifying** and considering **various costing alternatives** (additional work), and whether the expected savings can offset the cost of the additional design work.
- Expressed in units of **currency** ($, Euro, Yen, etc) to **facilitate comparisons both within & across projects**.
- Expressed in units of **measures** (staff hours or staff days) to **facilitate appropriate management control**.
- When completed, Cost Estimating should result in estimates & supporting detail on how the estimates were derived. It can also result in changes to resources, schedule, & other parts of the Project Management Plan in order to decrease the project costs.

The costs for schedule activities are estimated for **all resources**, i.e. labour, materials, equipment, services, facilities, **inflation allowance**, contingency cost, that will be charged to the project. This is a **quantitative assessment** of the likely costs of the resources required to complete the schedule activity.

What is estimated? All the work needed to complete the project including:
- Quality & Risk efforts
- The project manager's time
- Costs of project management activities
- Costs directly associated with the project, including training for the project, paper, pencils, needed labour
- Office expenses for offices used directly for the project
- **Profit**, when applicable
- Overhead, such as management salaries, general office expenses

Accuracy of Estimates :
- **Rough Order of Magnitude** (ROM), made during the **Initiating Process**, and is in the range of **-50% to +100%** from actual
- **Definitive**, the estimate could become more refined to a range of **-10% to +15%** from actual

Order of Magnitude Estimate - (**-25% to +75 %**)
This is an approximate estimate made **without** detailed data, that is usually produced from **cost capacity curves**, scale up or down factors that are appropriately escalated and approximate **cost capacity ratios**. This type of estimate is used during the formative stages of an expenditure program for **initial** evaluation of the project.

Project Scope Statement, such as :
- **Constraints** : specific factors that can limit cost estimating options, i.e. limited project budget, delivery dates, available skilled resources, & organisational policies.
- **Assumptions** : factors that will be considered to be true, real, or certain
- **Requirements**, with **contractual** & **legal** implications, i.e. health, safety, security, performance, environment, insurance, intellectual property rights, equal employment opportunity, licences, and permits
- A **list of deliverables**, & **Acceptance Criteria** for the project & its products, services, & results.

Project Management Plan :
- ***Schedule Management Plan*** :
  - **Activity Resource Estimating**, determine the availability & quantities required of staff, equipment, & material needed to perform schedule activity.
  - **Activity Duration Estimating** affect cost estimates :
    - On any project where project budget includes an **allowance** for the cost of financing, interest charges, & where resources are applied per unit of time.
    - That have **time-sensitive** costs
- ***Staffing Management Plan***, staffing attributes and **personnel rates**.
- ***Risk register,*** where the **cost estimator** considers information on Risk Responses

Analogous Estimating (empirical analysis / top-down)

What	Advantages	Disadvantages
• Using the **previous** / **similar** projects • Uses **top-down** estimating techniques • No detailed info about the project • Uses **Expert Judgement** • Less costly but less accurate • The persons or group preparing the estimates have the needed expertise	• Quick • Activities need not be identified • Less costly to create • Gives the Project Manager an idea of the level of management's expectations • Overall project costs will be capped	• Less accurate • Estimates are prepared with a limited amount of detailed information & understanding of the project • Requires considerable experience to do well • Infighting to gain the biggest piece of the budget without being able to justify the need • Extremely difficult for projects with uncertainty • Does not take into account the differences between projects

Bottom-up Estimating

What	Advantages	Disadvantages
• Sum the cost of individual work packages • Typically motivated by size & complexity of the individual schedule activity/work package • Detailed estimating is done for each activity (if available) or work package (if activities are not defined), & the estimates are then rolled up into an **overall project estimate**	• More accurate • Gains buy-in from the team because the team creates estimates they can live with • Based on detailed analysis of the project • Provides a basis for monitoring and controlling, performance measurement & management	• Take time & expense • Tendency for the team to pad estimates unless taught about reserves • Requires that the project be defined & well understood before work begins • Requires time to break the project down into smaller pieces

Parametric Estimating (statistical)
• Uses a **statistical** relationship between historical data & other variables (i.e. lines of codes, required labour hour, square footage in construction).
• Produce high level of accuracy (uses **mathematical model**)
• For ex : [planned quantity of work to be performed * historical cost per unit]

Determine Resource Cost Rates, by :
• **Gathering quotes** to obtain the unit cost rates, i.e. staff cost/hour, etc.
• Obtaining data from **commercial databases** & seller published **price lists**.

Vendor Bid Analysis
In cases where projects are won under **competitive processes**, additional cost estimating work can be required of the project team to examine **the price of individual deliverables**, and derive a cost that **supports the final total project cost**.

Activity Cost Estimates, a **quantitative assessment** of the likely costs of the resources (i.e. labour, materials, equipment, services, facilities, info tech, inflation allowance, cost contingency reserve) required to complete schedule activities.

Activity Cost Estimates Supporting Detail (should be clear, professional, & complete picture) , should include :
• Description of the schedule activity's Project Scope of Work
• Doc of the basis for the estimate (i.e. how it was developed)
• Doc of any **Assumptions made & Constraints**
• Indication of the range of possible estimates or **Rough Order of Magnitude** (ROM)

Cost of Quality (COQ) [Technique] : Determining the costs incurred to **ensure** quality.
Prevention and Appraisal Costs (Cost of Conformance) include costs for **QP, QC, and QA** to ensure compliance to requirements (i.e., training, QC systems, etc.). **Failure costs** (Cost of Non-Conformance) include costs to rework products (poor quality) , components, or processes that are non-compliant, costs of warranty work and waste, and loss of reputation.

I	TT	O
EEF [marketplace conditions & commercial databases] OPA : • Cost estimating policies & templates • Lessons learned & historical information • Project team knowledge & project files ***Project Scope Statement*** ***WBS & WBS Dictionary*** ***Project Management Plan***	**Analogous + Bottom-up + Parametric Estimating + Determine Resource Cost Rates** Project Management Software Vendor Bid Analysis Reserve Analysis / Contingency Allowances : • Used at the discretion of the project manager to deal with anticipated events ("**known unknowns**" & part of **Project Scope** & **Cost baseline**). **Cost of Quality**	**Activity Cost Estimates** **Activity Cost Estimates Supporting Detail** Requested Changes, that may affect the **Cost Management Plan**, **Activity Resource Requirement**, & other components of the **Project Management Plan**. Cost Management Plan (updates)

Cost Budgeting :
• Aggregating the estimated costs of **individual activities** or **work packages** to ESTABLISH a **cost baseline**.
• Project Scope Statement provides the **summary budget**.
• The schedule activity or work package cost estimates are **prepared PRIOR to the detailed budget requests & work authorisation**.

Cost Aggregation / Cost Budgeting steps :
Activities -> Work Packages -> Control Account -> Project -> Contingency Reserve -> Cost Baseline -> Management Reserve -> Cost Budget

Reserve Analysis, which establishes **Contingency Reserves** (is for the **risks remaining** after Risk Response Planning).
[**Management Contingency Reserves** are:
- budgets reserved for **unplanned changes** (**unforeseen risks**) to project scope & cost
- **not a part** of the project cost baseline, but **included** in the budget for the project
- **not distributed** as budget, so they're not a part of the Earned Value calculation.]

Managerial Reserves
Reserve accounts under the sole authority of senior management that can be used to allow for **unbudgeted expenses** or **transfer of funds** between strategy areas lacking sufficient budgeted funds or to cover cost overruns.

After **Cost Baseline & Cost Budget** are **completed**, **estimators** will compare these numbers to **Parametric Estimates**, for a sanity check of the detailed & high-level estimates. The detailed estimate is checked against these Parametric Estimates, & the difference are investigated and justified.

The next thing to be checked is **cash flow** (part of funding limit reconciliation). Funding may not be available when needed, causing changes to the other parts of the project and iterations of the project management plan (e.g., we will need $500,000 to purchase the equipment on June 1, but the money will not be available until July 1. We will have to move this activity to later in the schedule). The **cost baseline** therefore is **time-phased** and may be shown as an S-curve.

Before the proposed Cost Baseline & Cost Budget becomes final, **reconciliation** with any cost constraints in the **Preliminary Project Scope Statement** is needed. Such as meeting with management, justifying if their cost can be met, & proposing options to **decrease** costs. This is part of Project Manager's responsibility to **reconcile** in this way. Such reconciliation is part of **Integration**.

Parametric Estimating
It involves using project characteristics (parameters) in a **mathematical model** to **predict total project costs**. Cost & accuracy of parametric model are reliable when :
- historical info used to develop the model is **accurate**
- parameters used in the model are readily **quantifiable**
- **model is scalable (works for large and small project)**

Contingency Reserve [Output/Input] : The amount of funds, budget, or time needed **above the estimate** to **reduce** the risk of overruns of project objectives to a level acceptable to the organization. It should be **added to the base costs** of the project to account for risks.

I	TT	O
Project Scope Statement, i.e. **funding constraints** ***WBS & WBS Dictionary*** ***Activity Cost Estimates*** ***Activity Cost Estimates Supporting Detail*** ***Project Schedule***, includes planned start & finish dates for the project's schedule activities, schedule milestones, work packages, planning packages, & Control Account. ***Resource Calendars*** ***Contract***, any info related to what products, services, or results have been **purchased** ***Cost Management Plan***	Cost Aggregation Reserve Analysis Parametric Estimating Funding Limit Reconciliation, such as cash flow.	**Cost Baseline** is : - a time-phased budget used as a basis against which to measure, monitor, & control overall cost performance on the project - developed by **summing estimated costs by period** - displayed as an S-curve - must include a **contingency reserve** for risks Project Funding Requirements XXXX Cost Management Plan (updates) Requested Changes

Quality Planning :
- **identifying** which **quality standards** are relevant to the project & determining how to satisfy them.
- performed in parallel with other process, i.e. required changes in the product to meet quality standard may require cost or schedule adjustment.
- delivering precisely **what is promised**.
- the Project Charter and Project Scope Statement are needed **BEFORE** Quality Planning can begin.
- involves determining **what work will need to be done to meet the standards(found or created)**, in which work can be **added to the WBS**, resources can be changed and extra actions by the project manager **added** to the Project Management Plan.
- must be balanced with the other components of the "**triple constraint**"

Quality is planned, designed, and built in – not inspected in.

Standard
A standard is an agreed upon process to work or achieve a result. A standard is often strenuously tested before it is instituted, in order for it to become the recommended standard. Standards come from within the organization, or from government or professional associations. Standards are invaluable to **prevent reinventing the wheel** on the project, as they help get the work done faster and with higher quality.

Quality Policy
As endorsed by the senior management, the Quality Policy is the intended direction with regard to quality, adopted "as is" for use by the project.

Thresholds
Which are defined as Cost, Time, or resource value used as parameters, can be part of **Project Scope Statement**. If these threshold values are exceeded, it will require action from the project management team.

Acceptance Criteria
Includes performance **requirements** & **conditions** that must be achieved before project deliverables are accepted.

Formal acceptance
Validates that all **Acceptance Criteria** have been **satisfied**.

Cost-Benefit Analysis
The **main benefit** of meeting quality requirements is less rework, which means higher productivity, lower costs, & increased stakeholder satisfaction. The **main cost** of meeting quality requirements is the expense associated with Project Quality Management activities.

Quality Management Plan
Includes the following :
- What are the standards for this project
- describe how the project management team will **implement** the performing organisation **quality policy**.
- provides input to the overall Project Management Plan & address QC, QA, & continuous process improvement for the project
- Who'll be involved in managing quality, when & what will their specific duties
- Review of earlier decisions (**concepts, designs & tests**) to make sure they're correct, **to prevent a rework** (thus reduce the costs & schedules).
- Meetings about quality
- Reports that address quality
- Metrics used to measure quality
- What parts of project or deliverables will be measured and when

Quality Metrics
- a metric is an operational definition that describes what something is & how the QC process measures it.
- a measurement is an actual value.
- is used in the QA & QC process, for ex, **defect density, failure rate, availability, reliability, & test coverage**

Quality Checklists
- is a structured tool to verify that a set of required steps has been performed
- may available from professional associations or commercial service providers
- used in the **QC** process

Process Improvement Plan, steps for analysing processes to **eliminate wasteful activities**, such as :
- **process boundaries**, describes the purpose, start & end of process, input & output, data required.
- **process configuration**, a flowchart of process to facilitate analysis.
- **process metrics**, maintain control over status of processes.
- **targets for improved performance**.

I	TT	O
EEF, i.e. gov regulations, rules, standards, etc. OPA, i.e. quality policy (the project management team is responsible for ensuring that the project stakeholders are fully aware of the policy through the appropriate **Information Distribution**) *Project Scope Statement*, which is a key input since it documents major project deliverables, objectives that serve to define requirements, threshold, and **Acceptance Criteria**. *Project Management Plan*	**Cost-Benefit Analysis**, i.e. cost-benefits trade-off Benchmarking, to look at **past project** to determine ideas for improvement on the current project and to provide a basis to use in measurement of quality performance. Design of Experiments (DOE) : • a **statistical** method to identify factors that may improve the quality or optimise the product. • provides a **statistical framework** for systematically changing all of the important factors, instead of changing the factors one at a time. **Cost of Quality (COQ)** **Additional Quality Planning Tools**, i.e. brainstorming, affinity diagrams, **force field analysis**, nominal group technique, matrix diagrams, flowcharts, & prioritisation matrices.	**Quality Management Plan** **Quality Metrics** **Quality Checklists** **Process Improvement Plan** **Quality Baseline** : • records the quality objectives • is the basis for measuring & reporting quality performance as part of the **Performance Measurement Baseline**. Project Management Plan (updates), incorporation of the **Quality Management Plan** & **Process Improvement Plan**.

HR Planning :
Identifying & documenting project **roles**, **responsibilities**, and **reporting relationships**, as well as creating the **Staffing Management Plan**.

EEF needed as an input :
- organizational, i.e. depts involved & relationship among them
- technical, i.e. different skills, disciplines, & specialities involved
- interpersonal, i.e. **relationship** among team members, their job descriptions, supervisor-subordinate & supplier-customer relationship, **cultural** & **language** differences that may affect working relationship, the level of trust & respect.
- logistical, i.e. **geographical location**, time zones
- political, i.e. individual goals & agendas of the potential project stakeholder, **informal power**,& **alliances**.
- Constraints that can limit this process (**CEO**) :
  - Collective bargaining agreements, i.e. **unions**
  - Economic conditions, i.e. hiring freezes, reduces training funds, or a lack of travel budget
  - Organisational Structure, whose basic structure is a **weak matrix** (weak role for the project manager)

OPA needed as an input :
- Templates, i.e. project organization charts, position description, project performance appraisal, & a **standard conflict management approach.**
- Check-lists, i.e. common project role & responsibilities, training, compliance issues, **reward ideas**

Organization Charts & Position Descriptions
All roles and responsibilities on the project must be clearly **assigned** and closely linked to the **Project Scope Statement** [**communication assigned responsibilities**] :

- **Hierarchical-type charts**, i.e. OBS, RBS, & WBS
  - o **WBS** : project deliverables are broken down into work packages
  - o **OBS** : project deliverables are broken down into departments (IT Dept, Account Dept, etc), units, or teams
  - o **RBS** :
    - project deliverables are broken down by type of **resources**
    - helpful in **tracking project costs**
    - can be aligned with the organisation's **accounting system**
    - can contain **resource categories** other than HR

- **Matrix-based charts** - For ex RAM (**Responsibility Assignment Matrix**) - a structure, chart, or table :
  - o that relates the project OBS to WBS to ensure that each component of the project's scope of work is assigned to a responsible person (**who do what**)
  - o to designate **roles**, **responsibilities**, and level of **authority** for a specific activities (show who is participant, who is accountable, who handles reviews, who provides input and who must sign off on specific work packages or project phases)
    A type of RAM is called **RACI**.

- **Text-oriented formats** - a document which describe **position** and **role-responsibility-authority** of team members.

- Other sections of the Project Management Plan, such as risk register lists risk owners, the communication plan lists team members responsible for communication activities, and the quality plan for QA & QC activities.

Networking
This includes proactive correspondence, luncheon meetings, informal conversations, & trade conferences, which will impact the **effectiveness** of various Staffing Management options.

Roles & Responsibilities, must address :
Role – the label describing the portion of a project for which a person is **accountable**, i.e. business analyst, testing coordinator, etc.
Authority – **the right to apply project resources, make decisions, and sign approvals**.
Responsibility – the work that a project team member is **expected to perform** in order to **complete** the project's activities.
Competency – the skill & capacity **required** to complete project activities.

Staffing Management Plan :
- a subset of Project Management Plan
- a document which describes **when & how** team members will be **added to & released** from the project**, and what plan to develop team members**
- items to consider :
  - o **staff acquisition**, i.e. will the staff is external, internal, or contractor ? Will the staff working from home or office ?
  - o **time table / Resource Histogram / bar chart** , that shows the number of resources used per time period or **role over time**.
  - o staff **release criteria**, when team members are released from a project at the **optimum time**, payment made for people who are finished with their responsibilities can be eliminated and the costs reduced. Morale is improved when **smooth transitions** to upcoming projects are **already planned**.
  - o **training** needs
  - o **Recognition** & **Rewards**, part of **Develop Project Team** - to be effective, must make the link between performance and reward clear, explicit and achievable (this is one of the best ways to gain cooperation). This may include **team's bonus plan**.
  - o compliance with laws, HR policies, **union contracts**.
  - o **safety hazards**

I	TT	O
EEF & OPA *Project Management Plan*, i.e. **Activity Resource Requirements** (part of **Project Time Management**)	Organization Charts & Position Descriptions **Networking** Organizational Theory, which provides information regarding the ways that people, team, & organisational units behave. This will shorten the amount of time needed to create the HR Planning outputs & improves the likelihood that the planning will be effective.	**Roles & Responsibilities** **Staffing Management Plan** Project Organization Charts, which displays the team member & their reporting relationship.

Communications Planning :
- Determining the **information & communications needs of the stakeholders, ONLY STAKEHOLERS,** (who needs what information, when they'll need it, how it'll be given to them, how frequently, and by whom).
- Usually it's done as part of the **earliest** project phases.
- Often entails **creation of additional deliverables** that require additional time & effort. Thus, **the project's WBS, project schedule, & project budget are updated accordingly**.

Communication is not complete until the sender confirms the receiver has understood the intended message.

Communications Technologies
Factors that can affect the project :
- urgency of the need for information
- availability of technology
- the expected project staffing
- the length of the project
- the project environment – does the team meet & operate on a face-to-face basis or in a virtual environment ?

Communications Management Plan – **how you will manage & control communications**, is contained in or a subsidiary of Project Management Plan, provides :

- **Stakeholder communication requirements (stakeholder requirements & expectations provide an understanding of stakeholder goals, objectives, & level of communication during the project. The needs & expectations are identified, analysed, & documented in this plan)**
- Info to be communicated (format, content, & level of detail)
- Person responsible for communicating the info
- Person/groups who will receive the info
- Methods or technologies to convey the information
- Frequency of communication.
- Escalation process-identifying time frame and the management chain for escalation of issues that can't be resolved at a lower staff level
- Method for updating & refining the Communication Management Plan as the project progresses & develops.
- Guidelines for project status meetings, project team meetings, e-meetings, & e-mail.

A sample attributes of this plan can include :
- Comm. items (what info)
- Purpose & Frequency
- Start/End dates
- Format / medium
- Responsibility

I	TT	O
EEF OPA, i.e. lessons learned & historical information. **_Project Scope Statement_** – provides a common knowledge of project scope among stakeholders [**Stakeholder analysis is completed as part of the Scope Definition process**] **_Project Management Plan_** : • Constraints, i.e. geographic locations, incompatible communication software, or limited communications technical capabilities. • Assumptions – depend upon the particular project.	Communications Requirements Analysis : • **determine & limit** who will communicate with whom and who will **receive** what information. • the total number of communication channel is $n(n-1)/2$, where n=number of stakeholders/people. Communications Technologies	**Communications Management Plan**

Risk Management Planning :

- Deciding how to approach, plan, & execute the risk management activities for a project.
- Should be **completed early** during Project Planning, since it is crucial to successfully performing other process.
- **Tailored the risk rating rules**
- An input to the **Plan Purchases and Acquisitions** and **Plan Contracting Processes** in **Procurement Management**.
- An input to **Cost** and **Time Estimating**, **Schedule Development** and **Cost Budgeting**, because it contains **budgets** and **schedules**
- **Risks categories** are lists of common areas or sources of risk experienced by the company or similar project. These help analyse & identify. For example :
  - External (gov, regu, market shifts)
  - Internal (time, costs, HR, material)
  - Technical or technology
  - Unforeseeable
  - Customer ,suppliers ,customer's customers
  - Project management (lack of or poor)
  - Resistance to change
  - Stakeholder / sponsor-caused risks
  - Cultural risks
  - Risks origin (schedule, cost, quality, performance, scope, resource, customer/stakeholder satisfaction)

Risk Management Plan
It includes :
- **Methodology** - how you'll perform the risk management using different approaches, tools, & data sources.
- **Roles & Responsibilities** - who will perform and clarify their responsibilities
- **Budgeting** – assigns resources & estimates cost for the risk management process for **inclusion in the project cost baseline**.
- **Timing** (when & how often the Risk Management process will be performed and **establishes risk management activities to be included in the Project Schedule**). Risk Management should start **as soon as** you have the appropriate inputs, **repeated** throughout the **project life cycle**.
- **Risk categories or Risk Breakdown Structure (RBS)**
- Definitions & standards of **Risk Probability & Impact matrix** - helps **standardize** these interpretations and also helps **compare risks** (for use in **Qualitative Risk Analysis ???**) between projects :
  - relative scale for probability : "very unlikely" to "almost certainty".
  - relative scale for impact : rank-ordered descriptor ('very low', 'low', 'high', etc)
  - linear/non-linear scale for impact : to avoid high impact threats or to exploit high impact opportunities
- **Probability & Impact Matrix** : risks are **prioritised** (high, moderate, or low) according to their potential implications for meeting the project's objectives, and **reviewed** & **tailored** to he specific project during the Risk Management Planning process.
- **Revised stakeholders tolerances** - tolerances **should not be implied**, but uncovered in **Project Initiating** and clarified or refined continually.
- **Reporting formats** - describes the content and format of the Risk Register as well as any other risk reports required & defines how the outcomes of the risk management processes will be **documented**, **analysed**, and **communicated**.
- **Tracking**, i.e. auditing, documenting if risks occur

Risk Categories
Risk categories are lists of common areas or sources of risk experienced by the company, or on similar projects. The categories help analyse and identify risks on each project (**Risk Identification**) . There are many ways to **classify** or **categorize** risk, such as:

- **external** - regulatory, environmental, government, market shifts
- **internal** - time, cost, scope changes, inexperience, poor planning, people, staffing, materials,equipment
- **technical** - changes in technology
- **unforeseeable** - only a small portion of risks (some say about lo percent) are actually unforeseeable

Risk categories may be **revisited** during the **Risk Identification** process. A good practise is to **review** them during the **Risk Management Planning** process **PRIOR** to their use in the **Risk Identification**. Risk categories based on prior project may need to be **tailored**, **adjusted**, or **extended** to new situations before these categories can be used on the current project.

Source of risk or risk categories, that can be organised into an **RBS** :

- **schedule risk** - "The hardware may arrive earlier than planned, allowing work package XYZ to start three days earlier."
- **cost risk** - "Because the hardware may arrive later than planned, we may need to extend our lease on the staging area at a cost of $20,000."
- **quality risk** - "The concrete may dry before winter weather sets in, allowing us to start successor work packages earlier than planned."
- **performance or scope risk** - "We might not have correctly defined the scope for the computer installation. If that proves true, we will have to add work packages at a cost of $20,000."
- **resources risk** - "Riki is such an excellent designer that he may be called away to work on the new project everyone is so excited about. If that occurs, we will have to use someone else and our schedule will slip between 100 and 275 hours."
- **customer satisfaction (stakeholder satisfaction) risk** - "There is a chance that the customer will not be happy with the XYZ deliverable and not tell us, causing at least a 20 percent increase in communication problems."

Definitions & standards of Risk Probability & Impact
General definitions of probability levels and impact levels are tailored to the individual project during the Risk Management Planning process for use in the Qualitative Risk Analysis process.
Probability scale :

- from "very unlikely" to "almost certainty"
- numerical scale, i.e. 0.1, 0.3, 0.5, 0.7, 0.9
- degree of maturity of the project design

Impact scale
Reflects the significance of impact, either negative for threat or positive for opportunities. They are specific to the objective potentially impacted, the type & size of the project, the organisation's strategies & financial state, and the organisation's sensitivity to particular impacts :

- rank-ordered, i.e. "very low", "low", "moderate", "high", and "very high"
- linear, i.e. 0.1, 0.3, 0.5, 0.7, 0.9
- non-linear, i.e. 0.05, 0.1, 0.2, 0.4, 0.8 [may represent the organisation's desire to **avoid high-impact threats** or **exploit high-impact opportunities**]

Probability and Impact Matrix [Tool] : A common way to determine whether a risk is considered low, moderate, or high by combining the two dimensions of a risk: its **probability of occurrence**, and its **impact on objectives if it occurs**

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EEF – attitudes toward risk & risk tolerance OPA – predefined approaches to risk management, i.e. risk categories, common definition of concepts & terms, roles & responsibilities, and **authority levels** for **decision-making**. ***Project Scope Statement*** ***Project Management Plan***	Planning Meetings & Analysis : • everyone is involved in the meeting • basic plan for conducting the **risk management activities** • develop **risk cost element** for project budget • develop **schedule activities** for project schedule • to assign **risk responsibilities**	**Risk Management Plan** – describes how risk management will be **structured** & **performed** on the project.

Risk Identification :

- Finding which risks might affect the project & documenting their characteristics
- **Everyone** is involve in this process (to identify more risks, the input of other **stakeholders** is needed.)
- It's an **iterative** process, because new risks may become known as the project progresses.
- **Cannot be completed until a Project Scope Statement and WBS have been created** and the project team knows "what is the project."
- Leads to **Qualitative** & **Quantitative Risk Analysis**
- The sponsor may supply a list of risks in the **Preliminary Project Scope Statement**
- This process happen at the *onset* of the project (during the **Initiating** & **Planning** process)
- When a project has **deviated so far** from the baseline the best thing to do is to update Risk Identification and analysis.

When a new risk is identified, it should go through the **Risk Management** process. You first need to **determine the probability and impact** of the risk and then try to **diminish impact through Risk Response Planning**. Only after these efforts should you **add reserves**, and it is better to determine reserves based on a detailed analysis of risk.
Types of Risk :

- **Business** - normal risks that offer gain and loss
- **Pure** / **Insurable** - only loss, i.e. property damage, indirect consequential loss, legal liability, and personnel. For risk we can outsource, we have contract. For pure risks, we obtain insurance.

Information Gathering Techniques (BIRDS) :

- **Brainstorming :** a general data gathering & creativity technique used to identify **risks**, **ideas**, or **solutions** to issues by using a group of team

members or Subject Matter Expert (SME / **facilitator**). Its session is **structured** so that each participant's ideas are recorded for **later analysis**. Risks are then **identified** & **categorised** by type of risk and their definitions are **sharpened (RBS** used as framework).

- **Interviewing** - this consists of the team or project manager interviewing project participants, stakeholders or experts to identify risks on the project or a specific element of work
- **Root cause identification**, an inquiry into the essential cause of risk
- **Delphi technique :** a technique used to build **consensus** of experts who participate **anonymously**. A request for information is sent to the experts, their responses are compiled, and the results are sent back to them for further review until **consensus is reached**. This helps **reduce bias** in the data & keeps any one person from having **undue influence** on the outcome. This technique is most commonly used to obtain expert opinions **on technical issues, the necessary project or product scope, or the risks**.
- **Strength, weakness, opportunities, & threats (SWOT) analysis**

Check-lists Analysis
It's the check-list based on historical info & knowledge, and the lowest level of the RBS described in Risk Management Planning.
The check-list can **provide assistance** in **ensuring** that certain steps that need to be completed are done **as planned**. Check-list should be **reviewed** during the **Project Closure** for further project.

Risk Diagramming Techniques (CSI) :
- **Cause-&-effect / Ishikawa / fishbone** diagram – useful for identifying **causes of risks**.
- **System / Process Flow charts** – shows how various elements of a system **interrelate**.
- **Influence diagrams** – showing causal influences, time ordering of events

Risk Register
Think of it as **one document for the whole Risk Management** process that will be constantly updated with information as Risk Identification and Risk Management processes are completed. The Risk Register becomes part of the Project Management Plan and is also included in historical records which will be used for future projects. **It is the only output of many of the Risk Management processes.**
Risk Register is the place where most of the risk information is kept. This produces :
- List of identified risks
- List of potential responses, added to the **Risk Register** as they are identified, and analysed later as part of **Risk Response Planning**.
- Root causes of risk
- **Updated risk categories, the RBS developed in the Risk Management Planning process may have to be enhanced or amended, based on the outcomes of the Risk Identification process.**

Risk assessment : from Risk Identification to Quantitative Risk Analysis

Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis : This information gathering technique examines the project from the perspective of each project's strengths, weaknesses, opportunities, and threats to **increase the breadth of the risks** considered by risk management.

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EEF, i.e. published info, benchmarking, etc OPA, i.e. info from previous project, lessons learned. *Project Scope Statement*, i.e. project Assumption [**uncertainty in project Assumption is a potential causes of risk**] *Risk Management Plan*, i.e. assignment of **Roles** & **Responsibilities,** as specified in RBS. *Project Management Plan*, i.e. Schedule, Cost, & Quality Management Plan	Documentation Reviews [what is and what is not included in the **Preliminary Project Scope Statement**, the **Project Charter** and later documents can help identify risks]. **Information Gathering Techniques** Check-lists Analysis Assumptions Analysis : - Explores the **validity** of assumptions - Identifies risks from **inaccuracy**, **inconsistency**, or **incompleteness** of assumption **Risk Diagramming Techniques**	**Risk Register**

Qualitative Risk Analysis :
Methods for **prioritising the identified risks** (to avoid cost , time, and resources) for Quantitative Risk Analysis & Risk Response Planning by assessing & **combining** their **probability of occurrence & impact**. The activities of this process are **probability and impact definition, assumptions testing and probability and impact matrix development**. Qualifying the risk will give you an **indication** of how great the risk is. That information will help you determine how to proceed.

This process is a **subjective** analysis of the risks **identified** in **Risk Identification**:
- **the probability of each risk occurring (e.g., Low, Medium, High or 1 to 10)**
- the **impact** (amount at stake, or consequences, positive or negative) of each risk occurring (e.g., Low, Medium, High or 1 to 10)

This process :
- usually a **rapid & cost-effective** means of establishing priorities for **Risk Response Planning**
- lays the foundation for Quantitative Risk Analysis
- requires output of the Risk Management Planning & Risk Identification
- the project's risk can be compared to the **overall** risk of other projects
- the project may be **selected**, **continued**, or **terminated**
- l**ead into Quantitative Risk Analysis or Risk Response Planning, depending on the need of the project & the performing organization.**

Risk rating
- usually specified in advance of the project, and included in OPA.
- can be tailored in the Risk Management Planning

Risk Probability & Impact Assessment :
- investigates the **likelihood** (probability) that each specific risk will occur

- investigates the **potential effect** (impact) on a project objective (time, cost, scope, quality, threats, & opportunities)
- risks are **assessed** in **interviews** / **meetings**
- Expert Judgement and Facilitator are **required**
- **the level of probability** for each risk & its **impact** on each objective is evaluated during the interview or meeting
- risk probabilities & impacts are **rated according to the definitions** given in the Risk Management Plan [low rating of probability & impact sometimes will not be rated, but will be included on a **watchlist** for future **monitoring**].

Risk Probability & Impact Matrix :
- risks can be **prioritised** based on their **risks rating**
- ratings are assigned based on their **assessed probability** & **impact**
- used to **sort** or **rate** risks to determine which ones warrant a **risk response**

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OPA, i.e. **data** about risks on past projects & lessons learned knowledge base. _**Project Scope Statement**_, to help **evaluate the degree** in identified risks. _**Risk Management Plan**_, i.e. **roles** & **responsibilities** for conducting risk management, budgets, & schedule activities for risk management, risk categories, definition of probability & impact, the probability & impact matrix, & revised stakeholders' risk tolerance. _**Risk Register**_, i.e. **List of identified risks**	**Risk Probability & Impact Assessment & Matrix** Risk Data Quality Assessment : • extent of the understanding of the risk • data available about the risk • quality of the data • reliability & integrity of the data Risk Categorization, by : • source of risk, by using RBS • area of the project affected, using WBS [grouping risks by **common root causes** can lead to developing effective risk response]. **Risk Urgency Assessment** - urgent risks may then move, independently, right into **Risk Response Planning**, or they may be simply the first ones for which you plan a response.	Risk Register (Update) includes : • Relative ranking or priority list of project risks • Risks categorization • List of risks requiring **urgent** response • List of risks for **additional** analysis & response • Watch lists of **low priority** risks (to be **documented** for later revisit during **Risk Monitoring** & **Control**) • Trends in Qualitative Risk Analysis results

Quantitative Risk Analysis :

A **numerical** analysis of the Probability & Impact (**amount at stake** or **consequences**) of the **highest risks** (that have been **prioritised**) on the project from **Qualitative Risk Analysis**, to:
- Determine which risk events need **responses ,** determine **overall** project risk (**risk exposure**), & determine cost & schedule reserves
- Determine the **quantified** probability of meeting project objectives, i.e. :
  - We have 80% chance to complete within the 6 months required
  - We have 75% chance to complete within the $100 budget.
- Identify risks requiring the **most attention**
- Create **realistic** & **achievable** cost, schedule, or scope targets.

Quantitative Risk Analysis is **not required** for all projects and **may be skipped** in favour of moving on to Risk Response Planning. Proceed with Quantitative Risk Analysis only **if it is worth** the time and money on your project. This process should be **repeated** after **Risk Response Planning**, as well as **part** of **Risk Monitoring & Control,** to determine if the overall project risk has been satisfactorily **decreased**. **Trends** can indicate the need for more or less risk management action. It is an input to the Risk Response Planning process.

Quantitative Risk Analysis includes:
- further investigation into the **highest risks** on the project
- determination of the type of probability distribution that will be used, e.g., triangular, normal, beta, uniform or log normal distributions
- **Sensitivity Analysis** - determining which risks have the **most impact** on the project
- determining how much quantified risk the project has through Expected Monetary Value or Monte Carlo analysis.

Quantitative probability & impact can be determined :
- Interview
- Cost & time estimating
- Delphi technique, use of historical records, & Expert Judgement
- EMV (Expected Monetary Value) analysis, used in **quantifying** the **overall** risk on the project
- Monte Carlo analysis :
  - **Evaluates** the **overall** project risk
  - Provide the **probability** of completing the project at **any day at any cost**
  - Provide the **probability** of any activity actually being on the **Critical Path**
  - Takes into account path convergence
  - Translate **uncertainties** into impact to the total project
  - Can be used to assess **Cost & Schedule impacts**
  - Results in **probability distribution**

Data Gathering & Representation Techniques (PIE) :
- **Probability Distribution**, i.e. triangular, normal, beta, uniform, or log normal distributions - Continuous probability distribution represent the uncertainty in values.
- **Interview** & further investigation - Used to **quantify the probability and impact** of risks. The information needed would be gathered on the **Optimistic** (low), **Pessimistic** (high), and **Most-likely** scenario [**three-point estimates**]. Documenting the rationale of the risk range is an important, because it can provide information on **reliability& credibility** of the analysis.
- **Expert Judgement**, i.e. **statistical experts**.

Quantitative Risk Analysis & Modelling Technique (MEDS) :
- Modelling & Simulation, i.e. **Monte Carlo,** to :
  - **Quantify the possible outcomes**

- o **Asses the probability of achieving specific project objectives**
- o Identify **realistic** & **achievable** Cost, Schedule, or Scope targets, given the project risks
- o **Determine the best project management decision when some conditions or outcomes are uncertain**
- Expected Monetary Value (**EMV**) Analysis - a statistical concept that calculates the average outcome ([**probability * impact**])
- **Decision Tree Analysis** :
  - o Used to make decisions regarding individual risk when there is **uncertainty**
  - o Used to help make more informed decisions by taking into account the risks, probability & impact
  - o **Takes into account future events in trying to make a decision today**
  - o Calculates the EMV in more complex situation
  - o Involves mutual exclusivity
  - o **Is a model of a real situation**
  - o **used to make a decision between alternative capital strategies, such as build or upgrade.**
- **Sensitivity Analysis**, helps to determine which risks have the **most potential impact** (i.e. **Tornado diagram**, which is useful for comparing relative importance of variables that have a high degree of **uncertainty** to those that are more stable.)

For a **Cost Risk Analysis**, a simulation can use WBS or **Cost Breakdown Structure** as its model.
For a **Schedule Risk Analysis**, the Precedence Diagramming Model (**PDM**) schedule is used.

Expected Monetary Value (EMV) Analysis : A statistical technique that calculates the average outcome when the future includes scenarios that **may** or **may not happen**. A common use of this technique is within **decision tree analysis**. Modelling and simulation are recommended for **cost** and **schedule risk analysis** because it is more powerful and less subject to misapplication than expected monetary value analysis.

I	TT	O
OPA ***Project Scope Statement*** ***Risk Management Plan***, which include **roles** & **responsibilities** for conducting Risk Management, budget, and Schedule Activities for Risk Management, risk categories, the RBS, and revised stakeholder risk tolerances ***Risk Register***, which include the **List of Identified Risks**, the relative ranking or priority list of project risk, and the risks grouped by categories. Project Management Plan, which are : • **Project Schedule Management Plan** – establishes criteria for developing & controlling the project schedule. • **Project Cost Management Plan**- establishes criteria for planning, structuring, estimating, budgeting, & controlling project costs.	**Data Gathering & Representation Techniques (PIE)**. **Quantitative Risk Anal & Modelling Technique (MEDS)**	Risk Register (Update) includes : • **Prioritised list of quantified risks** – those that pose the greatest threat or present the greatest opportunity to the project. • **Amount of contingency time** & **cost reserves needed**, i.e. this project requires an additional time and cost to accommodate the project risks • Possible realistic & achievable completion dates & costs with confidence levels vs. the cost & time objectives for the project, i.e. We're 95% confident that we can complete this project on … • The **quantified probability** of meeting project objectives • **Trends in Qualitative Risk Analysis results**

Risk Response Planning :
- to develop options & actions to **enhance opportunities**, & to **reduce threats** to project objectives.
- to **follow Qualitative & Quantitative Risk Analysis** processes.
- includes the **identification** & **assignment** of one or more person [**risk response owner**] to take **responsibility**
- addresses the risks by their **priority**, inserting **resources** & **activities** into the budget, schedule, & Project Management Plan.
- **non-critical risk should be documented in a watch list and revisit periodically**

Responses may include doing something to :
- Eliminate the threats **before** they happen
- **Decrease** the probability & impact of **threats**, & **increase** the probability & impact of **opportunities**

In preparing the Risk Response Plan, the **sponsor** may have the **least knowledge** of what will work to solve the problems. Sponsors need to be involved in the project and **help identify risks**. They **may even approve** the response plans created by others, but they **would not generally be major contributors** to response plans.

Some strategies involve **changing** the planned approach to completing the project, e.g., changes to the WBS, Quality Management Plan, Resources, Communications, schedule or budget. Other strategies (called **Contingency Responses**) involve simply coming up with a plan to be implemented when and if the risk occurs.

For the remaining (**residual**) risks, do something IF :
- Risk happens : **Contingency Plans**
- Contingency Plans not effective : **Fallback Plan**

Several risk response strategies are available. The **strategy or mix of strategies** most likely to be effective should be selected for **each risk**. Risk analysis tools, such as **Decision Tree Analysis**, can be used to choose the **most appropriate responses**. Then, specific actions are developed to implement that strategy. **Primary** and **backup strategies** may be selected. A **fallback plan** can be developed for implementation if the selected strategy turns out not to be fully effective, or if an accepted risk occurs. Often, a **Contingency Reserve** is allocated for time or cost. Finally, **Contingency Plans** can be developed, along with identification of the conditions that trigger their execution.

Responses strategies for threats [ATMA] :
- **Avoidance** (elimination/abatement) - **eliminating cause eliminates risk** by **changing** the Project Plan or protecting project objectives from its impact. Risks that arise **early** in the project can be avoided by **clarifying requirements, obtaining information, improving communication, or acquiring expertise.**
- **Transfer - deflect or share , not eliminate (** e.g. **Insurance, warranties)**. Contracts may be used to transfer liability for a specified risk. Use of **Cost-Type contract** may transfer the cost risk to the **buyer**, while a **Fixed-Priced contract** may transfer risk to the **seller**.

- **Mitigation** (reduction) - reduce the **Expected Monetary Value (EMV)**, reduce the **probability and/or impact** of an adverse risk event to an acceptable threshold. Taking **early action** to reduce the probability and/or impact of a risk occurring on the project is often more effective than trying to repair the damage after the risk has occurred. . **Float** can be use to mitigate potential risks. **Revising** the project's scope, budget, schedule or quality, preferably without material impact on the project's objectives, in order to reduce **uncertainty** on the project. Risk mitigation is done to attempt **to minimize the bad risk or maximize the good risk**. In this case, management is attempting to minimize the impact of a labour strike. Mitigation actions, such as **adopting less complex processes, conducting more tests, or choosing a more stable supplier**, are **more effective** than trying to repair the damage after the risk has occurred. Mitigation may require **prototyping**. **You could not mitigate the risk until you qualified the risk**. Where it is not possible to reduce probability, a mitigation response might address the risk impact by targeting linkages that determine the severity. For example, **designing redundancy into a subsystem** may reduce the impact from a failure of the original component.
- **Acceptance** - accept or retain consequences. 2 types: **Active Acceptance** (develop a **Contingency Plan**) or **Passive Acceptance** (no action).

Responses strategies for opportunities [SEE] :
- **Share -** sharing a positive risk involves **allocating ownership** to a 3rd party who is best able to capture opportunity for the benefit of the project. For example **partnerships**, teams, special-purpose companies, or **joint ventures**, which can be established with the express purpose of managing opportunities
- **Enhance (opposite of Mitigation) -** modifies the "size" of an opportunity by **increasing probability and/or positive impacts**, and by identifying and **maximizing** key drivers of these positive-impact risks, seeking to facilitate or **strengthen the cause of the opportunity**, and pro actively targeting & reinforcing its trigger conditions, may increase probability.
- **Exploit (opposite of Avoidance) -** directly exploiting responses include **assigning more talented resources** to reduce the time to completion, or to provide **better quality** than originally planned.

Responses strategies for both :
- **Acceptance** : **not to change the Project Management Plan** to deal with a risk, or is **unable to identify** any other suitable response strategy :
  - o **Passive Acceptance** - requires no action, leaving the project team to deal with the threats or opportunities.
  - o **Active Acceptance** - establishes a **Contingency Plan** (the allocation of time, cost, & resources) to handle. A decision to accept a risk must be communicated **back to** stakeholders. **A reserve fund is acceptance, so it would not reduce the probability or impact of risks**.

Response planning & Risk Mitigation sometimes called "**Response development**".

Whether responding to threats or opportunities :
- Strategies must be timely
- The effort selected must be appropriate to the severity of the risk
- One response can be used to address more than one risk
- More than one response can be used to address the same risk
- A response can address a root cause of risk
- Involve the team, stakeholders, & expert in selecting a strategy

Contingency Planning
The development of management plans to be invoked in the event of specified risk events. Examples include the provision and prudent management of a Contingency Allowance in the budget, the preparation of alternative schedule activity sequences, workarounds and emergency responses to **reduce** the impacts of particular risk events, and the evaluation of liabilities in the event of complete project shut down.

Updates to Risk Register :
- **Residual Risks** - risks which **remain AFTER Risk Response Planning**, and those that have been **accepted** for which **Contingency Plans** and **Fallback Plans** can be created. Residual risks should be properly **documented** and **reviewed** throughout the project to see if their ranking has changed.
- **Risk Response Owner** - a key concept in Risk Response Planning is that the project manager does not have to do it all and neither does the team. Each risk must be **assigned to someone** who may help develop the risk response and who will be assigned to carry out the risk response or "own" the risk. The risk response owner can be a **stakeholder** rather than a team member.
- **Secondary Risks** – **new risks** that arises as a direct result of implementing a **Risk Response**. Frequently, **what is done to respond to one risk will cause other risks to occur**. For example, a risk of fire can be allocated to an insurance company, potentially causing the risk of cash flow problems. Cash flow should then be analysed and if appropriate, added to the Risk Management process.
- **Risk Triggers** - events that trigger the contingency response. A project manager should identify the early warning signs (indirect manifestations of actual risk events) for each risk on a project so that they will know when to take action.
- **Contracts** - a project manager must be involved **BEFORE** a contract is **signed**. **Before the contract is finalized,** the project manager will have **completed** a risk analysis and included contract terms and conditions required to mitigate or allocate threats and to enhance opportunities.
- **Contingency Plans** - plans describing the specific actions that will be taken if the opportunity or threat occurs.
- **Fallback Plans** - specific actions that will be taken if the Contingency Plan is **NOT** effective. Think how prepared you will feel if you have plans for what to do if a risk occurs and what to do if that original plan does not work.
- **Contingency Reserves** -

First, realize that having reserves for schedule and cost is a **required** part of project management. You cannot come up with a schedule or budget for the project without them. Reserves are covered in the Cost chapter.
There can be two kinds of reserves for time and cost : **Contingency Reserves and Management Reserves**.
Contingency Reserves account for "**known unknowns**;" items you identified in **Risk Management**. They cover the **residual risks** in the project.
Management Reserves account for "**unknown unknowns**," items you **did not or could not identify** in Risk Management. Projects can have both kinds. The Contingency Reserve is calculated and is made part of the **Cost Baseline**. Management Reserves are estimated (e.g., 5 percent of the project cost) and are made a part of the **project budget**, not the baseline. Therefore, **management approval** is **needed** to make use of Management Reserves.

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Risk Management Plan, i.e. **roles & responsibilities**, risk analysis definition, **risk thresholds** (for low, moderate, & high risks), and time & budget required to conduct Project Risk Management	**Strategies for Negative Risks & Threats** : [**ATMA**] **Strategies for Positive Risks & Opportunities** : [**SEE**]	Risk Register (Update), see above. Project Management Plan (Update), i.e. **work package could be added, removed, or assigned to different resources**.
Risk Register, include relative rating or priority list of project risk, a list of risks **requiring response in near term**, a list of risks for **additional** analysis & response, **trends** in Qualitative Risk Analysis results,	**Strategies for Both Threats & Opportunities** Contingent Response Strategy	Risk-Related Contractual Agreements, such as **agreements for insurance & services**.

root causes, risks categories, & **watch list of low priority risks**.		

Plan Purchases & Acquisitions :
- Involves consideration of **whether, how, what, how much, & when** to acquire/purchase.
- Consideration to who is **responsible** for obtaining or holding relevant **permits** & **licences** that may be required by legislation, regulation, or organisational policy in executing project.
- **Reviewing** the risks in **Make-or-Buy Decisions**.
- **Reviewing** the type of contract planned to be used with respect to **mitigating** & **transferring** risks to the seller.
- **Influenced by the project schedule**.

The decisions made in developing the **Procurement Management Plan** can influence the project schedule and are integrated with **Schedule Development, Activity Resource Estimating, and Make-or-Buy Decisions.**

Requirements, described by **Project Scope Statements** , with contractual & legal implications can include **health, safety, security, performance, environmental, insurance, intellectual property rights, equal employment opportunity, licences, and permits.**

Project Scope Statements :
- describes the project **boundaries**, **requirements**, **Constraints** & **Assumptions** related to the project scope. Constraints may include **availability of funds**, required delivery date, available skilled resources, and organizational policies.
- provides a list of **deliverables** & **acceptance criteria** for the project & its products, services, & results.
- provides info about **any technical issues** or concerns related to the products, services, & results of the project.

Make-or-Buy Analysis
The cost savings to purchase may be **outweighed** by the cost of managing the procurement. One of the main reasons to buy is to **decrease** risk to any component of the "triple constraint." It is **better** to "make" if:
- you have an **idle** plant or workforce
- you want to **retain control**
- the work involves **proprietary information** or procedures

Contract Type
The goal of Contract Type Selection is to have reasonable **distribution** of **risk** between the buyer and seller and the greatest **incentive** for the seller's efficient and economical performance.

The following factors may **influence** the type of contract selected :
- how **well-defined** the Contract Statement Of Work is or can be
- the amount or frequency of **changes** expected after project start
- the level of effort and expertise the buyer can devote to managing the seller
- **industry standards** of the type of contract used
- amount of **market competition** & amount of **risk**

The type of contracts :

1. Cost Reimbursable (CR)
- the seller's costs are reimbursed, plus an additional amount (**seller profit**).
- **The buyer** has the **most cost risk because the total costs are unknown. (if the costs increase, the buyer pays the added costs).**
- the buyer can only describe what is **needed**, rather than **what to do** (e.g., when the complete Contract Statement Of Work or requirements is **unknown**, as in situations of buying unique knowledge). The seller will therefore write the **detailed** Contract Statement Of Work.
- Costs are usually classified as direct costs or indirect costs. **Direct costs** are costs incurred for the **exclusive benefit** of the project, such as **salaries** of full-time project staff. Indirect costs, also called overhead and general and administrative cost, are **costs allocated to the project by the performing organization** as a cost of doing business, such as salaries of management indirectly involved in the project, and cost of electric utilities for the office. Indirect costs are usually calculated as a percentage of direct costs.
- Cost-Reimbursable contracts often include **incentive clauses** where, if the seller meets or exceeds selected project objectives, such as schedule targets or total cost, then the seller receives from the buyer an **incentive** or **bonus payment**.
- Research & Development or information technology projects where the scope is unknown are typical examples of Cost Reimbursable contracts.
- **Contract Statement Of Work** : describes only the **performance** or **requirements** because we are buying the **expertise** of "**how to do the work**", not "what to do" or "when to do"

1.1 Cost Plus Fee (CPF) or Cost Plus Percentage of Costs (CPPC)
The buyer **pay for all costs** plus a percent of costs as a fee. Sellers are not motivated to control costs because the seller will get paid profit on every cost without limit. **From seller's perspectives, this is the best contract.** From the buyer's perspective, this is the **highest risk**..
Example : Contract = Cost plus 10% of costs as fee.

1.2 Cost Plus Fixed Fee (CPFF)
The buyer **pays all costs**, but the fee (or profit) is **fixed** at a specific dollar amount. This helps to keep the seller's costs in line because a cost overrun will not generate any additional fee or profit. **Fees only change with approved change orders**. The seller could be charging the buyer for costs that should not be allocated to the buyer. Because of the size and dollar amount of these type of contracts and because the **risk to the buyer is great**, CPFF contracts need the **most auditing**. This fixed fee does not vary with the actual cost, **unless the project scope changes.**
Example : Contract = Cost plus a fee of $100,000.

1.3 Cost Plus Incentive Fee (CPIF)
The buyer **pays all costs** and an agreed upon fee, plus an **incentive** (**bonus**) for beating the performance objectives **stated in the contract**. An incentive helps bring **the seller's objectives in line with those of the buyer**. With an incentive, both buyer and seller work toward the same objective, such as **completing the project on time**.

1.4 Cost Plus Award Fee (CPAF)
The buyer **pays all costs** and an apportionment of a bonus based on performance. This is very similar to the **CPIF** contract except the award amount is **determined in advance** and **apportioned** out depending on performance. For example, the buyer might say that there is a $5o,ooo award fee available. It will be apportioned out at the rate of $5,000 for every month production on the project is over a certain amount.

Advantage	Disadvantage
Simpler Contract Statement Of Work Requires less work to write the scope than Fixed Price Generally **lower cost** than Fixed Price because the seller does not have to add as much for risk	Requires **auditing seller's invoices** Requires more work for the buyer to manage Seller has only a moderate incentive to control costs **Total price is unknown**

2. Time and Material (T&M) or Unit Price
- contract is priced on a **per hour or per item** basis
- a hybrid between Cost-Reimbursable (**total cost is unknown**) & Fixed-Price(fixed price per hour) type contractual arrangements
- does not have a great risk, so **less auditing**
- resemble Cost-Reimbursable type arrangements in that they have **no definitive end**, because the full value of the arrangement is not defined at the time of the award (**total cost is unknown**)
- resemble Fixed-Price arrangements. For example, the unit rates are preset by the buyer and seller, when both parties agree on the rates for the category of senior engineers.
- **Contract Statement Of Work** : can be any of the choices (performance, functional, or design), but it will be **brief**, describing **limited** performance, functional, or design requirements.

Example : Contract = $100 per hour plus expenses or materials at cost or $5 per linear meter of wood.

Advantage	Disadvantage
Quick to create Contract duration is **brief** Good choice when you are hiring "bodies" or people to augment your staff	Profit is in every hour billed Seller has no incentive to control costs Appropriate only for **small projects** Requires the most day to day oversight from the buyer

3. Fixed Price (FP, or Lump Sum, Firm Fixed Price, or Purchase Order)
- one price is agreed upon for **all the work** or for a **well-defined** product
- may include **incentives** for **meeting** or **exceeding** selected project objectives, such as **schedule targets**.
- **the buyer has the least cost risk (less auditing ???)** , provided the buyer has a **completely defined scope**, **know what they need**, because the risk of higher costs is borne by the **seller**.
- **the seller is most concerned with the Contract Statement Of Work**.
- high risk for the **seller** in a **Fixed Price**. (**if the costs increase, the seller pays the costs and makes less profit**).
- most appropriate when the buyer can completely describe the Contract Statement Of Work.
- **Contract Statement Of Work** : must be extraordinary complete because we are buying "**do it**", not "how to do it". In order for the seller to fix the price, they **need to know, in advance, ALL the work they are required to do.**

Example : Contract = $1,100,000.

Advantage	Disadvantage
Less work for buyer to manage Seller has a strong incentive to control costs Companies have experience with this type Buyer knows the total price at project start	Seller may underprice the work and try to make up profits on change orders Seller may **not complete** some of the contract Statement Of Work if they begin to **lose money** More work for buyer to write the contract Statement Of Work Can be more **expensive** than CR if the contract Statement Of Work is **incomplete** The seller will need to add to the price for their increased risk

Contract Statement Of Work
The SOW for each contract is developed from the **Project Scope Statement**, **WBS**, & **WBS Dictionary**. The contract SOW can be **revised** & **refined** as required as it moves through the **Procurement** process **until** incorporated into a **signed contract**. Type of contract SOW :
- **Performance** - conveys what the **final product** should be able to accomplish, rather than how it should be built or what its design characteristics should be (e.g., "I want a car that will go zero to 120 kilometers per hour in 4.2 seconds.")
- **Functional** - conveys the **end purpose or result**, rather than specific procedures, etc. It is to be used in the performance of the work and may also include a statement of the minimum essential characteristics of the product (e.g., "I want a car with 23 cup holders.")
- **Design** - conveys **precisely what work is to be done** (e.g., "Build it exactly as shown on these drawings.")

It describes :
- **what work is to be completed under the contract**. It must be as clear, complete, and concise as possible, and describe **ALL the work & activities** the seller is required to complete.
- the **detail of procurement item**, to allow prospective sellers to determine if they're capable of providing them.
- **products, services, or results to be supplied** by the seller
- specification, quantity desired, quality levels, performance data, period of performance, work location.
- **Performance Reporting** or post-project operational support for the procured item

Performance and **Functional** contract Statements Of Work are commonly used for **information systems, information technology, high-tech, R&D**, and projects that have **NEVER** been done before. Design is most commonly used in **construction**, **equipment purchasing** and other types of projects. Components of a contract Statement Of Work can include drawings, specifications, technical and descriptive wording, etc. No matter what it contains, you should realize that the contract Statement Of Work becomes part of the contract.

Point of Total Assumption
The point of total assumption (PTA) is a price determined by a **Fixed Price plus Incentive Fee** contract (**FPIF**) above which the **seller bears all the loss of a cost overrun (the seller assumes the costs)** . It is also known as the "**most pessimistic cost**" because it represents the **highest point beyond which costs are not expected to rise**, given reasonable issues. If costs go beyond the PTA, they are assumed to be due to **mis-management** rather than a worst-case set of difficulties. The seller bears all of the cost risk at PTA and beyond. In addition, once the costs on an FPIF contract reach PTA, the maximum amount the buyer will pay is **the ceiling price**. Any FPIF contract specifies a target cost, a target profit, a target price, a ceiling price, and one or more share ratios. The PTA is the difference between the ceiling and target prices, divided by the buyer's portion of the share ratio for that price range, plus the target cost.

PTA = ((Ceiling Price - Target Price)/buyer's Share Ratio) + Target Cost
For example, assume:

Target Cost: 2,000,000	Target Profit: 200,000	Target Price: 2,200,000
Ceiling Price: 2,450,000	Share Ratio: 80% buyer–20% seller for overruns, 50%–50% for underruns	

PTA = ((2,450,000 - 2,200,000)/ 0.80) + 2,000,000 = 2,312,500

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EEA [conditions of the **marketplace** & what products -services are available in the marketplace, from whom and under what terms & conditions]. OPA – (in)formal procurement-related policies, procedures, guidelines, **multi-tier supplier system of selected & pre-qualified sellers**. ***Project Scope Statements*** ***WBS & WBS Dictionary*** ***Project Management Plan***, such as : • Risk Register (the identified risks, risk owners, & risk responses) • Risk-related contractual agreements (**agreements for insurance**, services) • **Activity Resource** requirements • Project schedule • **Activity Cost** estimates • Cost baseline	**Make-or-Buy Analysis** Expert Judgement **Contract Types**	**Procurement Management Plan** – describes how the procurement processes will be planned, managed, & executed from developing procurement documentation through **Contract Closure**. It can includes : • **types of contract to be used** • who will prepare independent estimates & if they're needed as Evaluation Criteria • **identifying pre-qualified Selected Sellers**, if any, to be used **Contract SOW** **Make-or-Buy Decisions**, the documented decisions of what project products, services, or results will be **acquired** or will be **developed** by the project team. Requested Changes

Plan Contracting :
• Documenting products, services, & results requirements and **identifying potential sellers**.
• Prepare the documents needed to support the **Request Seller Responses** and **Select Sellers** processes.

Procurement Document (Bid Document)
The documents put together by the buyer to tell the seller its needs, to seek proposals from prospective sellers. May take one of the following form :
• **Request for Proposal** (RFP, sometimes called Request for Tender) - requests a price, but also a detailed **proposal** on **how the work will be accomplished, who will do it, resumes, company experience, etc**.
• **Invitation for Bid** (IFB, or Request for Bid, RFB) - requests one price to do **all the work**
• **Request for Quotation** (RFQ) - requests a price quote per item, hour or foot

Procurement Documents may include the following:
• Information for sellers :
    o Background information
    o Procedures for replying or guidelines for preparation of the response
    o Form of response required
    o **Evaluation Criteria**
    o Pricing forms
• **Contract Statement Of Work**
• Proposed **terms and conditions** of the contract (legal and business)
• **rigorous** enough to ensure **consistent**,**comparable** responses, but **flexible** enough to allow **consideration** of seller suggestions for better ways to satisfy the requirements.

The terms and conditions of the contract are also **work that needs to be done** and have costs associated with them (**warranties**, **ownership**, etc.). The seller must be aware of all the work that needs to be completed to adequately understand and price the project.

Well-designed Procurement Documents can have the following effects on the project:
• **Easier comparison** of sellers' responses
• More **complete responses** and **accurate pricing**
• Decrease in the number of changes to the project

The sellers **could make suggestions** for changes to the Procurement Documents, including the **Contract SOW** and the **Project Management Plan**.

Non-Disclosure Agreement
This is an agreement between the buyer and any prospective sellers stating **what information or documents they will hold confidential and control**, and **who in their organization will gain access to the confidential information**. With a non-disclosure agreement in place, the buyer can talk more openly about its needs without fear that one of the buyer's competitors will gain access to the information shared.

Standard Contract
Companies frequently have standard, **preauthorised contracts** for the **purchase of goods or services**. These types of standard contracts need no further legal review if used as they are. If signed without changes, they are legally sufficient.

Special Provisions (Special Conditions)
The project manager meets with the contract manager to discuss the needs of the project and determine the final contract terms and conditions. These **additions**, **changes** or **removals** are sometimes called special provisions and are a result of:
• Risk analysis
• The requirements of the project
• The type of project
• Administrative, legal or business requirements

Non-Competitive Forms of Procurement
When would you award work to a company **without competition**? The following is a more complete list :
• The project is under **extreme schedule pressure**.
• A seller has **unique qualifications**.

- There is only **one seller**.
- A seller **holds a patent** for the item you need.
- Other mechanisms exist to ensure that the seller's **prices are reasonable**.

You should be familiar with the following forms of non-competitive procurements:
- **Single Source** - contract directly with your preferred seller **WITHOUT** going through the procurement process. This might be a company that you have worked with before and, for various reasons, you do not want to look for another.
- **Sole Source** - there is **ONLY one selle**r. This might be a company that **owns a patent**.

Topics must be addressed in creating a contract for non-competitive procurement that would not need as much attention in a competitive environment :
For Single Source-Preferred Supplier
- Scope - More work will be needed to document all the items received free in the past to make sure you get them now. Only what is in the contract will be received.
- Scope - There could be a tendency for the performing organization to say, "The seller knows us and we know them, we do not have to spend so much time determining our requirements and completing a contract statement of work. They know what we want."
- Quality The seller may never be asked to prove they have the experience, cash flow and manpower to complete the new work.
- Cost Time will need to be spent to compare previous costs to the new cost to check for reasonableness.
- Schedule Now that the seller knows they have you as a longer term customer, they may not be as responsive to your needs.
- Customer satisfaction Now that the seller knows they have you as a longer term customer, they may not be as responsive to your needs.
- Risk The risk can be weighted more toward the buyer unless the above are investigated.

For Sole Source-There Is Only One Supplier
- What if the seller owns a patent and goes out of business?
- If the seller owns a patent and goes bankrupt, who owns the patent?
- Quality You may have to take what you get rather than request a certain quality level.
- Cost Multiple year agreements will be required for the purchase of items to prevent a price increase in the future.
- Schedule The seller has little incentive to agree to a schedule.
- Scope You may have to change the project to accommodate the procurement rather than change the procurement to accommodate the project.
- Customer satisfaction The seller has little incentive to be concerned with the buyer's needs and desires.
- Risk The overall risk can be weighted more toward the buyer unless the above are investigated and resolved.

Evaluation Criteria
Used to developed & used to **rate / score** proposals and to give the seller an understanding of the buyer's needs and help them decide if they should bid or make a proposal on the work. During **Select Sellers,** Evaluation Criteria become the **basis** by which the bids or proposals are evaluated by the buyer. If the buyer is purchasing a commodity like linear meters of wood, the Evaluation Criteria may be just the lowest price. If they are buying construction services, the Evaluation Criteria may be **price plus experience**. If the buyer is buying services only, the Evaluation Criteria will be more extensive. In the latter case, such Evaluation Criteria may include:
- Understanding of **need**
- **Overall or life cycle cost** (see definition in the Cost chapter)
- **Technical ability**
- **Management approach**
- **Financial capacity**
- **Project management ability** (I had to put this in! Shouldn't you require your sellers or vendors to use the project management techniques you have learned? How about asking for a WBS, network diagram and risk analysis?)

Bid Documents	Contract Type	Contract SOW	Seller Selection (based on)	Risk
Request for Proposal (RFP)	Cost Reimbursable	Performance or Functional	**Technical skills / approach**	Buyer
Invitation for Bid (IFB)	Fixed Price	Design (well-defined)	**Price**	Seller
Request for Quotation (RFQ)	Time & Material or Unit Price	Any	**Price**	Buyer&Seller

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Procurement Management Plan ***Contract SOW*** ***Make-or-Buy Decisions*** ***Project Management Plan***, such as : • Risk Register (the identified risks, risk owners, & risk responses) • Risk-related contractual agreements (**agreements for insurance**, services) • Activity resource requirements • Project schedule • Activity cost estimates • Cost baseline	Standard Forms, i.e. standard contracts, descriptions of procurement items, non-disclosure agreements, proposal Evaluation Criteria check-lists. Expert Judgement	**Procurement Documents** (**bid documents**) **Evaluation Criteria** Contract SOW (updates)

EXECUTING				
	Initiating Process Group	**Planning Process Group**	**Executing Process Group**	**Monitoring & Controlling Process Group**	**Closing Process Group**
Integration	Develop Project Charter Develop Preliminary Project Scope Statement	Develop Project Mgmt Plan	Direct & Manage Project Execution	Monitor & Control Project Work Integrated Changed Control	Close Project
Scope		Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	
Time		Activity Definition Activity Sequencing Activity Resource Estimating Activity Duration Estimating Schedule Development		Schedule Control	
Cost		Cost Estimating Cost Budgeting		Cost Control	
Quality		QP	QA	QC	
HR		HR Planning	Acquire Project Team Develop Project Team	Manage Project Team	
Communications		Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	
Risk		Risk Mgmt Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning		Risk Monitoring & Control	
Procurement		Plan Purchases & Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

The purpose of the Executing Processes Group is **to complete work** in the Project Management Plan and **to meet** the project objectives. This is the "do" step of the **Plan-Do-Check-Act** cycle. The focus is on **managing people**, **following processes** and **distributing information**. It is essentially a **guiding**, **proactive role** accomplished by constant referral back to the Project Management Plan.

The processes of project management are not always performed in the same sequence.

Executing means **executing the Project Management Plan** or **the latest revised** Project Management Plan. You are always executing to the Project Management Plan, but the plan might have changed over time.

Direct & Manage Project Execution :
- Execute the Project Management Plan as defined in the **Project Scope Statement**
- Produce **deliverables**
- Creates **Work Performance Information**

This process requires **implementation** of:
- **Approved Corrective Actions** that will bring anticipated project performance into **compliance** / **conformance** with the Project Management Plan
- **Approved Preventive Actions** to reduce the probability of potential **negative consequences of project risks**
- **Approved Defect Repair** requests to correct product defects found during the **Quality inspection** or the **audit** process.

Administrative Closure Procedure
The administrative closure procedure documents all the activities, interactions, and related roles and responsibilities needed in executing the administrative closure procedure for the project.

Deliverables
Any **unique** and **verifiable** product, result or capability to perform a service that is identified in the project management planning documentation, and must be produced and provided to complete the project.

Work Performance Information
Information on the status of the project activities being performed to accomplish the project work is routinely collected as part of the Project Management Plan execution. It's **fed into the Performance Reporting** process. This information includes, but is not limited to:
- Schedule progress showing **status** information
- Deliverables that have been **(not) completed**
- Schedule activities that have **started** and those that have been **finished**
- Extent to which **Quality** standards are being met
- Costs authorized and incurred
- Estimates to complete the schedule activities that have started
- Percent physically complete of the in-progress schedule activities
- Documented lessons learned posted to the **lessons learned knowledge base**
- Resource utilization detail.

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Project Management Plan *Approved Corrective & Preventive Actions* *Approved Changed Requests* *Approved & Validated Defect Repair* *Administrative Closure Procedure*	PMM Project MIS	**Deliverables** Requested Changes **Implemented Change Requests** **Implemented Corrective & Preventive Actions** **Implemented Defect Repair** **Work Performance Information**

Perform Quality Assurance :
- to **determine** whether standards are being met, the work is continuously **improved** and deficiencies **corrected**.
- includes **identifying improvements** (**Quality Improvement**) that the organization needs to make.

Quality Control Measurement
Are the results of **QC** activities that are fed back to the QA for use in **re-evaluating and analysing the quality standards** & **processes** for the project.

Quality Audits
- Is a structured, **independent review** to determine whether project activities **comply** with organisational & project
- carried out by **trained in-house auditors** or by **3rd parties,** may be **scheduled** or at **random**.
- Is to identify **inefficient** and **ineffective** policies, processes, & procedures in use on the project
- it **confirms** the implementation of **approved Change Requests, Corrective & Preventive Actions, and Defect Repairs**

Process Analysis
- part of continuous improvement
- Examines problem & constraints experienced, and non-value-added activities
- Includes **root cause analysis**, techniques to analyse a problem/situation, determine the underlying causes that lead to it.
- Create Preventive Actions for similar problems.

Corrective Actions
An action that is **recommended IMMEDIATELY** as a result of QA activities, such as **audits** and **process analysis**.

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Quality Management Plan *Quality Metrics* *Process Improvement Plan* *Work Performance Information* *Approved Changed Requests,* i.e. modifications to work methods, product requirements, quality requirements, scope, and schedule. *Quality Control Measurements* *Implemented Change Requests* *Implemented Corrective & Preventive Actions* *Implemented Defect Repair*	**Quality Planning Tools & Techniques** **Quality Control Tools & Techniques** **Quality Audits** **Process Analysis**	Requested Changes & Recommended Corrective Actions, for quality improvement. OPA (updates) Process Improvement Plan (updates)

Acquire (final) Project Team :
Obtaining the HR needed to complete the project, in which the project manager may or may not have control over team member selected.

This process involves :
- know which resources are **pre-assigned**
- negotiate for the best possible resources
- hire new employee
- outsourcing
- issues with virtual team

Virtual Teams

A team made up of people with little or no time spent meeting face-to-face, such as :
- team members, included specialised expertise, located in different geographic areas
- team members work from home
- team members work in different shifts or hours
- people with mobility **handicaps**
- **travel expenses** is an issues

Additional time may be needed to set clear expectations, develop protocols for **confronting conflict**, include decision-making people, and share credit in successes.

Negotiation

To negotiate for resources from within the organization, the project manager should understand the following:

- know the **needs** of your project and its **priority** within the organization.
- be able to express what is in it for the resource manager to assist you.
- understand that the resource manager has his own work to do and that he may not gain benefits from supporting your project.
- do not ask for the best resources if you do not need them.
- be able to prove, by using the tools of project management such as the **network diagram** and **project schedule**, why you need better resources if you need them.
- use the negotiation as an opportunity to discover from the resource manager what she will need from you in order to manage her own resources.
- build a relationship so that you can call on the resource manager's expertise later in the project if necessary.
- work with the resource manager **to deal with the situation**

Halo Effect is the assumption that because the person is good at a technology, he will be good as a project manager.

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EEF, such as who is available, do they work well together, do they want to work on the project and how much do they cost. OPA, i.e. hiring procedures **_Roles & Responsibilities_** **_Project Organization Charts_** **_Staffing Management Plan_**	Pre-Assignment, team members are known in advance, i.e. staff was **identified** in the **Project Charter**. Negotiation Acquisition, i.e. **consultants** or **subcontracting** work to third party Virtual Teams, needs **Communications Planning**	Project Staff Assignments, the appropriate people **assigned** to staff the project (**who are on the team**). **Project Organisation Charts & Schedules are updated with names.** Resource Availability, **document the time periods** each project team member can work on the project. Staffing Management Plan (Update), updates to reflect changes, as specific people fill specific roles. This may include **promotions, retirements, illness, performance issues, & changing workloads**.

Develop Project Team :

Improving the **competencies** and **interaction** of team members to **enhance project performance**. The Team Development efforts have greater benefit when **conducted early**, but should take place throughout the project life cycle.   Team Development means

- enhancing the ability of **stakeholders to contribute** as individuals
- enhancing the ability of the team to **function as a team**

Objectives include:

- improve **skills** of team members to increase their ability
- improves feelings of **trust** & **cohesiveness** to raise productivity through greater teamwork

Effective teamwork includes:

- **assisting** one another
- **communicating** in a way that fit individual preferences.
- **sharing** information & resources.

The project manager :

- guide, manage, & improve the interaction of team members.
- improve the trust & cohesiveness among the team.
- incorporate team building activities into all project activities

Team Building

Team building is forming the project team into a **cohesive** group working for the best interest of the project, in order to **enhance project performance**. Make sure you know:

- it is the job of the project manager to guide, manage and improve the **interaction** of team members.
- the project manager should improve the **trust** and **cohesiveness** among the team.
- project managers should **incorporate** team building activities into all project activities.
- team building requires a **concerted effort** and **continued attention** throughout the life of the project.
- the **WBS creation** is a team building tool.
- team building should start **early** in the life of the project

Team-Building Activities can include :

- build trust & establishing good working relationship (milestone parties, holiday, birthday celebrations, work trips)
- creating the WBS
- requires a concerted effort and continued attention throughout the project's life
- planning the project by getting everyone involved in some way (start early in the life of the project)

Ground Rules - establish a clear **expectations** regarding **acceptable behaviour** by team members, allows team members to **discover values** to one another.

Co-Location or War Room, to place team members in the same location, to :

- enhance **communication**
- decreases the impact of **conflict** (since all parties are right there)
- improves project **identity** for the project team and for management in a matrix organization.

Team Performance Assessment

By continually assessing the project team's performance, actions can be taken to **resolve issues**, **modify communications**, **address conflict**, & **improve team interaction**, analysis of how much team members' **skills** have improved, & reduce staff **turnover rate**.

Recognition & Rewards
- the original plans to reward people are developed during **Human Resource Planning**
- award decisions are made, formally or informally, during the process of **Managing the Project Team through Performance Appraisals**
- rewarding **win-win** behaviour that **EVERYONE** can achieve, tends to increase support among team members.
- recognition and rewards should consider **cultural differences**.

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Project Staff Assignments, the **list** of project team members. **_Staffing Management Plan_**, which identifies **training strategies** & **plan** for developing the project team. Rewards, feedback, additional training, & disciplinary actions are added to the plan. **_Resource Availability_**, which identifies **times** that project team members can participate in team development activities.	General Management Skills, i.e. **soft skills** or **interpersonal skills**, such as empathy, influence, creativity, & group facilitation. Training – **scheduled training** takes place as stated in the Staffing Management Plan; **unscheduled training** takes place as a result of **observation**, **conversation**, & **Project Performance Appraisals** conducted during the controlling process of managing the project team. Team-Building Activities Ground Rules Co-Location or War room Recognition & Rewards	**Team Performance Assessment**

Information Distribution :
- making information **available** to project **STAKEHOLDERS** in a timely manner.
- **implement _Communications Management Plan_**
- **responding** to unexpected requests for information
- involves creating reports providing informations that was **not planned**.

Communications Skills
- make sure that the **right persons** get the **right info** at the **right time**.
- **managing stakeholder requirement.**

Type of communication :
- written and oral, listening and speaking
- internal (within the project) and external (customer, the media, the public)
- formal (reports, briefings) and informal (memos, ad hoc conversations)
- vertical (up & down the organisation) and horizontal (with peers)

Information Gathering and Retrieval Systems
Information can be gathered and retrieved through a variety of media including **manual filing systems**, **electronic databases**, **project management software**, and systems that allow access to **technical documentation**, such as **engineering drawings**, **design specifications**, and **test plans**.

Information Distribution Methods
Project information can be distributed using a variety of methods, including:
- **Project meetings**, hard-copy document distribution, manual filing systems, and shared-access electronic databases
- **Electronic communication and conferencing tools**, such as e-mail, fax, voice mail, telephone, video and Web conferencing, and Web publishing
- **Electronic tools for project management**, such as Web interfaces to scheduling and project management software, meeting and virtual office support software, portals, and collaborative work management tools.

Lessons Learned Process :
- provide :
  - o Update of the lessons learned KB
  - o Input to knowledge mgmt system
  - o Updated corporate policies, procedures
  - o **Improved business skills**
  - o Overall product & service improvements
  - o Updates to the **Risk Management Plan**
- **created throughout** the project and then **finalized** during Project Closing or Project Phase Closing.
- help **recall** what went right, wrong, progress, etc. on the project.
- might be sent out **as they are created**, as part of **Information Distribution** activities on the project.
- the project managers have an obligation to **conduct** lessons learned sessions for all projects with key **internal** & **external stakeholders**.
- a project **cannot be considered complete** unless the lessons learned are **completed**. Continuous improvement of the project management process cannot occur **without** lessons learned.
- one should not wait until the project is over to share lessons learned with other projects.
- to be as valuable as possible, lessons learned should cover three areas:
  - o **technical aspects** of the project
  - o **project management** (How did we do with WBS creation, risk, etc.?)
  - o **management** (How did I do with communications and leadership as a project manager?)

Project records - **correspondence**, **memos**, and documents describing the project.

Project reports – formal & informal reports detail **project status**, and include lessons learned, issues logs, project closure reports, and outputs from other Knowledge Areas.

Stakeholder notifications
Information may be provided to stakeholder about resolved issues, approved changes, and general project status.

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Communications Management Plan	**Communications Skills** **Information Gathering & Retrieval Systems** **Information Distribution Methods** **Lessons Learned Process**	OPA (updates) : • Lessons Learned documentation • Project records, reports, & presentations • **Feedback from stakeholders**, concerning **project operations** • **Stakeholder notifications** Requested Changes, should trigger changes to the **Project Management Plan** and the **Communications Management Plan**.

Request Seller Responses :
• Getting the **Procurement Documents** into the hands of sellers
• answering the sellers' questions and the sellers preparing the proposals.

Bidder Conferences (Contractor Conferences, Vendor Conferences, Pre-Bid Conferences)
• are meetings with prospective seller **prior** to preparation of a bid or proposal
• to ensure that **ALL** prospective sellers have a **clear** and **common** understanding of the procurement (i.e. technical & contract requirements), so that **no one bidder is given an unfair advantage**
• an opportunity for the buyer to discover anything that is missing.

Things the Project Manager must **watch out** for in a Bidder Conference :
• Collusion
• Sellers not asking their questions in front of their competition
• Making sure all questions and answers are put in **writing** and **issued to all potential sellers** by the buyer as **addenda** to the Procurement Documents. This **ensures** that **all sellers are responding to the same contract Statement Of Work**.

Procurement Document Package
The procurement document package is a **buyer-prepared formal request sent to each seller** and is the basis upon which a seller prepares a bid for the requested products, services, or results that are defined and described in the procurement documentation.

Proposals - seller's response, seller-prepared documents that describe the seller's **ability** & **willingness** to provide the requested products, services, or results described in the **Procurement Documents**

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OPA ***Procurement Management Plan*** ***Procurement Documents***	Bidder Conference Advertising Develop Qualified Sellers List	**Qualified Sellers List** **Procurement Document Package** **Proposals**

Select Sellers :
• **reviewing** offers , **choosing** among potential sellers, and **negotiating** a written contract with each seller.
• receives and reviewing bids or proposals and selecting one or more sellers
• the **Evaluation Criteria** identified in the **Plan Contracting** process are used to assess the potential sellers' **ability** and **willingness** to provide the requested products or services. Because they are measurable, the criteria provide a basis for **quantitatively** evaluating proposals to minimize the influence of personal prejudices. In this process:
  o A seller may simply be **selected** and **asked to sign a standard contract**
  o A seller may be asked to make a presentation and then, if all goes well, go on to **negotiations**
  o The list of sellers may be narrowed down ("**short-listed**") to a few
  o The short-listed sellers may be asked to make presentations and the selected seller then asked to go on to **negotiations**
  o The buyer can negotiate with more than one seller
  o Or some combination of presentations and negotiations

Weighting System
• a method for **quantifying qualitative data** to minimize the effect of **personal prejudice** on seller selection
• weighting the **Evaluation Criteria** according to your **priorities**, and **comparing** sellers to choose the one who best meets your criteria

Independent Estimates
Comparing the cost to an estimate created **in-house** or with outside assistance (referred to as "**should-cost**" estimate) . This allows the discovery of **significant differences** between what the buyer and seller intend in the contract statement of work, which means :
• the Contract SOW was not **adequate**
• the prospective seller either **misunderstood** or failed to **respond fully** to the Contract SOW
• the marketplace has **changed**

Screening System
Eliminating sellers that do not meet minimum **requirements** of the *Evaluation Criteria*, and can employ **Weighting System & Independent Estimates**

Contract Negotiation
Used to **clarify** the **requirement** of the contract so that mutual agreement can be reached **PRIOR** to signing the contact. It concludes with a **document** that can be **signed** by both the buyer and seller, that is , the **CONTRACT**. The **final contract** means **ALL** agreements are reached, but can be a **revised offer** by the seller or a **counter offer** by the buyer. Subjects covered include responsibilities and authorities, applicable terms and law, technical and business management approaches, proprietary rights, contract financing, technical solution, overall schedule, **payments**, and **price**.
The objectives of negotiation are to :

- obtain a **fair** and **reasonable price**
- develop a good **relationship** with the seller

The **main items** to address while **negotiating a contrac**t are:
- Responsibilities
- Authority
- Applicable law-Under whose law will the contract fall
- Technical and business management approaches
- Contract financing
- Schedule
- Payments and price

Contract
A contract is a legally binding document :
- in which all **terms and conditions** in that document must be **met**.
- that obligates the seller to provide the specified products, services, or results, and **obligates the buyer to pay the seller**
- that any changes to it, are made **formally in writing**.
- include a **Contract SOW**
- sign-off (i.e. acceptance) from both parties
- seller's address is **NOT** required.
- awarded to each selected seller and **is a legal relationship subject to remedy in the courts**.

Contract can be amended any time prior to Contract Closure by mutual consent, in accordance with the change control term of the contract.

To have a **legal contract**, you'll need :
- an offer
- acceptance
- consideration - something of value, not necessarily money
- legal capacity - separate legal parties, competent parties
- legal purpose - you cannot have a contract for the sale of illegal goods

I	TT	O
OPA	Weighting System	**Selected Sellers**
Procurement Management Plan Evaluation Criteria *** Procurement Document Package Proposals*** *** Qualified Sellers List*** *** Project Management Plan***, as above	Independent Estimates	**Contract**
	Screening System	**Contract Management Plan**, a plan specific to **one contract** , talks only about **Contract,** and covers the **Contract Administration** activities throughout the life of the contract.
	Contract Negotiation	
	Seller Rating Systems, used in **addition** to the proposal evaluations **Screening System** to select sellers.	Resource Availability
	Expert Judgement	Procurement Management Plan (updates), address how all procurements on a project will be managed.
	Proposal Evaluation Techniques, can employ a **Screening System** and use data from a **Seller Rating System**.	Requested Changes, to the Project Management Plan.

MONITORING & CONTROLLING

	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
Integration	Develop Project Charter Develop Preliminary Project Scope Statement	Develop Project Mgmt Plan	Direct & Manage Project Execution	Monitor & Control Project Work Integrated Changed Control	Close Project
Scope		Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	
Time		Activity Definition Activity Sequencing Activity Resource Estimating Activity Duration Estimating Schedule Development		Schedule Control	
Cost		Cost Estimating Cost Budgeting		Cost Control	
Quality		QP	QA	QC	
HR		HR Planning	Acquire Project Team Develop Project Team	Manage Project Team	
Communications		Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	
Risk		Risk Mgmt Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning		Risk Monitoring & Control	
Procurement		Plan Purchases & Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

It's measuring the performance of the project to the project management plan, approving change requests, preventive actions and defect repair, and managing changes.

The Monitoring and Controlling Process Group :
- consists of those processes performed to observe project execution so that potential problems can be **identified** in a **timely manner** and **corrective action** can be taken, when necessary, to control the execution of the project.
- the **project team** should **determine** which of the processes are **required** for the team's specific project.
- to **observe** the project performance and to **measure** regularly to identify variances from the project management plan.
- includes **controlling changes** and **recommending preventive action** in anticipation of possible problems.
- includes **monitoring** the **ongoing** project activities against the project management plan and the project **performance baseline**
- includes influencing the factors that could **circumvent** Integrated Change Control so **ONLY** approved changes are **implemented**.
- in multi-phase projects, provides **feedback** between **project phases**, in order to implement corrective or preventive actions to bring the project into compliance with the project management plan.

When variances jeopardize the project objectives, appropriate project management processes within the Planning Process Group are revisited as part of the modified **Plan-Do-Check-Act** cycle. This review can result in **recommended updates** to the Project Management Plan. For example, a missed activity finish date can require adjustments to the current staffing plan, reliance on overtime, or tradeoffs between budget and schedule objectives.

All Monitoring and Control Processes except (Integration Management & Manage Stakeholders) will have following 4 outputs:
- Requested Changes
- Recommended Corrective Actions
- Project Management plan (Updates) (Except in Performance Reporting)
- Organizational Process Assets (Updates)

Monitor & Control Project Work :
It is concerned with:
- **Comparing actual** project **performance** against the Project Management Plan
- Assessing **performance** to determine whether any Corrective or Preventive Actions are indicated, and then **recommending** those actions as necessary
- **Analysing**, **tracking**, and **monitoring** project **risks** to make sure the risks are **identified**, their status is **reported**, and that appropriate **Risk Response Plans** are being executed
- Maintaining an **accurate**, **timely information** base concerning the project's product(s) and their associated documentation through project completion
- Providing information to **support** status reporting, progress measurement, and forecasting
- Providing **forecasts** to update current cost and current schedule information
- **Monitoring implementation of approved changes** when and as they occur.

Earned Value Technique (EVT)
The EVT measures performance of the project as it moves from Project Initiation through Project Closure. The Earned Value Management methodology also provides a means to forecast future performance based upon past performance.

Corrective Action
Documented direction to bring expected future project performance in line with the Project Management Plan or to deal with **actual deviations** from the performance baselines (the documents become part of the **historical records** database). To implement it, you need:

- a focused attention
- proactive (look for problems rather than just waiting)
- metrics created in the Planning Process group that cover all aspects of the project
- a realistic Project Management Plan to measure against
- continued measurement throughout the project
- the ability to know when the project is off track
- the ability to identify the need for Recommending Corrective Action
- the ability to find the root cause of the deviation
- measurement of project performance after Corrective Action is implemented to evaluate the effectiveness of the Corrective Action
- a determination of the need for recommending further Corrective Action

When	Where (Output of)
When meeting with the customer to obtain acceptance of deliverables	Scope Verification
When measuring project performance against Performance Measurement Baselines	Scope, Schedule, Cost, Perform Quality Control
When making sure people are using the correct processes	Perform Quality Assurance
When creating performance reports	Performance Reporting
When working with the project team	Manage project team
When you notice that there are many unidentified risks occurring	Risk monitoring and control
When you discover that the seller's performance is not meeting expectations	Contract Administration
When you discover that a team member is not performing	Manage project team

Preventive Action
Deals with **anticipated or possible deviations** from the performance baselines. Examples :
- action to prevent the same problem from occurring again later in the project
- changing a resource because the resource's last activity nearly failed to meet its Acceptance Criteria
- arranging for team members to gain training in a certain area because there is no one with the necessary skills to back up a team member who may unexpectedly get sick.

Preventive Action can be implemented at **any time for any project management process**, but **Recommended Preventive Action** is only specifically mentioned in the PMBOK" Guide as being an output of:
- **Monitor and control project work** (Integration chapter)
- **Perform quality control** (Quality chapter)
- **Manage project team** (Human Resources chapter)
- **Risk monitoring** & **control** (Risk chapter)

[Like Corrective Actions, Preventive Actions result in the **creation** of **Recommended Change Requests** which are approved or rejected in the **Integrated Change Control** process and implemented during the **Direct and Manage Project Execution** process.]

Defect Repair
Another word for rework and is necessary when a component of the project does not meet its specifications. Discovered during the **Quality Management** process, and formed into a Change Request during the **Monitor and Control** Project work process, these changes are approved or rejected in the **Integrated Change Control** process. Defect Repair relates to Quality, so Recommended Defect Repair is only specifically mentioned in the PMBOK" Guide as being an output of:
- **Monitor and control project work** (Integration chapter)
- **Perform quality control** (Quality chapter)

Earned Value Management (EVM) : A management methodology for integrating scope, schedule, and resources, and for objectively measuring project performance and progress. **Performance** is measured by determining the budgeted cost of work performed (i.e., **Earned Value**) and comparing it to the actual cost of work performed (i.e., **Actual Cost**). **Progress** is measured by comparing the **Earned Value (EV)** to the **Planned Value (PV).**

Earned Value Technique (EVT) [Technique] : A specific technique for measuring the performance of work for a WBS component, Control Account, or project. Also referred to as the **Earning Rules** and **Crediting** method.

Forecasts : Estimates or predictions of conditions and events in the project's future based on information and knowledge available at the time of the forecast. Forecasts are updated and reissued based on **Work Performance Information** provided as the project is executed. The information is based on the project's **past performance** and **expected future performance**, and includes information that could impact the project in the future, such as Estimate At Completion (**EAC**) and Estimate To Complete (**ETC**).

I	TT	O
Project Management Plan *Work Performance Information* Rejected Change Requests	PMM Project MIS **EVT** Expert Judgement	**Recommended Corrective Action & Defect Repair** **Preventive Action** Requested Changes Forecast

Integrated Changed Control :

- The process of **reviewing** all change requests, **approving** changes, and **controlling** changes to deliverables and organizational process assets.
- Performed throughout the project from **Project Initiating** through **Project Closure**
- Identify that a change **needs to occur or has occurred**
- **Influencing** other factors so that **only** approved changes are implemented
- Review & approve Requested Changes
- Managing the approved changes when and as they occur, by regulating the **flow** of Requested Changes
- Managing the **integrity of baselines** by releasing only approved changes
- Review & approve **Recommended Corrective & Preventive Actions**.
- **Controlling & updating the Scope, Cost, Budget, Schedule, Resource, & Quality requirements based on Approved Changes, by coordinating changes across the entire project [impact on 'triple constraint']**
- Document the impact of requested changes
- **Validating** Defect Repair
- **Controlling project quality to standards based on quality reports**

Proposed changes can require :
- **new or revised** cost estimates, schedule activity sequences, schedule dates, resource requirements, and analysis of risk response alternatives.
- **adjustments** to the Project Management Plan, Project Scope Statement, or other project deliverables.

A change in any component of the "triple constraint" should be <u>FIRST</u> evaluated for impacts on all the other components

For handling changes (change request) , generally, the project manager should follow these steps:
- **Evaluate impact** - evaluate (assess) the impact of the change to the project **[impact on 'triple constraint']**
- **Create options** - this can include cutting other activities, crashing, fast tracking, etc., as described in the Time chapter. (e.g., we can decrease the effect of the change on the project by spending more time decreasing project risk, or by adding one more technician to the project team).
- Get **internal** buy-in & **customer** buy-in (if required)

Process for Making Changes :
- **Prevent the root cause of change** - The project manager should pro actively eliminate the need for changes, and the sponsor should prevent unnecessary changes to the project objectives (as project objectives is stated in the Project Charter)
- **Identify change** - Discovering a change earlier will decrease the impact of the change.
- **Create a change request** – see above.
- **Assess the change** - Does the change fall within the Project Charter? **If not, it should not be a change to your project, but may be an entirely different project**. Is the change beneficial to the project? Is it needed? If the answer to any of these questions is no, **the change should not be approved**. However, any change that already had a reserve created for it (**a previously identified risk event**) should be handled as part of **Risk Management**.
- **Look at the impact of the change** - If it is a scope change, how will it affect the scope of the project? If it is a time change, how will it affect the schedule for the project?
- **Perform Integrated Change Control** - How will the change affect all other components of the "triple constraint?"
- **Look for options** - Options include actions to decrease threats further, increase opportunities, compress the schedule through crashing, fast tracking, changing how the work is performed, adjusting quality or cutting scope so that the effect of the change will be minimized. Be careful, it is not wise to decrease the impact of every change. In doing so, the project manager could decrease the overall probability of success on the project as a whole. Sometimes an additional two weeks worth of scope added to the project should receive a two week extension of time to the project, if the work occurs on the **Critical Path**.
- **Change is approved or rejected** - All the Recommended Corrective Actions, Preventive Actions and Requested Changes feed into Integrated Change Control, but nowhere in the PMBOK" Guide does it describe who approves changes?
  - o If there is a change to the **Project Charter, the sponsor who signed or approved the Project Charter has to make the final decision**. The project manager **may provide options**.
  - o If the change affects or changes the **Performance Measurement Baselines or any project constraints, the Change Control Board or sponsor needs to be involved**. The project manager should **analyse the project to see if the baselines or constraints can be met**. If not, then come up with **options**, including **crashing** and **fast tracking**.
  - o If the change is within the **Project Management Plan, or the project manager can adjust the project to accommodate the change, the project manager can make the decision**. He may, under certain circumstances, get the sponsor involved to help protect the project from changes. So, although a formal change request must be created for all changes to the project, the project manager could be the one to create and approve certain change requests without getting anyone else's approval.
  - o **It is important to realize the project manager is often given the authority to approve most changes in emergency situations**.
- **Adjust the Project Management Plan and baselines** - Approved changes need to be **incorporated** into the project baselines. The changes could affect other parts of the Project Management Plan or affect the way the project manager will manage the project, so changes could be made to management plans (e.g., schedule management plan) and the project management plan as a whole.
- **Notify stakeholders affected by the change** - This could be thought of as **Configuration Management**, a form of version control or a way to make sure everyone is working off the same project management plan.
- Manage the project to the new project management plan

Change Control Board : a group of **stakeholders** responsible for **reviewing**, **evaluating**, **approving**, **delaying**, or **rejecting** changes to the project, with all decisions & recommendations being **recorded** [if a project is being provided under a **contract**, then some proposed changes to be approved by the **Customer**].

The Configuration Management Systems accomplishes 3 objectives :
- establishes a method to identify & request changes to **ESTABLISHED baselines**, and to assess the value & effectiveness of those changes.
- to continuously validate & improve the project by considering the **impact** of each change
- **to communicate all changes to stakeholders**

The Configuration Management Systems with **Change Control** :
- provides a **standardised**, **effective**, & **efficient** process to **centrally manage changes** within a project.
- includes **identifying, documenting, and controlling** changes to the **baseline**.

The Configuration Management activities included in this process are :
- Configuration Identification
- Configuration Status Accounting

- Configuration Verification & Auditing

Change Control : Identifying, documenting, approving or rejecting, and controlling changes to the project **baselines**.

Change Control Board (CCB) : A formally constituted group of stakeholders responsible for reviewing, evaluating, approving, delaying, or rejecting changes to the project, with **ALL decisions** and **recommendations** being **recorded**.

Change Control System [Tool] : A collection of formal documented procedures that define how project deliverables and documentation will be **controlled**, **changed**, and **approved**. In most application areas the Change Control System is a subset of the *Configuration Management System*.

Configuration Management System [Tool] : A subsystem of the overall Project Management System. It is a collection of formal documented procedures used to apply technical and administrative direction and surveillance to:
- **identify** and **document** the functional and physical characteristics of a product, result, service, or component
- **control any changes** to such characteristics
- **record** and **report each change** and its **implementation status**
- support the **audit** of the products, results, or components to **verify conformance** to requirements.

It includes the documentation, **tracking systems**, and defined approval levels necessary for **authorizing** and **controlling** changes.

I	TT	O
Project Management Plan ***Deliverables*** ***Work Performance Information*** Recommended Corrective & Preventive Actions Recommended Defect Repair Requested Changes	PMM Project MIS Expert Judgement	Project Management Plan (Update) Project Scope Statement (Update) **Approved / Rejected Change Requests** **Approved Corrective & Preventive Actions** **Approved & Validated Defect Repair** **Deliverables**

Scope Verification :
- is the process of **checking** the work against the **Project Management Plan** and the **Project Scope Management Plan**, **WBS** and **WBS Dictionary**, and then meeting with the customer **to obtain formal acceptance of the completed project deliverables**
- can be done at **the end of each project phase** in the project life cycle (to verify the phase deliverables along the way) and during the **Monitoring and Controlling Process group** in the Project Management Process.
- if the project is **terminated early**, this process should establish and document the **level** and **extent** of **completion**
- primarily concerned with the customer **acceptance of deliverables** [while Quality Control (QC) is primarily concerned with **meeting the quality requirements** specified for the deliverable and analysis of the **correctness** of the work]
- in general, QC is performed **BEFORE** Scope Verification (to make sure the work meets the quality requirements **before** meeting with the customer)
- only has **WBS Dictionary** as input **NOT WBS.**

Alternative ways to describe Scope Verification:
- **Reviewing** work products and results to ensure that all are completed according to **specifications**
- Conducting **inspections**, **reviews**, **audits**
- Determining whether results **conform** to requirements and whether work products are **completed** correctly
- Documenting completion of deliverables
- **Gaining formal sign-off**

Accepted (Satisfactory) Deliverables
The Scope Verification process documents those completed deliverables that have been accepted (satisfactory). Those completed deliverables that have not been accepted are documented, along with the reasons for non-acceptance (non-satisfactory). Scope verification includes supporting documentation received from the customer or sponsor and acknowledging stakeholder acceptance of the project's deliverables.

I	TT	O
Project Scope Statement WBS Dictionary ***Project Scope Management Plan*** ***Deliverables***	Inspection, such as : - Measuring, examining, & verifying whether the work & deliverables meet requirement & product acceptance criteria - AKA audit, walkthrough, or reviews	**Accepted Deliverables** Requested Changes Recommended Corrective Actions

Scope Control :
- to control **changes** to the Project Scope.
- to **manage** the actual changes when they occur & integrated with the other control process
- to make sure **ALL Requested Changes & Recommended Corrective Actions** are processed through **Integrated Change Control**
- to determine **the cause of variance** relative to the scope baseline.

To control scope **(Uncontrolled changes are often referred to as project scope creep) :**
- one first needs to have a **clear definition** of what is the scope on the project; the **Project Scope Statement**, **WBS** and **WBS Dictionary**.
- One then has to measure scope performance against the **scope baseline**.
- Once that information is known, the next step is to determine if any updates to the Project Management Plan or the components of the scope baseline are **needed**, and what corrective and preventive actions should be **recommended**.

Performance Reports
Performance reports provide information on project work performance, such as interim deliverables that have been completed.

Approved Change Requests
An approved change request impacting project scope is any modification to the agreed-upon project **scope baseline**, as defined by the approved **Project**

Scope Statement, **WBS**, and **WBS Dictionary**.

Change Control System
is the **procedure by which the Project Scope and Product Scope can be changed** (i.e. documentation, tracking systems, approval level, contractual provisions).

Variance Analysis
This analysis allows to determine the **cause of variance relative to the scope baseline** and deciding whether corrective action is required.

Configuration Management System
A formal Configuration Management System provides procedures for the status of the deliverables, and assures that requested changes to the project scope and product scope are thoroughly considered and documented **BEFORE** being processed through the **Integrated Change Control** process.

Scope Creep : Adding features and functionality (project scope) without addressing the effects on time, costs, and resources, or without customer approval.

I	TT	O
Project Scope Statement *WBS & WBS Dictionary* *Project Scope Management Plan* *Performance Reports* *Approved Change Requests* *Work Performance Information*	**Change Control System** **Variance Analysis** Replanning Configuration Management System	Project Scope Statement (Updates) WBS (Updates) WBS Dictionary (Updates) Scope Baseline (Updates) Requested Changes Recommended Corrective Actions OPA (Updates) Project Management Plan (Updates)

Schedule Control :

Is the process of effectively **managing changes** to the project schedule, then **integrating** those changes across the entire project through the **Integrated Change Control** process. This process is concerned with:

* determining the **current status** of the project schedule
* influencing the factors that create schedule changes
* determining that the project schedule has changed
* managing the actual changes as they occur.
* adjusting future parts of the project for delays, rather than asking for a time extension
* adjusting metrics that are not giving the project manager the information needed to properly manage the project
* adjusting progress reports and reporting
* utilizing the **Change Control** processes
* **identifying Requested Changes and Recommended Corrective Actions**

Progress Reporting
A useful method to control schedule and costs , which provide information on an **estimate of percent complete for each work package or activity**. On projects where work cannot be measured, this estimate is simply a **guess**.

Performance Measurements
Produce the **Schedule Variance** (**SV**) & **Schedule Performance Index** (**SPI**) to help determine the severity of plan variances.

Requested Changes
Schedule variance analysis, review of progress reports, results of performance measurement, and modifications to the project schedule model, can result in Requested Changes.

I	TT	O
Schedule Management Plan, describes how schedule changes will be managed & controlled. *Schedule Baseline*, which provides the basis for **measuring & reporting schedule performance** as part of the Performance Measurement Baseline. *Performance Reports*, such charts, tables, histograms, etc. that summarise **schedule performance**. *Approved Change Requests*	Progress Reporting, information on actual start/finish dates and remaining durations. Schedule Change Control System, part of **Integrated Change Control.** **Performance Measurements** Project Management Software **Variance Analysis**, comparing target objectives to actuals (schedule / cost), to identify need for Corrective Action. Schedule Comparison Bar Charts, bar charts that compare planned performance & actual progress.	Schedule Model Data (Update), any & all modifications to schedule model data Schedule Baseline (Update), schedule revision resulting from Approved Change Request Performance Measurements, the SV & SPI values for WBS components are **communicated to stakeholder** Requested Changes, to the project schedule baseline Recommended Corrective Actions, actions taken to bring **future schedule performance** into **conformance** with plan, requires analysis to identify the cause of the variations. OPA (Update), schedule control related lesson learned Activity List (Update) Activity Attributes (Update) Project Management Plan (Update), mainly Schedule Management Plan.

Cost Control :

Includes :
* Influencing the factors that create cost variances and controlling changes to the project budget.
* **Determine the cause of a variance, the magnitude of the variance, & to decide if the variance requires Corrective Actions**.
* Ensuring requested changes are agreed upon

- Managing the actual changes when & as they occur
- **Assuring** that potential cost overruns do not exceed the authorised funding periodically & in total for the project
- **Monitoring** cost performance to detect & understand variances from the cost baseline
- **Recording** all appropriate changes accurately against cost baseline
- **Preventing incorrect, inappropriate, or unapproved changes from being included in the reported cost or resource usage**
- **Informing** appropriate stakeholders of approved changes
- Acting to bring expected cost overruns within acceptable limits
- Follow **Change Control System**
- Measure schedule performance against the **Performance Measurement Baselines**
- **Manage** actual changes
- Control impact of cost changes
- Recommend Corrective Actions
- Request changes
- Analyse variances
- Document lessons learned
- **Update Project Management Plan & Cost baseline**
- **Recalculate** the estimate at completion (**EAC**)
- **Obtain additional funding when needed**
- Manage the budget reserve
- Use Earned Value (EV)

EVT :
- a method to **measure project performance against the project baseline**
- indicates **potential deviations** of the project from cost & schedule baselines
- integrates Cost, Time, & the work done (or Scope), and can be used to **forecast** future performance & project completion dates & costs
- lead to new forecasted completion costs, Change Requests, & other items that will need to be **communicated** (Communication Management).
- involves developing these key values for each schedule activity, work package, or Control Account

Name	Meaning
Planned Value (PV)	[**%Complete x BAC**] What is the estimated value of the work **planned** to be done / **schedule ?**
Earned Value (EV)	[**%Complete x BAC**] What is the estimated value of the work **actually accomplished** ?
Actual Cost (AC)	What is the actual cost incurred for the work accomplished ?
Percentage complete	[**EV / BAC**]
Estimate To Complete (ETC)	[**EAC – AC**] From this point on, how much MORE do we expect it to cost to finish the project ? The **forecast amount remaining** to complete the release.
Estimate At Completion (EAC)	[**BAC / CPI**] What do we currently expect the TOTAL project to cost ? This is the **forecast** of **total spend** for the release, the anticipated total cost at project completion. **AC + ETC** -- Initial Estimates are flawed **AC + BAC - EV** -- Future variance are Atypical **AC + (BAC - EV) / CPI** -- Future Variance would be typical
Budget At Completion (BAC)	How much did we BUDGET for the TOTAL project effort ? This is the planned budget.
Variance At Completion (VAC)	[**BAC – AEC**] How much over or under budget do we expect to be at the end of the project?
Cost Variance (CV)	[**EV – AC**] NEGATIVE is over budget, POSITIVE is under budget
Schedule Variance (SV)	[**EV – PV**] NEGATIVE is behind schedule, POSITIVE is ahead of schedule.
Cost Performance Index (CPI)	[**EV / AC**] We are getting $xxx worth of work out of every $1 spent. Funds are or are not being used efficiently. A value less than 1.0 indicates a cost overrun of the estimates. The CPI is the **most commonly used cost-efficiency indicator**.
Cumulative CPI (CPI c)	Widely used to **forecast project costs at completion**
Schedule Performance Index (SPI)	[**EV / PV**] We are (only) progressing at x% of the rate originally planned. The SPI is used : • to predict the completion date • with the CPI to **forecast** the project completion estimates.

- The PV, EV, & AC are used in combination to **provide performance measures** of whether or not work is being accomplished as planned at any given point in time.
- The values of CV and SV tend to decrease as the project reaches completion due to the compensating effect of more work being accomplished. These two values can be converted to **efficiency indicators** to reflect the cost & schedule performance of any project.
- When CPI and SPI are **less than 100%**, means a Critical Path activity took **longer** and needed **more time** & **cost** to complete (**lower = loser**). If your CPI is below 1.0, then your project is over its budget. If the SPI is below 1.0, then the project is behind schedule.
- When **BAC = EAC**, all **work packages are complete**.

Forecasting
Forecasts are **generated**, **updated**, and **reissued** based on **Work Performance Information** (**WPI**). WPI is about the **project's past performance** and any information that could impact the project in the future, such as **ETC** and **EAC**. Forecasting is a cost monitoring tool that helps you predict how much more money you'll need to spend on the project. For that you'll need **ETC and VAC**.

Performance Measurement
A method used to relate physical **progress achieved to cost status**. The method identifies whether cost variances are due to differences in the value of the work being performed, i.e. **too expensive or under budget**. From this, it is possible to assess whether a project is **ahead**, on or **behind** budget and whether the trend is likely to continue. The calculated CV, SV, CPI, & SPI values for WBS components (work package or Control Account) are **documented** & **communicated** to stakeholders.

Project Performance Reviews
This method compare costs performance over time, schedule activities or work package over/under running budget (**Planned Value**), milestones due & milestones met. Performance reviews are **meetings** held to assess schedule activity, work package, or cost account **status** and **progress**, by using :
- **Variance Analysis**, compares actual project performance to planned or expected performance (mainly CV and SV).
- **Trend Analysis**, examining project performance over time to determine if performance is **improving** or **deteriorating**
- **EVT**, compares planned performance to actual performance.

Cost Estimates (updates)
- stakeholders are **notified** as needed
- may require **adjustment** to other aspects of Project Management Plan (such as **eliminate risks in estimates and re-estimate**)

Cost Baseline (updates)
- **budget updates are changes to an approved Cost Baseline, and only revised in response to approved changes in Project Scope**
- cost variances can be so **severe** that a **revised cost baseline** is needed to provide a **realistic basis** for performance measurement

Actual Cost (AC) : **Total costs actually incurred** and **recorded** in accomplishing work performed during a given time period for a schedule activity or WBS component. Actual Cost can sometimes be direct **labour hours** alone, **direct costs** alone, or all costs including indirect costs.

I	TT	O
Cost Baseline *Project Funding Requirements* *Performance Reports* *Work Performance Information*, such as : • (Un)completed deliverables • Costs authorised and incurred • Estimates to complete the schedule activities • % physically complete of the schedule activities *Approved Change Requests*, from the **Integrated Change Control** process can include modifications to the cost terms of the contract, Project Scope, cost baseline, or Cost Management Plan. *Project Management Plan*	**Cost Change Control System** (see *Change Control System*), defines by **the procedure by which the Cost baseline can be changed**. **Performance Measurements Analysis,** helps to assess the magnitude of any variances that will invariably occur, see EVT above. Forecasting, helps to assess EAC & ETC, see above Project Performance Reviews Project Management Software Variance Management	Cost Estimates (updates) & Cost Baseline (updates) Performance Measurements Forecasted Completion, either a calculated EAC value or ETC value, is documented & the value communicated to stakeholders. Requested Changes Recommended Corrective Actions, involves **adjusting** schedule activity budgets (special actions taken to **balance cost variances**) OPA (updates) Project Management Plan (updates)

Perform Quality Control :
Involves monitoring specific project results to determine whether they **comply** with relevant Quality Standards (QS) and **identifying ways (rework) to eliminate causes of unsatisfactory performance.**

Where QA looks at whether **standards and procedures are being followed**, QC looks at specific measurements to see if the **project and its processes are in control (correctness of the work)**. It is during QC that the height of tables in a manufacturing process will be measured, where the number of bugs per module will be measured. Quality control helps answer the questions; "Is everything all right on the project?" "Do I have to spend any additional time or change my project management activities?" "Will the project succeed?"

QS includes **project processes & product goals**.

QC includes taking action to eliminate causes of unsatisfactory project performance to **meet QS** :
- Hold periodic **inspections**
- Ensure authorized approaches and processes are **followed**
- **Recommended Corrective & Preventive Action**
- Make changes or improvements to work and processes
- Complete **rework** as needed to meet requirements
- Make decisions to accept or reject work
- **Evaluate the effectiveness of implemented corrective actions**
- **Reassess the effectiveness of project control systems**
- Improve quality
- **Repaired defect AFTER approval in Integration Change Control**

The team need to know the following terms :
- **Prevention** : keeping errors out of process vs. **Inspection** : keeping errors out of hands of the customer
- **Attribute sampling** : the result conforms, or it does not vs. **Variables sampling** : the result is rated on a continuous scale that measures the degree of conformity
- **Special causes** : unusual event vs. **Common / random cause** : normal process variation
- **Tolerances** : the result is acceptable if it falls within the range specified by the tolerance vs. **Control limits** : the process is in control if the result falls within the control limits

Cause and Effect / Ishikawa / Fishbone Diagram :
- in **QC**, it's a creative way to look at the **causes** or **potential causes** of a problem or to look backward
- in **QP**, it can be used to explore the factors that will result in a **desired future outcome** or to look **forward**
- helps stimulate thinking, organizes thoughts and generates discussion

Control Charts (control process) :
- to determine whether or not a **process** is stable or has **predictable performance**.
- help to determine if a process is **within acceptable** limits.
- can be used to **monitor** project performance figures such as cost and schedule variances.
- helps monitor production and other processes to see if the processes are within **acceptable limits** and if there are any actions required.
- would help the project manager know **whether to take action or not**.
- serve as a data gathering tool to show when a process is subject to "**special cause variation**", which **creates an out-of-control condition**
- **illustrate how a process behaves over time**
- used to assess whether the application of process changes resulted in the desired improvements
- if a process is outside acceptable limits, it should be adjusted
- the upper & lower control limit are usually set at **+/- 3 sigma** (**standard deviation**)
- for cost / schedule variances, is +/- 10 %
- used to monitor project performance, i.e. cost & schedule variances, volume & frequency scope changes, error in project documents.
- has three important lines on it: **the mean** (or the average of all data points), an **upper control limit** and a **lower control limit**. Any time you find a data point that's either above the upper control limit or below the lower control limit, that tells you that your process is out of control. **Seven values on one side of the mean in a control chart indicate a problem with the process that is being measured**.

Flow Chart :
- help analyse **how problems occurs**, help **anticipating problems**
- Shows how a process/system flows & how the elements interrelate
- In **QC** to analyse **quality problem**
- In **QP** to analyse **potential future quality problem & determine QS**

Histogram :
- in which each column of a bar chart represents an attribute or characteristic of a problem.
- helps to identify the cause of problem in a process by the shape & width of the distribution

Pareto Chart :
- a **histogram**, ordered by **frequency of occurrence**, which shows how **many defects** were generated by type/category of **identified cause**
- used primarily to **identify** & **evaluate non**-**conformities**
- rank ordering is used to **guide Corrective Action**
- helps focus attention on the **most critical issues**
- **prioritise potential cause** of the problems
- **separates the critical few from the uncritical many**
- often represents the most common **sources of defects**, the highest occurring type of defect, or the most frequent reasons for **customer complaints**, etc.
- focus on relatively small number of causes which typically produce a large majority of the problems or defects. This is commonly referred to as the **80/20 principle**, where 80 percent of the problems are due to 20 percent of the causes. Pareto diagrams also can be used to **summarize all types of data for 80/20 analyses.**

Run Chart :
- shows the **history & pattern of variation**
- shows **trends** in a process, variation, declines, & improvements in a process over time
- **Trend Analysis** is performed using this chart, & used to monitor :
  o **Technical performance**, i.e. how many errors have been identified, how many remain uncorrected ?
  o **Cost & schedule performance**, i.e. how many activities per period were completed with significant variances ?

Scatter Diagram
Shows the pattern of relationship between 2 variables. Dependent variables versus independent variables are plotted. **The closer the points are to a diagonal line, the more closely they are related (have a strong relationship)** and thus one measurement has a strong relationship (correlation) to the other; therefore, you would be able to prove that one item affects the other closely. If the points are far each other (no correlation , no relationship between the two items), you need to review the "Cause-and-Effect" Diagram or "brain-storming" session.

Inspection :
- is the examination of a work product to determine whether it **conforms to standards**
- the result of this include measurements
- also called **reviews, peer reviews, audits, walkthroughs**
- used to **validate defect repairs**

Recommended Corrective Action
Actions taken, as a result of a QC measurements that indicates the process exceeds established parameters, to bring expected performance in line with the Project Management Plan. Recommended Corrective Action is anything that needs to be done to **bring the seller in compliance with the terms of the contract**.

Recommended Preventive Action
Action taken to prevent a condition that may exceed established parameters (thus negative consequences), to **bring the project into compliance with the project plan**.

Defect
- is where a component **does not meet** its requirements or specifications, and needs to be repaired or replaced [the repaired items is reinspected and will be either accepted or rejected, and rejected items may require further defect repair].
- is identified & recommended for repair by QC department.

I	TT	O
Quality Management Plan	Cause and Effect / Ishikawa / Fishbone	**Quality Control Measurements**, represent the

Quality Metrics *Quality Check-lists* OPA *Work Performance Information*, i.e. technical performance measures, project deliverables, completion status, and implementation of required corrective actions. *Approved Change Requests,* such as revised work methods and revised schedule. *Deliverables*	**Diagram** **Control + Flow + Pareto + Run Charts** Histogram **Scatter Diagram** Statistical Sampling, involves choosing **part of a population** of interest for inspection. Inspection Defect Repair Review, to ensure that product defects are repaired & brought into compliance with requirements or specifications.	result of QC activities that are **fed back to QA**. Recommended & Validated Defect Repair Recommended Corrective & Preventive Action Requested Changes Quality Baseline (updates) OPA (updates) : • Completed check-lists • Lessons learned doc Validated Deliverables Project Management Plan (updates)

Manage Project Team :

Tracking / measuring team member performance, providing feedback, resolving issues, & coordinating changes to enhance project performance. This process is dealing with **conflict** and **motivation**.

This process is **complicated** when team members are accountable to **both** a functional manager and the project manager within a **matrix organization**.

The project manager should :
• observes team behaviour
• manage & resolve conflict.
• appraise team member performance
• update Staffing Management Plan.
• maintain issue log.

Project Performance Appraisals
The project manager can adjust the project to handle **changes in performance** based on these **appraisals**, to include input of co-workers and subordinates as well as supervisors (**360-degree feedback** principal).
The project manager will collect information from team members' supervisors when Project Performance Appraisals are completed. Team Performance Assessment is done by the project manager in order to evaluate and improve the effectiveness of the team. Objective of this process can include **reclarification** of roles & responsibilities, individual **training plan**, & to establish **specific goals** for future time periods.

Recommended Corrective Actions
This may include staffing issues, additional training, & disciplinary actions. Staff changes can include :
• moving people to different assignments
• outsourcing some work
• replacing team members who leave
• the project manager determines how & when to give out recognition & rewards based on team's performance.

Recommended Preventive Actions
This process can be developed to reduce the probability and/or impact of problem before they occur. This process can include :
• cross-training in order to reduce problems during team member absences
• additional role clarification
• added personal time in anticipation of extra work

Power of the Project Manager :
• **Legitimate** (Formal) - derived from formal position ("Do the work because I'm in charge !")
• **Penalty** (Coercive) - predicated on fear
• **Reward** - involves positive reinforcement and ability to award something of value. Project often needs its own rewards system to affect employee performance. Used correctly, bring the team's goals and objectives in line with each other and with the project. **Reward should be within the company's rule.**
• **Expert** - held in esteem because of special knowledge or skill (requires time) or **expertise & experience**
• **Referent** - ability to **influence** others through charisma, personality, etc. ("The VP has put this project at the top of his list ! We'll do the work on this project first. ")

The best forms of power are generally Reward and Expert

Leadership style :
• Directing (telling others what to do), during Project Initiating
• Facilitating (coordinating the input of others) , during Project Executing
• Coaching (instructing others) , during Project Executing
• Supporting (providing assistance along the way) , during Project Executing
• Autocratic (making decisions without input)
• Consultative (inviting ideas from others)
• Consensus (problem solving in a group with decision-making based on group agreement)

Conflict Management
Conditions leading to conflict
• Ambiguous roles, work boundaries, responsibility and authority
• Inconsistent or incompatible goals, when the individual or the units define and establish their own missions and purposes within the organization

- Communication problems, misinterpretation, misunderstood, missed delivery date, etc
- Dependence on another party (activities ,resources, etc)
- Specialization or differentiation, due to professional egos
- Need for joint decision making, due to different opinions & point of views
- Need for consensus, when project teams having a diverse mix of team members with divergent talents, backgrounds, and norms must agree among themselves
- Behaviour regulations, as individuals tend to resist tight boundaries placed on their actions. Such situations may involve safety and security concerns (policies, rules and procedures)
- Unresolved prior conflicts, the failure to manage and deal with conflict quickly leads to more serious problems in the future

Value of Conflict

Positive Aspects	Negative Aspects
Diffuses more serious conflicts	Can lead to more hostility and aggression
Fosters change and creativity as new options are explored	Desire to "win" blocks exploration of new opportunities
Enhances excommunication if both parties are committed to mutual gain	Inhibits communication; relevant information never shared
Increases performance, energy, and group cohesion	Causes stress; creates in unproductive atmosphere
Balances power and influence if collaborative problem solving techniques are emphasized	May cause loss of status or position power when both parties take it as a contest of wills and strive for a win-lose outcome
Clarifies issues and goals	Real issues overlooked as positions become confused with personalities

Conflict is unavoidable because of the
- Nature of projects trying to address the needs and requirements of many stakeholders
- Limited power of the project manager
- Necessity of obtaining resources from Functional Managers

Conflict can be **avoided** through the following techniques :
1. Informing the team of :
    - Exactly where the project is **headed**
    - Project constraints and **objectives**
    - The **content** of Project Charter
    - All key decision and changes
2. Clearly assigning work **without** ambiguity or **overlapping** responsibilities
3. Making work assignments **interesting** and **challenging**

Source of conflict in order of frequency :
1. schedules
2. project priorities
3. resources
4. technical opinions
5. administrative procedures
6. cost
7. personality - it becomes personal if the root cause of the problem is not resolved.

Conflict is best resolved by those **involved** in the conflict. The project manager should generally try to resolve problems and conflict as long as he or she has **authority** over those in conflict or the issues in conflict. If not, the **sponsor** or **functional managers** may be called in to assist. There is one exception. In instances of professional and social responsibility (breaking laws, policies, ethics) the project manager must go over the head of the person in conflict.

3 steps of problem solving:
- Analyse the situation / document the situation
- Develop alternatives with the team
- Go to management

Process of solving problems :
- Define the cause of problems
- Analyse the problem
- Identify solutions
- Implement a decision
- Review the decision and confirm that the decision solved the problem

Conflict Management Techniques

Conflict management techniques include :

1. **Stimulating conflict** :
- Accept conflict as desirable on certain occasions.
- Bring new individuals into an existing situation.

- Restructure the organization.
- Introduce programs designed to increase competition.
- Introduce programmed conflict

2. **Resolving structural conflicts** - focus on the structural aspects of the project organisation that may be causing the conflict :
- Procedural changes – changing work procedures
- Personnel changes – transfer individual into or out of the project
- Authority changes – clarify or alter lines of authority & responsibility
- Layout changes – rearrange work space
- Resources changes – increase resources

3. **Interpersonal conflict resolution techniques** - focus on the human interaction in a conflict situation.
   The "best" approach would be the one that both minimise the obstacles to project completion AND helps to develop cohesive & effective project teams.

   6 Conflict Management Styles :

Style	Description	Effect	Thomas-Kilmann model
Forcing	Pushes one view-point at the expense of others; offers only win-lose solutions	Hard feelings may come back in other forms [**win / lose**]	when you're sure that you're right when an emergency situation exist ('do' or 'die') when stakes are high and issues are important when you are stronger (never start a battle you can't win) to gain a status or demonstrate position power when the acceptance is not important
Smoothing / Accommodating	Emphasizes areas of agreement rather than areas of difference	Provides only short-term solution	to reach an overarching goal to create obligation for a trade-off at a later date when stakes are low and liability is limited to maintain harmony, peace, & goodwill when any solution will be adequate when you'll lose anyway to gain time
Withdrawing / Avoiding	Retreats from an actual or potential conflict situation	Does not solve the problem	when you can't win or the stakes are low when the stakes are high but you aren't ready yet to gain status or demonstrate position power to gain time to discourage your opponent to maintain neutrality or reputation when you think the problem will go away by itself
Compromising	Searches for and bargains for solutions that bring some degree of satisfaction to all parties	Provides definitive resolution [**lose / lose**]	for temporary solutions to complex issues for backup if collaborations fails when both parties need to be winners when you can't win or don't have enough time when others are as strong as you are to maintain your relationship with your opponent when you're not sure you are right when you get nothing if you don't when goals are moderately high
Collaborating	Incorporates multiple viewpoints and insights from differing perspectives; leads to consensus and commitment	Provides long-term resolution	when you both get at least what you want and maybe more to reduce overall project costs to gain commitment & create a common power base when there is enough time, and skills are complementary when you want to preclude later use of other methods to maintain future relationships when there is mutual trust, respect, and confidence
Confronting / Problem Solving	Treats conflict as a problem to be solved by examining alternatives; requires give-and-take attitude and open dialogue	Provides ultimate resolution [**win / win**]	See Collaborating

4. **Choosing a conflict resolution approach**, which involves:
   a. Analysing and evaluating conflict resolution techniques
      Thomas-Kilmann model (see table above) :
      Forcing, **Withdrawal**, & **Smoothing** are **less effective** because they fail to deal with the **basic cause** of the conflict.
      But in some circumstances, these may be useful because they impose a period of **peace**.

      Filley's model (based on concern for personal goals and relationships):
      1. **win-lose** style / "tough battler"(high concern for personal goals and low concern for relationships)
      2. **yield-lose** style / "friendly helper" (low concern for personal goals and high concern for relationships)
      3. **lose-leave** style / "conflict is useless, hopeless" (low concern for both personal goals and relationships)
      4. **compromise** style / "try to find a position where each side benefits & ends up with something" (moderate concern for both personal goals and relationships)
      5. **integrated** style / "problem solver" (high concern for both personal goals and relationships)

      1., 2., and 3. generally lead to **project failure**. 4. and 5. generally lead to **project success**.

   b. Understanding the dynamics of handling two-party conflicts

   c. Choosing the best conflict resolution approach (negotiating to solve problems by using **win-win** strategy)
      Forcing, smoothing, withdrawing, majority rule and the superordinate goal techniques are generally **not effective** in resolving conflicts because they fail to deal with the **real cause** of the conflict. But, sometimes, they may be appropriate when it is important to create a period of **peace** and **harmony**. **Compromise**, **mediation** and **arbitration** are usually used in **labour-management** disputes. In compromising, each party

gives up something and **neither gets exactly what it wants**. In arbitration, both parties may be **unhappy** with the arbitrator or with the **binding decision**.

The best solution for managing project conflicts is the **confronting** / **problem solving**, or **negotiation**, which aims for a **win**-**win strategy**, which is best for both the **project** and the **parties** involved.

Confronting / Problem Solving (Negotiation) Approach

Its goal is to arrive at an acceptable agreement that resolves conflicts or disagreements and helps move the project ahead.
Project managers may use the following simple three-step approach :
1. Define the problem, by following these steps :
    Acknowledge that conflict exists
    Establish common ground or shared goals through effective communication
    Separate the problem from the people.
2. Explore and evaluate alternatives - the alternatives should be analysed and ranked by using an **objective criteria**, not opinions and attitudes
3. Select & implement the best alternative

Tactics for Minimizing Conflict

Minimizing Conflict with Senior Management (Boss) :
- Place yourself in boss's shoes - understand and be sympathetic to the challenges, problems and pressures of senior management
- Analyse boss's thinking pattern - try to be consistent with the boss's way of thinking (analytical or intuitive).
- Don't take only problems to the boss, take solutions as well - explore alternatives and suggest recommendations; try to make the boss's job easier.
- Keep the boss informed of your progress and plans - it will help the boss be your effective mentor. Also you can get better support from your boss
- Listen to and observe your boss
- Consult the boss on policy, procedures and criteria - it will help clarify management philosophy and your boundaries related to administrative issues
- Don't steamroll the boss - be patient and give time for thinking and evaluating your propositions; timing is vital

Minimizing Conflict with Project Team Members (Subordinates) :
- Discover professional and personal goals of your team members - match tasks to their interests and personal goals. This is a key to motivation.
- Clarify your expectations
- Define contra1 parameters
- Develop a tolerance for failure to encourage creativity
- Give positive feedback - avoid criticisms. When you need to point out a mistake, balance your comments with positive feedback
- Give timely praise and recognition

Minimizing Conflict with 0ther Project and Functional Managers (Peers) :
- Help your peers meet their personal and professional goals
- Establish a cooperative climate - the law of reciprocity suggests that if you are cooperative with your peers, they are more likely to collaborate with you.
- Give advance notice of any help you need from peers
- Cultivate informal communication channel - have lunch together, develop social encounters, and discuss topics other than daily work
- Treat them the way you want to be treated

Minimizing Conflict with Clients and Users (Clients) :
- Be supportive towards the client representative
- Maintain close contact with the client
- Avoid giving surprises
- Keep in touch at all levels
- Establish informal relationships as well
- Conduct regular project status meeting

Motivations

6 core phases in the motivational process :
- identify the person's needs
- create drives
- select goal-directed behaviour
- perform the task
- receive feedback
- reassess needs & goals

Comparisons Among Content Theories of Motivation

```
        Needs Theories                    Motivator-Hygiene Theories        Achievement Motivation Theory
Needs Hierarchy ( Maslow ) ERG Theory           ( Herzberg )                        ( McClelland's )
Self-Actualisation --|
                     |--> Growth -----------> Motivators
Esteem -------------|                       ( advancement, growth, achievement ) ------> Need for Achievement
                                                                                    |
Social/Affiliation -----> Relatedness --|                                           |-----> Need for Power
                                        |----> Hygienes
Safety/Security -----|          |    ( job security, salary,
                     |--> Existence ----|     working conditions, group membership ) --> Need for Affiliation
Physiological -------|
```

Factors upon which motivation depends :
- project culture (openness, teamwork, effective communication, clear understanding of plans & expectations)
- project reward system (recognition, promotions, remuneration)
- work content
- environment / working condition

- supervision (well-managed without being over-managed)
- previous success
- competition
- believing in what you do

Motivational factors related to project tasks/jobs

Managers can design jobs with built-in potential motivators by incorporating Herzberg's essentials of a "good" job :

- Direct feedback - prompt and objective information about individual performance in daily work
- Client relationship - an individual customer to be served inside or outside the organization
- New learning - continued opportunity for acquiring skills that are valued by the employee
- Scheduling - opportunity to pace one's own work and to time one's own work breaks within the constraints set by management deadlines
- Unique expertise - some job aspects that leave room for doing one's "own thing"
- Control over resources - some degree of control, such as providing an independent mini-budget.
- Direct communications authority - an open communications system with direct access to relevant information centers
- Personal accountability - personal inspection of output equates the level of accountability for work performance with personal competence.

Motivational factors related to personal drives

Factors that play a positive or a negative role in motivating participants in a project :

"Turn Ons"	"Turn Offs"
Opportunities for intellectual growth and advancement	Lack of challenging assignments
Sense of accomplishment or achievement	Personal accomplishments not valued
Variety of projects / assignments	Routine, boring jobs / tasks
Open communication and access to information	Poor communication, information not readily accessible
Recognition and rewards (monetary and otherwise)	No recognition for good performance
Status and flexibility	Restrictive company policies and administration
Direction and support for meeting project goals	Lack of support/resources
Enthusiastic project manager	Negative attitude by project manager
Cohesive, harmonious teams	No team spirit
High levels of trust and respect participants	Lack of trust among project

Motivational factors related to project managers

Project managers play a very important role in motivating project team members and others involved in the project :

- Use appropriate methods of reinforcement - recognize employees when they do good work.
- Eliminate unnecessary threats & punishments.
- Assign project personnel some responsibility and hold them accountable - giving people appropriate responsibility is always a good motivator.
- Encourage employees to set their own goals - people tend to know their own capabilities and limitations better than anyone else.
- Relate tasks to personal and organizational goals - explain the "big picture" to project stakeholders and show them how it relates to their personal goals.
- Clarify expectations and ensure that project team members understand them - this avoids the frustration of not being sure what is expected.
- Encourage project participants to engage in nove1 and challenging activities - provide opportunities for project participants to try new tasks. This fosters creativity and innovation
- Don't eliminate anxiety completely - a certain leve1 of anxiety is fundamental to motivation. Sometimes the best work is done under pressure.
- Don't believe that "liking" is always correlated with positive performance - a task can be intrinsically boring, yet the consequences are highly motivating.
- Individualize your supervisor - to maximize motivation, treat people as individuals.
- Provide immediate and relevant feedback - this will help project team members improve their performance in the future. Inform employees how they might improve their performance with informational feedback.
- Exhibit confidence in your project team - this results in positive performance.
- Show interest in each team member and their knowledge - people need to feel important and personally significant.
- Encourage individuals to participate in making decisions that affect them - this increases their acceptance and hence their commitment to implement those decisions. People who have no control over their destiny become passive.
- Establish a climate of trust and open communication - lack of trust and open communication are common obstacles to high motivation.
- Minimize the use of statutory position powers - try managing democratically, encouraging input and participation. Inappropriate use of position power turns people off.
- Listen to and deal effectively with employee complaints - handle problems before they become blown out of proportion. People are motivated when interests are looked after.
- Emphasize the need for improvements in performance, no matter how small - frequent encouragement to improve performance in the early stages and throughout the project life cycle will yield continuous improvement as confidence and proficiency are obtained.
- Demonstrate your own motivation through behaviour and attitude - be positive: it's contagious. Walk your talk and set examples.
- Criticize behaviour, not people - this is more effective in resolving conflict. When criticized personally, people become defensive, which reduces objectivity.

Motivational factors related to organisational climate / environment

Top management must implement policies like the following :

- Make sure that accomplishment is adequately recognized - people need to feel important. Also remember that what gets rewarded gets done.
- Provide people with flexibility and choice - permit employees to make decisions when possible.
- Provide an appropriate mix of extrinsic rewards and intrinsic satisfaction - employees need to obtain personal satisfaction in addition to extrinsic rewards. Ensure that the reward systems are equitable to everyone working on the project.
- Design tasks and environments to be consistent with employees' needs - different people need different activities. Use good common sense in

making the proper "fit."
- Make sure that effort pays off in results - if effort does not result in accomplishment, effort will be withheld.
- Be concerned with short-term and long-term motivation - people should receive reinforcement in short-term and long-term assignments.

Motivational Theory: Content & Process Theories

Content: "What" energizes, directs behaviour –
1. Maslow's Hierarchy of Needs Theory (Physiological, Safety, Social/Belonging, Esteem, Self-Actualisation)
2. Hertzberg's Motivator/Hygiene Theories (Motivator: Responsibility, Self-Actualisation, Professional growth, Recognition ; Hygiene: Working conditions, Salary, Personal life, Relationships at work, Security , Status)

Process: "How" personal factors influence behaviour
1. McGregor's Theory X and Theory Y (X: Assumes people lack ambition, dislike responsibility, are inherently self-centered and are not very bright; motivate by reward and punishment. Y: Assumes people become lazy w/o recognition, will accept responsibility, can become self-motivated and exercise self-control; motivate by removing obstacles and providing self-directed environment.)
2. Ouchi's Theory Z/Japanese Theory (focus on team, company; usually lifetime employment, collective decision making)

Motivating people is best done by :
- Rewarding them
- Letting them grow

Other Motivational Theories:
- **Behaviourism** – people behaviour can be modified through manipulation of rewards and punishments
- **Expectancy Theory** – Motivation is explained in terms of expectations that people have about (1) their **ability to perform effectively** on the job, (2) the **rewards** they might obtain if they do perform effectively and (3) the value or **degree of satisfaction** they anticipate from those rewards.
- **MBO** – More support to team, not more power (remain to PM)

Leadership Theories:
- **McGregor –** Theory X (employee lack ambition ,need to be watched all the time) and Theory Y (org structure are responsible for motivation)
- **Tannenabaum-Schmidt model** – Continuum of leadership styles between the autocratic and participative styles
- **Blake and Mouton** – ref to managerial grid (Concern for People Vs Concern for Production), whereas 1,1 is laissez faire management, 1,9 is Country Club management, 9,1 is Task oriented management, 5,5 is Compromise management and 9,9 is team management.

Management Styles
1. Authoritarian   : Lets individuals know what is expected of them
2. Combative   : Eager to fight or be disagreeable over any situation
3. Conciliatory   : Friendly and agreeable
4. Disruptive   : Tends to disrupt unity and cause disorder
5. Ethical   : Honest and sincere
6. Facilitating   : Does not interfere with day-to-day tasks, but is available for help and guidance when needed
7. Intimidating   : Reprimands employees for the sake of a "tough guy" image
8. Judicial   : Applies sound judgement
9. Promotional   : Cultivates team spirit; rewards good work; encourages subordinates to realize their full potential
10. Secretive   : Not open or outgoing in speech, activity, or purpose

Management Skills
1. Leading   : Establishing direction, aligning people, and motivating and inspiring
2. Communicating   : The exchange of information in a variety of dimensions
3. Negotiating   : Conferring with others in order to come to terms or reach an agreement
4. Problem Solving   : A combination of problem definition and decision making
5. Influencing the Organization : The ability to get things done based on an understanding or the formal and informal structures of the organization

Roles of the Project Manager	Functions of the Project Manager
• Integrator • Communicator • Team Leader • Decision Maker • Climate Creator/Builder	• Planning • Organizing • Leading • Controlling

I	TT	O
OPA, i.e. **rewarding** policies & procedures, bonus structures, certificates of appreciation, etc. **Project Staff Assignments** – list of members to be **evaluated**. **Roles & Responsibilities** – a list of staff's roles & responsibilities used to **monitor** & **evaluate performance**. **Project Organization Charts** – **reporting relationship** chart. **Staffing Management Plan** – lists the **time periods** that team members are expected to work, including info such as **training plans,**	Observations & Conversation (keep in touch with the **work** & **attitudes** of team members), i.e. "**how things are going**" Project Performance Appraisals - **evaluation** of the performance of employees by those that supervise them. Issues Log - the objective of the log is to help the project team **monitor issues until closure**. The issue resolution can addresses these obstacles : • differences of opinion • situation to be investigated • emerging / unanticipated responsibilities that need to be assigned to someone on	Requested Changes, i.e. staffing changes. Staffing issues, that may cause **schedule** / **cost** to be **extended**, must be processed through **ICC** **Recommended Corrective Actions,** such as **moving people to different assignments, outsourcing some work, and replacing team members who leave, determines how and when to give out recognition and rewards.** **Recommended Preventive Actions**, such as **cross-training** (during team member absence), **additional role clarification**, & **added personal time in anticipation of extra work.** OPA (Update) :

| certification requirement, & compliance issues.

Team Performance Assessment – (in)formal assessment.

Work Performance Information – collection of team member information : meeting participation, follow-up on action items, & communication clarity.

Performance Reports – reports indicating team performance. These performance include results from **Schedule Control, Cost Control, QC, Scope Verification, & Procurement Audits**. | the project team.

Conflict Management - conflict should be addressed **early** & usually in private, using a **direct** and **collaborative** approach. | • Input to Organizational Performance Appraisals
• Lessons learned documentation, can include:
  o Project organisation charts
  o Ground rules, conflict mgmt technique
  o Proc for virtual teams, co-location
  o Special skills / competencies
  o Issues & solutions

Project Management Plan (Updates) - this may include :
• new project team member roles
• additional training
• reward decision |

Performance Reporting :
- Collecting & distributing **performance information**, **status reporting**, **progress measurements**, & **forecasting** to **stakeholders**.
- Continually measure project performance using variance or trend analysis, Earned Value
- Hold performance reviews
- Identify & analyse trends and variances

The key thing here is to realize that performance is **reported against the Performance Measurement Baselines (PMB)** set in the Project Management Plan. Remember that you should have Performance Measurement Baselines that can be measured, and that you are reporting on Cost, Schedule, Scope and Quality, not just Schedule.

Reports help the team know where they need to **recommend** and **implement corrective action**. Included in Performance Reporting is the need to look into the future. Forecasts can help **determine recommended corrective action** needed **from the team and from the sponsor**. Other reports may include risk reserve reports and reports for other knowledge areas.

When completed, information distribution should result in:
- The issuing of reports from other knowledge areas
- Feedback from those who received the reports
- Lessons learned
- Requested changes to the Project Management Plan and Communications Management Plan
- Reports, forecasts, requested changes and corrective actions and lessons learned documentation

Performance Reports, which includes ;
- **Status Report**, describe where the project now **stands** regarding PMB in cost, schedule, scope, & quality
- **Progress Report**, what has been **completed**, a regular report to senior personnel, sponsors or stakeholders summarizing the progress of a project including key events, milestones, costs and other issues.
- **Trend Report**, examining the project **result over time** to see if performance is improving or not
- **Forecasting Report**, predict future project status or performance (Estimate At Completion and Estimate To Complete)
- **Variance Report**, comparing **actual** results to **baseline**
- **Earned Value**, integrating scope, cost, & schedule measures to assess project performance
- **Lessons learned**

I	TT	O
Work Performance Information ***Performance Measurements*** Forecasted Completion ***Quality Control Measurements*** ***Project Management Pla***n, mainly **Performance Measurement Baseline (PMB)** ***Approved Change Requests*** ***Deliverables***	Information Presentation Tools, i.e. software package, PPT, spreadsheets Performance Information Gathering & Compilation Status Review Meetings, a regular meeting to exchange information about the project. Time & Cost Reporting Systems	**Performance Reports** Requested Changes Recommended Corrective Actions OPA (Updates)

Manage Stakeholders :
Managing **communications** to **satisfy the requirements of, and resolve issues with, project stakeholders**. **Actively managing stakeholders** increase the likelihood that the project will not veer off track due to **unresolved stakeholder issues**, enhances the ability of persons to operate synergistically, and **limits disruptions during the project**. The Project Manager is **responsible** for stakeholder management.

Issues Logs
Issues **DO NOT** usually rise to the importance of becoming a project or activity, but are usually **addressed** in order t**o maintain good, constructive working relationships among various stakeholders, including team members**. An issue is **clarified** and stated in a way that can be **resolved**. An owner is assigned and a target date is usually established for closure. **Unresolved issues can be a major source of conflict and project delays**.

Resolved Issues
As stakeholder requirements are **identified** and **resolved (final resolutions)** , the issues log will document concerns that have been addressed and closed. Examples :
- Customers agree to follow-on contract, which ends protracted discussion of whether requested changes to project scope are within or outside the scope of the current project.
- more staff is added to the project, thus closing the issue that the project is short on required skills.

- negotiations with functional managers in the organisation competing for scarce HR end in a mutually satisfactory solution before causing delays.
- issues raised by board members about the financial viability of the project have been answered, allowing the project to move forward as planned.

I	TT	O
Communications Management Plan OPA, i.e. the Project Manager should address and resolve the project issues with the appropriate project stakeholders.	Communications Methods, i.e. meeting, phone, e-mail, etc. Issues Logs : is a tool that can be used to **document** and **monitor** the resolution of issues.	**Resolved Issues** Approved Change Requests – **authorised** changes that may affect stakeholder communications. Approved Corrective Actions – **authorised** actions taken to align expected future project performance with the plan. OPA (updates) Project Management Plan (updates)

Risk Monitoring & Control :

- identifying, analysing, & planning for **new risks (REMEMBER: Risk identification is done during Risk Identification as well as Risk Monitoring and Controlling!)**
- tracking **identified & watch list risks**, re-analysing existing risks, monitoring trigger conditions for **contingency plan**
- monitoring **residual risks**, executing Risk Response plans, & evaluating their effectiveness throughout the project life cycle.

This process is to determine if :
- Project assumption is still **valid**
- Risk has **change** from its prior state
- Proper risk management policies & procedures are being **followed**
- Contingency reserves of cost or schedule should be modified in line with the risk of the project

Can involve **choosing alternative strategies**, **executing a contingency** or **fall-back plan**, taking corrective action, & **modifying Project Management Plan**

Workarounds
Whereas contingency responses are developed **in advance**, workarounds are **unplanned responses** developed to deal with the occurrence of unanticipated risk events. You don't develop a workaround for an **identified risks**, because a workaround is an unplanned response to a risk that is occurring.

New risks
When a risk is identified that is **NOT** in the risk register, first you need to determine what the risk **entails** and the **impact** to the project, then determine what actions you will take regarding the risk.

Change Request
In a Change Request, first, you should **evaluate the impact of the change**. Next, **determine options**. Then go to **management** and the **customer**.

Variance Analysis [Technique] : A method for resolving the **total variance** in the set of scope, cost, and schedule variables into specific component variances that are associated with defined factors affecting the scope, cost, and schedule variables. It's also a technique used to **measure** the project performance by **comparing the actual performance to the planned performance** in terms of scope, cost , & schedule. So, VA can be used in **Cost Control, Scope Control, & Schedule Control**.

Trend Analysis [Technique] : An analytical technique that uses mathematical models to forecast future outcomes based on **historical results**. It is a method of **determining the variance from a baseline** of a budget, cost, schedule, or scope parameter by using prior progress reporting periods' data and projecting how much that parameter's variance from baseline might be at some future point in the project if no changes are made in executing the project.

I	TT	O
Risk Management Plan, i.e. role & responsibilities, risk owner. ***Risk Register***, i.e. **watch list of non-critical risk** ***Approved Change Requests*** – **all changes should be formally documented, any verbally discussed, but undocumented, changes should not be processed or implemented.** ***Work Performance Information***, i.e. project deliverables status, corrective actions, & **performance reports** ***Performance Reports*** – information or project work performance.	**Risk Reassessment** : identification of **new** risks & **reassessment** of risks -> **ADDITIONAL to Ql & Qn Risk Analysis, and Risk Response Planning** **Risk Audits** : examine & document the **effectiveness** of risk responses in dealing with identified risks & their root causes, as well as the effectiveness of the risks management process Variance & Trend Analysis : the outcomes from these analysis may **forecast potential deviation** of the project from cost and schedule targets. **Deviation from the baseline plan may indicate the potential impact of threats or opportunities.** Technical Performance Measurements : compares **technical accomplishments** during project execution to the project management plan's schedule of technical achievement. **Deviation can help to forecast the degree of success in achieving the project's scope.** Reserve Analysis, managed by project manager, **to compare the amount of contingency reserves remaining to the amount of risk remaining at any time, in order to determine if the remaining reserve is adequate**.	Risk Register (Update), which contains : - Outcomes of risk reassessments, risk audits, & periodic risk reviews - The actual outcomes of project's risks, & risk responses. - Closing of risks that are no longer applicable - Details of what happened when risks occurred - Lessons learned Requested Changes, these changes are reviewed in **Integration Change Control**, then implemented in **Direct & Manage Project Execution**, and **Risk Monitoring & Control** Recommended Corrective Action, includes **contingency plan and workaround plan** Recommended Preventive Action, used to bring the project into **compliance** with the Project Management Plan. OPA (Update), such as risk templates, RBS, lesson learned [the **final versions** of the risk register & the Risk Management Plan templates,

	Status Meetings	check-lists, and RBSs are included]. Project Management Plan (Update)

Contract Administration :

- Ito ensure that the **performance** of both parties to the contract meets **contractual requirements / obligations.**
- to ensure that **payment** terms defined within the contract are met and that seller compensation is linked to seller progress.
- to **review and to document the seller's performance**, and established corrective actions
- to manage any early **termination** of the contracted worked (**for cause, convenience, or default**) in accordance with the **termination clause** of the contract

The project management processes that are applied to this process are :
- **Direct & Manage Project Execution**, to authorise the contractor's work at the **appropriate time**
- **Performance Reporting**, to monitor contractor **cost**, **schedule**, and **technical performance**
- **Perform QC**, to inspect and verify the **adequacy** of the contractor's products
- **Integrated Change Control**, to ensure that changes are properly **approved**, and that all those with a need to know basis are aware of such changes
- **Risk Monitoring & Control**, to ensure that risks are **mitigated**

Contract can be amended any time prior to contract closure by mutual consent, in accordance with the change control terms of the contract.

Contract Administration & Contract Types

Cost Reimbursable	Time & Material	Fixed Price
• Make sure all the costs charged are applicable to the project • Audit every invoice • Make sure the seller's work is progressing efficiently • Watch for the seller adding resources to your project that do not add value or perform real work • Watch for resources being shifted from what was said in the original proposal (more experienced people proposed but less experienced used, but charged at the higher rate) • Watch for seller charges that were not part of the original plan • Re-estimate the cost of the project	• Provide day-to-day direction to the seller • Attempt to get concrete deliverables • Make sure the project length is not extended and the number of hours spent on work is reasonable • Watch for situations when switching to a different form of contract makes sense (You determine the contract statement of work under a T&M contract and then switch to a fixed price contract for completion of the project)	• Watch for seller cutting scope & quality • Watch for seller charging the buyer for costs they have not yet incurred (unless allowable in the contract) • Watch for overpriced change orders • Check for scope misunderstandings

Conflict
The ONLY person who is authorised to change the contract is the Contract Manager or Contract Administrator.

How the project control is different in a contracted environment :
- you need to deal with a different company's set of procedures
- it is not as easy to "see" problems
- greater reliance on reports to determine if a problem exists
- greater reliance on relationships between the buyer's and seller's project managers

Contract Change Control System
All changes, such as **paperwork**, **tracking systems**, **dispute resolution procedures**, & **approval levels** necessary for **authorising changes**, should be made **formally**. Changes are requested through the **procurement process** and are handled as part of the project **Integrated Change Control** efforts. **A seller cannot issue a change order, he may requested one**.

Buyer-Conducted Performance Review
- to determine and recommend needed **Corrective** and **Preventive Actions** and to **request formal changes**.
- a meeting to see if the seller is **performing**.
- a review of seller-prepared documentation and **buyer inspection**, as well as **quality audits** conducted during seller's execution of the work
- to **identify performance** success or failures, progress with respect to the contract Statement Of Work, and contract non-compliance that allows the buyer to **quantify** the seller's ability or inability to perform work.

Claim Administration
Is an assertion that the buyer did something that has hurt the seller and the seller asking for **compensation.. Contested changes** & **constructive changes** are those requested changes where the buyer & seller cannot agree on compensation for the change or cannot agree that a change has even occurred. These contested changes are also called **claims, disputes, or appeals**. Another way of looking at claims is that they are a form of seller's **Change Requests**.

Records Management System
used by the project manager to manage **Contract Documentation** and records [part of **Project** MIS, which may include **indexing systems**, **archiving systems** and **information retrieval systems** for projects with extensive documentation.]

Contract Documentation
Includes :
- any seller-developed technical documentation and other **WPI** (Work Performance Information), such as deliverables, seller performance reports, **warranties**, financial documents (**invoices** & **payment records**), and the results of **contract-related inspection**.
- the contract, with all supporting schedules, requested unapproved contract changes, and approved Change Request

Seller Performance Evaluation Documentation
This document can form **the basis for early termination** of the seller's contract, or determining how contract **penalties**, **fees**, or **incentives** are **administered**. It can also be included in the appropriate **Qualified Seller Lists**.

I	TT	O
Contract ***Contract Management Plan*** ***Selected Sellers*** ***Performance Reports*** – seller performance-related documentation. ***Approved Change Requests*** – any modification to the terms & conditions of the contract, including the contract Statement Of Work, pricing, and description of the products, services, or results to be provided. **All changes are formally documented in writing & approved before being implemented**. ***Work Performance Information*** [which **quality standards** are being met, what costs have been incurred or committed, **seller invoice**].	Contract Change Control System Buyer-Conducted Performance Review Inspections & Audits, which can be conducted during execution of the project to identify **any weakness** in the seller's work processes or deliverables. Performance Reporting, provides management with info about how **effectively** the seller is **achieving** the contractual objectives. Payment System **Claims Administration** **Records Management System** Information Technology	**Contract Documentation** Requested Changes, any changes from the buyers & sellers for a constructive contract. Recommended Corrective Actions, to bring the seller in **compliance** with the terms of the contract. OPA (updates) • Correspondence • Payment schedules & requests • **Seller Performance Evaluation** Documentation, prepared by the buyer, indicate (evaluate) if the seller can be **allowed to perform work on future projec**t Project Management Plan (Update) : • Procurement Management Plan, to reflect any **approved Change Requests** that affect procurement management. • Contract Management Plan, to reflect any **approved Change Requests** that affect **Contract Administration**.

CLOSING

	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
Integration	Develop Project Charter Develop Preliminary Project Scope Statement	Develop Project Mgmt Plan	Direct & Manage Project Execution	Monitor & Control Project Work Integrated Changed Control	Close Project
Scope		Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	
Time		Activity Definition Activity Sequencing Activity Resource Estimating Activity Duration Estimating Schedule Development		Schedule Control	
Cost		Cost Estimating Cost Budgeting		Cost Control	
Quality		QP	QA	QC	
HR		HR Planning	Acquire Project Team Develop Project Team	Manage Project Team	
Communications		Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	
Risk		Risk Mgmt Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning		Risk Monitoring & Control	
Procurement		Plan Purchases & Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

It is during project Closing that the team compiles the **final version** of the lessons learned and makes them available to other projects and the Project Management Office. In addition, a concerted effort must be made to index and put all files, letters, correspondence and other records of the project into **an organized archive** which is stored for use on future projects.

Formal sign-off is important because it indicates the customer considers the project completed and accepts the whole project. Formal sign-off in a contracting situation constitutes **legal acceptance**. Without that acceptance, one cannot be sure the project was **successful**.

In addition to obtaining formal acceptance, another important part of project closing is **measuring customer satisfaction**. Just like lessons learned, measuring customer satisfaction should be ongoing throughout the project, but **MUST** occur during all parts of project closing.

Once administrative closure is **completed** and **formal sign-off** that the products of the project are acceptable is received from the customer, other stakeholders and/or the sponsor, the project is **closed**.

Close Project :
- Formally **ending** either the project or project phase & **finalizing ALL** <u>activities</u> <u>completed</u> across all Project Management Process Group
- Perform the project closure portion of the Project Management Plan
- Establish procedures to coordinates activities needed to :
  - o **Verify** & **document** the project **deliverable**
  - o **Formalize** deliverables by customer or sponsor
  - o Investigate & document the reasons for actions taken if a project is terminated **BEFORE** completion
- Developed 2 procedures :
  - o Administrative Closure Procedure
  - o Contract Closure Procedure

Administrative Closure Procedure :
- Focus on closing **the project or project phase**.
- Details **ALL** activities, interactions, & related roles/responsibilities of the project team member & other stakeholder involved in executing Adm Clos. Proc for the project.
- Detail activities to verify that all **deliverables** have been provided & accepted, and validate that **completion** & **exit criteria** have been met.
- Integrated activities to **collect** project records, analyse project **success** or **failure**, **gather lessons learned**, & **archived project info for future use**.
- Actions and activities to define the stakeholder **approval requirements** for changes and **ALL levels** of **deliverables**
- Actions and activities that are necessary to confirm that **the project has met ALL sponsor, customer, and other stakeholders' requirements**, verify that **ALL** deliverables have been **provided** and **accepted**, and validate that completion and exit criteria have been met
- Actions and activities necessary to **satisfy completion** or **exit criteria** for the project.

Contract Closure Procedure :
- Focuses on closing **a contract that is part of a project**.
- Activities & interactions needed to settle & close any contract agreement
- **Product verification (all work completed correctly & satisfactorily)**
- Updating of contract record and **terms & conditions** - make sure that the **contract's terms are satisfied**
- **formally close all contacts associated with the completed project**
- If your project went well, then this means making sure that **payment was made** and all of the clauses of the contract were adhered to. But even if the project got terminated, there may still be some **contractual obligations** that need to be met

You always close out a project no matter the circumstances under which it stops, is terminated, or completed.

Contract Documentation
Contract documentation is an input used to perform the Contract Closure process, and includes the contract itself, as well as changes to the contract and other documentation (such as the technical approach, product description, or deliverable acceptance criteria and procedures).

Final Product, Service, or Result
Formal **acceptance** and **handover** of the final product, service, or result that the project was authorized to produce. The acceptance includes **receipt of a formal statement that the terms of the contract have been met**.

I	TT	O
EEF& OPA _**Project Management Plan**_ _**Contract Documentation**_ _**Work Performance Information**_ _**Deliverables**_	PMM Project MIS Expert Judgement	**Final Product, Service, or Result** **Administrative Closure Procedure** & **Contract Closure Procedure** : OPA (Update) : • Formal Acceptance Doc (by customer or sponsor). • Project Files • Project Closure Documents (formal doc indicating completion or termination) • Historical information (project records, reports, etc)

Contract Closure :
• Completing & settling each **contract**, including the resolution of any open items
• **Closing each contrac**t applicable to the project or a project phase
• **Verification** of all work & **deliverable** are _**acceptable**_.
• Unresolved claims may be subject to **litigation AFTER** contract closure.
• Part of the **Close Project**, described in Integration.
• Involves administrative activities, such as **updating records** to reflect final results and archiving such information for future use.

Contract closure is done:
• when a contract **ends**
• when a contract is terminated before the work is completed (**early termination**)

If the seller completes the work specified in the contract Statement Of Work (even if the buyer is **not satisfied** with the result) , the contract is considered **complete**. That does not mean the same thing as contract closed. **Contract Closure must still occur**.

Difference between **Administrative Closure** and **Contract Closure** :
• Contract Closure **occurs first**. All contracts must be closed out **before** the project is closed out. Therefore, at the end of the contract, the project manager performs a **procurement audit** for each contract, administratively closes out the contract, and then administratively closes out the project when the whole project is **completed**.
• Administrative closure may be done at **the end** of each project phase and **at the end** of the project as a whole. Contract closure is done only **once**, at the end of the contract.
• Administrative closure uses the term **"lessons learned"** and Contract Closure uses the term **"procurement audit."**
• Contract Closure requires **more record keeping** and must be done more formally than is generally required for Administrative Closure, in order to make sure **to protect the legal interests of both parties**.

Contract File
(Project Archives in Administrative Closure) putting records of the contract into an organized file. This file will be stored for use as **historical records** and help protect the project in case of **arguments or legal action** regarding what was done and not done on the contract. The file should include:
• Contract
• Changes (approved and rejected)
• Submittal from the seller
• Seller performance reports
• Financial information
• Inspection results
• Lessons learned

Formal Acceptance and Closure
Once closure is **completed** and **formal sign-off** that the products of the contract are **acceptable** is received from the buyer, the contract is **closed**. In gaining formal acceptance the seller is also working to measure **customer satisfaction**. Often a formal customer satisfaction survey may be included in Contract Closure.

Termination
The contract should have provisions for stopping work before completion. Termination can be for **cause** or for **convenience**. The buyer may terminate a contract for cause if the seller breaches the contract (e.g., **does not perform**). The buyer can also terminate the contract because they no longer want the work done (**termination for convenience**). It is rare to allow the seller to terminate a contract, but it could be appropriate on some projects. Termination **automatically** puts the project into the **Closing** process group.

Project Manager's role in Contract :
• Know the Procurement process
• Understand contract terms and conditions
• Make sure the contract contains all the Project Management requirements such as attendance at meetings, reports, actions and communications deemed necessary
• Identify risks and incorporate mitigation and allocation of risks into the contract
• Help tailor the contract to the unique needs of the project

- Fit the schedule for completion of the Procurement process into the Schedule for the project
- Be involved during Contract Negotiation to protect the relationship with the seller
- Protect the integrity of the project and the ability to get the work done
- Uphold the entire contract, not just the contract Statement Of Work
- Work with the Contract Manager to manage changes to the contract

If a question describes some activity and that activity is after the proposal is created and before the contract is signed, then it must be taking place as part of **Select Sellers**. If is taking place after the contract is signed, but before the work is substantially done, it must be occurring during **Contract Administration.**

Procurement Audits :
- a structured review of the procurement process from the **Plan Purchases & Acquisitions** through **Contract Administration**.
- a **lessons learned** of the procurement process that can help improve other procurements [the seller may be involved in **procurement audits** and/or lessons learned activities].
- to **identify successes or failures** that **warrant** recognition in the preparation or administration of other procurement contracts.

I	TT	O
Procurement Management Plan *Contract Management Plan* *Contract Documentation* *Contract Closure Procedure*	**Procurement Audits** Records Management System	**Closed Contracts** [the buyer provides the seller with **formal written notice** that the contract has been **completed**]. OPA (updates) : • contract file • deliverable acceptance • lessons learned documentation

PROFESSIONAL & SOCIAL RESPONSIBILITY

Professional responsibility **REQUIRES** the project manager to obtain the authority necessary to manage the project.
Professional and social responsibility **REQUIRES** the project manager to handle an unrealistic schedule problem upfront.

Professional and social responsibility can be broken down into the following categories:
- Ensure individual integrity
- Contribute to the project management knowledge base
- Enhance personal professional competence
- Promote interaction among stakeholders

Ensure Individual Integrity
This topic may require you to know that a Project Manager must:
- Tell the **truth** in project reports, conversations and other communications
- **Follow** copyright and other laws
- Not **divulge** company data to unauthorized parties
- Value and **protect** intellectual (non-tangible) property
- Not put **personal gain** over the needs of the project
- **Prevent** conflicts of interest or the appearance of conflicts of interest and deal with them **when they do occur**
- Not give or take **bribes** or inappropriate **gifts, even if it's after the project has finished.**
- Treat everyone with **respect**
- Follow PMI's Code of Professional Conduct
- Do the **right** thing
- Follow the **right** process
- Report **violations** of laws, business policies, ethics and other rules

Contribute to the Project Management Knowledge Base
This topic may require you to know that a project manager should:
- Share lessons learned from the project with other project managers in the company
- Write articles about project management
- Support the education of other project managers and stakeholders about project management
- Coach or mentor other project managers and project team members
- Perform research to discover best practices for the use of project management and share the results with others
- Perform research on projects done within the company for the purpose of calculating performance metrics

Enhance Personal Professional Competence
This topic may require you to know that project managers:
- Work to understand their personal strengths and weaknesses
- Continue to learn to apply the science of project management
- Plan their own professional development
- Constantly look for new information and practices that will help the company or its projects
- Continue to learn about the industry or industries where they work

Promote interaction among stakeholders
Balancing stakeholders' interests - it is an impossible effort if you do not have clear project **objectives**, if you have not previously identified **ALL** the stakeholders and determined **ALL** their requirements. Being able to balance their interests implies that you also know the priority of their requirements.

Resolve Competing Interests - the project manager should facilitate the resolution of competing interests by accepting those that best comply with the following:
- The reason the project was initiated (market demand, legal requirement, etc.)
- The Project Charter
- The Preliminary Project Scope Statement
- The Project Scope Statement
- The components of the "triple constraint"

In order to deal with competing interests, the project manager would take the following actions:
- Determine and understand the interests of all stakeholders
- Actively look for competing interests
- Get management involved when the team cannot resolve the competing interests
- Determine options for fair resolution of conflict
- Use conflict resolution, communication, negotiation, information distribution, team building and problem solving skills (see those topics in this book)
- Review the competing interests against those listed above (Those needs that are in line with the items listed above may be accepted, those that are not are rejected and may become a parts of a future project)
- Look for options including: **schedule compression**, **re-estimating**, **brainstorming** and other project management and management-related techniques
- Hold meetings, interviews and discussions to facilitate resolution of competing interests
- Make decisions and changes that do not impact the reason the project was initiated, the Project Charter, the Preliminary Project Scope Statement, the Project Scope Statement or the components of the "triple constraint"
- **Bring suggested changes to the Project Charter to the Sponsor's attention for approval**
- Escalate when a fair and equitable solution cannot be facilitated

Deal With Problems and Conflicts As They Arise

Interact With Team and Stakeholders in a Professional and Cooperative Manner
A project manager must:
- Respect the needs of resource managers
- Realize that team members' reputations can be negatively affected by the project
- Identify and understand cultural differences

- Uncover communication preferences when identifying stakeholders
- Uncover and respect different work ethics and practices of team members
- Provide formal and informal training to stakeholders as needed for them to effectively work on the project
- Follow the practices in use in other countries as long as they do not violate laws

Identify and Understand Cultural Differences
The project manager must :
- Embrace diversity. Cultural differences can make a project more fun.
- Prevent culture shock. The disorientation that occurs when you find yourself working with other cultures in a different environment. Training and advance research about the different cultures will help prevent culture shock.
- Expect cultural differences to surface on the project.
- Use clear communication to the right people and in the right form, as outlined in the Communications chapter, to prevent cultural differences from becoming a problem.
- Uncover cultural differences when identifying stakeholders.
- Ask for clarification whenever a cultural difference arises.
- Discuss the topic of cultural differences at team meetings as needed.

Uncover Communication Preferences When Identifying Stakeholders

The PMP Code of Professional Conduct

As a PMP you agree to support and adhere to the Code of conduct. It is described with two sections:
- Responsibility to the Profession and
- Responsibility to Customers and the Public

Responsibility to the Profession : Here you have six basic responsibilities
- Be truthful at all times and in all situations
- Report Code violations (with factual basis)
- Disclose conflicts of interest
- Comply with laws
- Respect other's intellectual property rights
- Support the Code

Responsibility to Customers and the Public : Here you have five basic responsibilities
- Be truthful at all times and in all situations
- Maintain professional integrity (satisfy the scope of your professional services)
- Respect the confidentiality of sensitive information
- **Refrain from gift or compensation giving/receiving where inappropriate**
- Ensure conflicts of interest do not interfere with client's interest or interfere with professional judgement

Business Ethics

Ethics in project management involves learning **what is right or wrong**, and then **doing the right thing**.

But in the real world, 'the right thing' is not as straightforward as conveyed in lots of business ethics literature.

Here are eight guidelines to help you establish a strong ethics foundation for your project.
- Recognize that managing ethics is a process. Ethics management is the **process of reflection and dialogue** . that produces deliverables such as codes, policies and procedures.
- The goal of an ethics management initiative is **preferred behaviour** in the project environment.
- The best way to manage ethical dilemmas, like negative project risks, is **to avoid their occurrence in the first place**
- Make ethics decisions in **teams**, and make decisions **public**, **as appropriate**.
- Integrate ethics management with other project practices. **Define preferred ethical values directly in the project plan**.
- Use **cross-functional teams** to develop your ethics management plan. Benefit from varied input.
- Value **forgiveness** Help project personnel **recognize** and address their **mistakes** and then **support** them to continue to try to operate ethically
- Give yourself credit for trying. Attempting to operate ethically and making a few mistakes is **better than not trying at all**. All projects are comprised of people and people are not perfect.

Until recently, ethics in business typically meant philanthropy of some sort. However, in light of today's corporate scandals, ethics has surfaced as an important issue. As a result, values are increasingly becoming an integral part of effective project management.

How do project managers turn to values? Here are five areas to approach:
- **Risk Management**: This is fairly straightforward. Incorporating values into your project can help eliminate risks associated with organizational and individual misconduct.
- **Organizational functioning**: Planned-in values can build a well-functioning project organization by **encouraging cooperation**, **inspiring commitment**, **nurturing innovation** and **energizing team members** around a positive self-image.
- **Civic positioning**: Values can establish the project organization's standing in the community as a **progressive force for social betterment** and as a **solid contributing citizen**.
- **Market positioning**: Values can shape a project **organization's identity and reputation**. Values can help build the organization's **brands** and earn the trust of customers, suppliers and partners
- **Simply a better way**: Although values do provide financial benefits, this should not be the justification for ethics. Values are **worthwhile** and **fundamental** principles of **responsibility**, **humanity** and **citizenship**. They need **NO JUSTIFICATION**.

How to Face a Public Crisis :

Hopefully, you will never encounter the misfortune of having to deal with a public crisis. But, as project manager, you are the one that may be called upon to face the community. Here's how to handle it: Understand this is a formative experience and let these seven words be your guiding principle... Tell the Truth and Tell it Fast. Communicate frequently, invite everyone, answer all questions willingly and truthfully.

Cultural Competencies :

As modern business continues its evolution to becoming a world community, project managers increasingly find themselves managing multicultural teams. Many projects today are even global in scope, with project teams working from different locations around the world.

Today's project managers must add 'cultural competency' to their long list of general management skills.

To become truly expert and fluent in cultural competencies, you could spend a lifetime studying and travelling. For our purposes, maintaining a professional sensitivity to cultural differences and knowing a few basic 'rules' should be adequate.

There is no need to study this material meticulously. Simply read it to develop a general feel for the subject.

Differences :

Differences exist, not only between countries, but within a country's own borders as well. Some key differences between countries

• Physical time • Perceived time • Monetary policies	• Procurement practices • Negotiating practices • Language	• Body Language • Education • Governments	• Management styles • Trust • Quality Standards	• Risk thresholds • Travel constraints (country infrastructure)

Some key cultural differences in perception and behaviour:
- Social groups
- Religions
- Races
- Class structure
- Genders
- Local laws

Some key cultural differences in perception and behaviour:
- Environment
- Time
- Action
- Communication
- Space
- Power
- Individualism
- Competitiveness
- Structure
- Thinking

Dos and Don'ts in Managing Global Projects :

In managing global projects, it is essential to **develop cultural self-awareness**. The first, and most important, step is becoming aware of your own cultural orientations and the impact they can make in managing projects across cultures. You must prepare for cross-cultural project encounters with purpose and thoroughness. Here are a few dos and don'ts to consider.

DO
- Develop your cultural self-awareness.
- Set realistic expectations for yourself and others.
- Accept that you will make mistakes, but remain confident.
- Be patient.
- Slow down. Make relationships.
- Keep your sense of humour.
- Keep your integrity.
- Stay objective . minimize blame.

DON'T:
- Assume similarity.
- Try to adopt the orientations of the other culture. **Adaptation does not mean adoption**.
- Dwell on comparing the other culture with your own.
- Evaluate the other culture in terms of good or bad.
- Assume that just being yourself is enough to bring you cross-cultural success.

How to Develop Multicultural Excellence in Global Projects

As we rapidly evolve into a global community, many project managers find themselves managing project teams across vast geographical landscapes. To improve your success probability in such environments, it is essential to develop multicultural competencies.

Here are few things you can do to help develop multicultural excellence:
- **Multiple languages**: Recruit core team members who speak multiple languages
- **Multicultural experience:** Provide core team members with multicultural experiences.
- **Cross-cultural experience:** Arrange cross-cultural experiences for extended team members.
- **Continuous improvement:** Acknowledge the continuous need to improve cross-cultural experiences for all team members.

Across the Miles, Keep Team Members Feeling Connected :

It is important to let offsite project team members know they mean more to the project than just deliverables, an email address or a teleconference voice.

Although personal events have little to do with work, make it a routine practice to acknowledge events such as birthdays, weddings, births and graduations. This level of thoughtfulness sends a powerful message and helps to enhance overall team performance

SUMMARY

	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
Integration	Develop Project Charter Develop Preliminary Project Scope Statement	Develop Project Mgmt Plan	Direct & Manage Project Execution	Monitor & Control Project Work Integrated Changed Control	Close Project
Scope		Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	
Time		Activity Definition Activity Sequencing Activity Resource Estimating Activity Duration Estimating Schedule Development		Schedule Control	
Cost		Cost Estimating Cost Budgeting		Cost Control	
Quality		QP	QA	QC	
HR		HR Planning	Acquire Project Team Develop Project Team	Manage Project Team	
Communications		Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	
Risk		Risk Mgmt Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning		Risk Monitoring & Control	
Procurement		Plan Purchases & Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

MEMORY AIDS

The following are common TT for all the processes in the Project Integration Management knowledge area:
- Project Management Methodology and PMIS
- Expert Judgement (**except** Direct and Manage Project Execution)

After the Project Management Plan is developed, it is an input for **ALL SUCCESSIVE PROCESSES** in the **Project Integration Management** knowledge area.

Activity Attributes Updates is a common output for all the processes in the **Project Time Management** knowledge area except the first process where activity attributes are created.

Requested Changes is a common output for all the processes in the Project Cost, Time, Quality & Scope Management knowledge area except the Activity Duration Estimating Process , Quality Planning, and Scope Planning.

Seven basic tools of Quality: CCFRHPS (**Cat Cat-Fish Runs on Horse Pony Stallion**) :
- Cause and Effect Diagrams.
- Control Charts.
- Flow charting
- Run Chart
- Histogram
- Pareto Chart
- Scatter Diagram

PAW
Scope Control, Cost Control, Risk Monitoring & Control, and Contract Administration processes have PAW in Inputs :) .
PAW stands for Performance Reporting, Approved Change Requests and Work Performance Information.
The other M & C Processes have two of PAW inputs except (Integration Management & Manage Stakeholders)
You can remember this as SCRC has PAW

Recommended Preventive Actions
This occurs in only 4 processes - Monitor & Control Project Work, Risk Monitoring and Control, Quality Control and Manage Project Team.
Recommended Preventive Action is used to **bring the project into compliance with the project plan**. Recommended Corrective Action is anything that needs to be done to **bring the seller in compliance with the terms of the contract**.

Recommended Defect Repair is output of only two processes : M & C Project Work and Quality Control

Cost of Quality - Input to Quality Planning and TT For Cost Estimating.

Forecasting
- Forecasts are outputs of M & C Project Work and Performance Reporting
- Forecasted completion is output of Cost Control and input to Performance Reporting
- Forecasting is TT for Cost Control

Five outputs of Direct & Manage Project Execution are inputs to Quality Assurance namely
- Implemented Change requests
- Implemented Corrective actions
- Implemented Preventive actions
- Implemented Defect Repair.
- Work Performance Information.

Contract which is output of Select Sellers process is input to Contract Administration and Cost Budgeting

There is only one Tool & Technique for Risk Management Planning: Planning Meetings & Analysis.

Prevention is keeping errors out of the process. **Inspection** is keeping errors out of the hands of the customer.

Attribute sampling is whether the result conforms or not. In Variables sampling, the result is rated on a continuous scale that measures the degree of conformity.

Common causes (a.k.a random causes) are normal process variations. Special causes are unusual events.

The result is acceptable if it falls within the range specified by the tolerance control limits. The process is in control if it falls within the control limits.

TIPS / FLASHCARDS

When a new stakeholder comes in and affecting your project you're managing, the best thing to do is to get his opinion incorporated in the project **up front**. It's important that **ALL** of the project stakeholders understand the needs and objectives that the project is meant to address. The worst case is to have the stakeholder's opinion incorporated at the end of the project -- that could mean a lot of re-work or even an entirely unacceptable product.

When handling a team member for poor behaviour affecting the project, punishment is the best choice of power. Always remember to do this **one-on-one, in person, and in private**! Punishing someone in front of peers or superiors (Functional Manager) is extremely embarrassing, and will be really counter-productive.

EMV Calculations [When you calculate EMV, anything that **saves your project money** is counted as **positive**, and anything that **costs it money** is **negative**. Multiply each by the probability and add them together] :
The team estimates that there is a 40% chance that the subcontractor will fail to deliver. If that happens, it will cost an additional $15,250 to pay your engineers to rewrite the work, and the delay will cost the company $20,000 in lost business. Another team member points out an opportunity to save money an another area to offset the risk: if an existing component can be adapted, it will save the project $4,500 in engineering costs. There is a 65% probability that the team can take advantage of that opportunity.
EMV = 40% * (- $15250 - $20000) + 65% * (+$4500) = -$14100 + $2925 = -$11175

When it comes to stakeholder expectations, nothing beats documentation ! **Get stakeholder expectations in writing ASAP** !.

Know that customers can be **internal** or **external**, but they all have the same theme: Customers pay for, or use, the product deliverables. In some instances, they'll pay for, and use, the deliverable.

Project management processes are the processes you'll want to study. Product-oriented processes, on the other hand, are **unique to the organization creating the product**.

Assumptions should be **documented** whenever they are used. This includes estimates, planning, scheduling, and so on. Assumptions can be considered as **risks** because **false assumptions can alter the entire project**.

Money already spent on a project is called **sunk costs** and should not be taken into consideration when determining if a project should continue. Instead, the cost of the work to complete is one of the elements that should be taken into consideration when considering whether to kill a project.

Perhaps the most important reason to include stakeholders is that they can **contribute** to the project management plan. Stakeholders know things that the project team doesn't, thus you should use the stakeholders to help the project succeed.

The Project Charter does not have to come from the project sponsor. It can come from a manager **outside** of the project or some other initiator. In addition, the Project Charter doesn't launch the project—it authorizes the project manager.

Open issues are **acceptable**, as long as they are not related to major issues that will prevent the project from moving forward. For example, conflicting objectives and requirements between stakeholders **CAN'T be** an open issue. A resolution and agreement on project requirements has to be in place before the project work can begin.

Hidden stakeholders can influence the outcome of the project. They can also add cost, schedule requirements, or risk to a project.

Leadership and management are **interrelated**. You won't have effective leadership without management, and vice-versa. Know that leadership can also come from project team members, not just from the project manager.

If the scope has been completed, the project is finished. Beware of exam questions that tell you the scope is completed but that the customer isn't satisfied. This is because **if the scope is complete, the project is complete**.

With vendor disputes, refer to the **contract** since it's the legal document for the client-vendor relationship.

Historical information is **proven** and **documented**, and comes from reliable sources, hence more important than project team members' opinions.

Phases are unique to each project. Phases are not the same as initiating, planning, executing, monitoring and controlling, and closing. These are the process groups, and are universal to all projects.

With respect to negotiation, it is important to move beyond cultural stereotyping and seeing people as individuals with unique personality traits and experiences.

There are **NO** rejected corrective actions and preventive actions. PMBOK implies that they are all approved.

A **letter of credit** is issued by a financial institution, guaranteeing payment upon receipt of goods. It is the normal means of financing overseas shipments. The financial institution must be paid, either through cash settlement or a draw against credit, before releasing the shipment. A **letter of intent** (a) is a non-binding statement indicating a willingness to conduct business upon certain conditions being met. A **line of credit** (c) is a commitment from a lending institution to grant financing to a business, and could be the backing for a letter of credit. A completion bond is a type of performance bond used in the entertainment industry.

The three **major causes** of change on a project are:
*   **errors** in the initial assessment of how to achieve the goal of the project
*   **new information** about the project deliverable
*   **new mandate**

Re-baselining may be an output of Cost Control when CVs are **severe**, and a **realistic measure of performance** is needed.

Your project team identified six related projects with major dependencies on your deliverables. Some of these projects have a very similar scope and may overlap with your deliverables. In light of this, you should be MOST concerned about Risk Response Planning.

If there is a question in exam around delegation, try to watch for the options as follows
*   **Technical stuff** - All technical stuff can be delegated
*   WBS and similar items - Remember that WBS , estimation etc is best done by project team rather than PM
*   Working with customers on Technical details. PM need not be involved. He can just be informed.
PM should not delegate value added stuff which are mainly responsibilities like
*   Motivating team members
*   Giving out rewards. You can invite senior managers but not delegate

- Watch out for things in PMBOK where it says this is PM;s responsibility.

The purchase order becomes a "contract" when it is accepted and signed by the vendor.

When there is uncertainty associated with one or more aspects of the project, one of the first steps to take is to increase the estimated cost.

Communication barriers are a more frequent source of conflict in matrix and projectised environments than functional organizations for the following reasons :
- team members are often physically separated in a matrix or project environment
- there are increased numbers of levels of authority in a matrix or projectised environment
- team members are often separated in the timing of their contributions to a matrix or project environment
- team members with differing skills and backgrounds can be asked to contribute to project results

To determine resource requirements, a new project manager should look to WBS.

The major difference(s) between time-limited scheduling and resource levelling is that time-limited scheduling reschedules activities according to resource availability while resource levelling attempts to smooth out resource requirements by rescheduling.

The legal contractual relationship that exists between the buyer and the seller is called **contract privity**.

Random variance in a process, as measured by the standard deviation. can be directly reduced by identifying patterns of variance using **Control Charts**.

CPM uses most likely **time estimate**.
PERT is superior to CPM because it requires three time estimates per task.
PERT provides an optimistic, pessimistic and most likely estimate for each task.

The project is not completed until formal acceptance is received, and any other requirements for project closure as stated in the contract are met.

The customer on a project tells the project manager he has run out of money to pay for the project. In this situation, the project manager should enter the administrative closure.

[from http://projectsteps.blogspot.com/2007/07/project-management-professional.html]
You are working in a country where it is customary to exchange gifts between contractor and customer. Your company code of conduct clearly states that you cannot accept gifts from any client. Failure to accept the gift from this client may result in termination of the contract. The action to take in this case would be to **contact your project sponsor and /or your legal or public relations group for assistance**.

During your assignment as project manager you add a new member to your project team. This new team member was recently hired from a competitor and offers to share a substantial amount of proprietary information from his previous company. This information could put you and your team in a very strong position for future business. You are aware of a non compete clause in the new hire's condition of employment. You should **review the condition of employment with the new hire and advise her to reconsider the offer**.

An example of a conflict of interest would be as a public official you make a decision about a contract award that will benefit you personally and NOT a disagree with a task cost estimate with a functional manager

In order to balance the needs of the many stakeholders involved in your project the most desirable method to achieve resolution of conflicts would be **confrontation**.

In order for the project manager to fully and effectively understand a stake holder's personal concerns or grievances it may necessary to **attempt to empathize** with the stakeholder instead of getting involve the project sponsor as an arbitrator.

The integrity of the project manager is often challenged by stakeholders who attempt to use personal power or influence to change the scope of an agreed upon deliverable. In these situations the project manager's most appropriate response would be to **refer the stakeholder to the process for change documented in the approved contrac**t.

Before reporting a perceived violation of an established rule or policy the project manager should **ensure** there is a reasonably **clear** and **factual basis** for reporting the violation.

When no stakeholders agree on the project objectives, this is a **conflict issue**. The best course of action would be to perform a **feasibility analysis** (as this is a problem solving method).

If the sponsor has already reject the funding for an additional work requested by the stakeholder, there is no need to make a second request for an additional work, just tell the stakeholders the scope **CANNOT** be added.

[FASTrack]

{ INITIATING }

Because orders are numerous and of short duration, this situation is a process, not a project.

Deliverables are
- part of the project charter, which is created before the work is completely defined and planning occurs.
- determined in part by the customer
- defined at project onset with the input of project stakeholders

In a predominantly hierarchical organisation, the project Charter is BEST created jointly with management for distribution to potential team members & stakeholders.

Generally, a difference in objectives is resolved in favour of the customer. However, it is the project manager's responsibility to inform the customer of other options.

Stakeholders can be identified **throughout** the project management process groups. However, the earlier stakeholders are identified, the better for the project. If all of the stakeholders' needs and requirements are taken into account before plans are finalized and project work is begun, fewer changes will

be needed later in the project, when they will be more costly.

A feasibility study addresses whether the project should be done.

Manufacturing is generally considered a process, not a project, as it is not temporary. A project charter will not be appropriate here.

A project is temporary and unique. This is an example of a business process that is ongoing and repeatable. Such processes are best managed in a functional organization.

Because a project done in a matrix organization involves people from across the organization, communications are more complex.

The Preliminary Project Scope Statement should include how success will be measured, where as the business needs are in the Project Charter.

{ Framework }
The project manager must facilitate a fair and equitable solution, but the customer is the first of equals.

The MOST appropriate things to do during the Monitoring & Controlling Process group is to facilitate conflict resolution using conflict resolution techniques, to determine individual team member performance.

Manufacturing is generally considered a process, not a project, as it is not temporary. A project charter will not be appropriate here.

On most successful projects, the stakeholders are actively involved in project management plan creation.

By definition, risk is the uncertainty of some aspect of the project.

The MOST appropriate things to do during the Planning Process group is the kickoff meeting.

The PMO determines whether a project supports the organization's strategic plan and can authorize exceptions to projects not linked to the strategic plan.

Requirements must be measurable to ensure they are understood and reachable. This is even more important than resolving a difference of requirements in favour of the customer, because you cannot meet the customer's needs if the requirements are ambiguous.

Management by objectives tries to focus all activities on meeting the company's objectives. If the project's objectives are not in line with the company's objectives, the project may be impacted or cancelled.

{ Integration }
The role of the PMO is defined by its parent organization, can vary from an advisory capacity to full authority over projects.

A lessons learned document describes more than just the decisions made. It should help recall what went right, wrong, progress, etc. on the project.

Once the change has been made, the project manager need to update the documents affected by the change, all of which are included in the project management plan. Then, request CCB involvement.

A project without a charter is a project without support.

Integration is a key responsibility of the project manager.

Only with formal acceptance can the project manager be sure the project work is really complete.

You want the process to be formal so changes don't "just happen." You manage them. You want them documented for historical purposes so there is an audit trail indicating why you made the changes. This is why Change Control System should be created.

Once the Integrated Change Control has already been done, any changes should go to the CCB.

It is important to realize that delays or cost increases do not automatically result in changes to baselines. Changes can be made to the baselines, but only when they are officially approved.

Changes are not listed in the Project Scope Management Plan or in the Project Charter.

The lessons learned can only be completed after all the (technical) work is completed.

Imagine the situation as a fire. First put it out, then find out why it occurred.

Who does each activity is managed with the schedule and Responsibility Assignment Matrix. When each activity is done is managed with the project schedule. A Work Authorization System is used to coordinate when and in what order the work is performed so that work and people may properly interface with other work and other people.

The detailed budget is created by the project manager with input from the team so this cannot be best.

Determining that the project is following policies & procedures is QA, and accepting work results is Scope Verification.

The biggest problem is retaining team members until closure of the project. People start looking for their next project and leave before administrative closure is complete.

{ Scope }
A good WBS identifies each work package so that each can be properly assigned, thus reducing the possibility that the same work will be done by more than one resource.

The WBS helps ensure everyone understands the scope of the work.

The rules of the Delphi Technique are: keep the experts' identities anonymous, do not bring the experts together in the same room, and build consensus.

A team member should have flexibility at the work package level to make some changes as long as they are within the overall scope of the WBS dictionary (used to make sure the team clearly knows what work is included in each of their work packages).

The baseline can be changed with any approved changes.

The WBS allows communication vertically and horizontally within the organization as well as outside the project.

Scope verification focuses on customer acceptance of a deliverable while product verification is focused on making sure all the work is completed satisfactorily.

{ Time }
Getting functional managers to approve will also, indirectly get team members' approval. Remember that the book PMP Exam Prep says to assume a matrix organization. If functional managers knew what each of their people were doing, the timeframe and when they were on the critical path, resource problems would not be as frequent. Approval of the schedule by functional managers provides the most benefits.

If the project qill require redesign after completion of testing, GERT should be use, because GERT is the only diagramming technique that allows loops.

If a project activity on the Critical Path is delayed, then the best thing to do is to compress the schedule.

The activities common to the critical paths are the most likely to change (to be compressed or removed).

The critical path does not change if the scope is the same.

Critical Path deals with schedule, Precedence Diagramming deals with the relationship between activities.

You would pick the activity with the most float so that the inexperienced team member would not delay the project as he is learning.

Milestone reports present the right level of detail for upper management.

Adding a dummy activities on the schedule network, would have no effect on the Critical Path. But, it will add more dependencies on the project, hence more communications.

If there is a major delay on a non-Critical Path activity, there is no need to change the project schedule.
Unless, the delay is more than the activity's float.

{ Cost }
Life cycle costing looks at operations and maintenance costs and balances them with the project costs to try to reduce the cost across its entire life. The life cycle cost will provide the picture of the total cost of the project.

The best method to control cost is to estimate at the beginning of the project and then check costs
against the baseline.

The larger the BCR, SPI and CPI the better.

Funding limit reconciliation most likely will affect the project schedule, since work will need to be moved to when funds will be available.

The project must take into account what will happen after the project is completed. This means that the cost of maintaining the product must be considered as part of the project. The impact of not doing this is the greatest.

Earned value analysis is a great reporting tool. With it, you can show where you stand on budget and schedule as well as provide forecasts for the rest of the project.

The Cost Management Plan contains a description of the WBS level at which earned value will be calculated.

The cost contingency reserves should be added to the base costs of the project to account for risks.
During the risk management process, you determine appropriate cost contingency reserves for risk events. The sum of these reserves should be added to the total project estimate to cover the cost of risk events happening.

Final funding limit reconciliation would have been done after fast tracking.

{ Quality }

Inspections may be conducted at any level including the project team, and at any time throughout the product development. They are used to prevent defects from being delivered to the customer.

Two events that are mutually exclusive cannot happen on the same trial.
Statistical independence deals with two events not being linked.

{ Procurement }

Quality is defined as conformance to requirements. If inspection work is not performed as required in the contract, you are not meeting the project's quality standards.

The only contract that limits fees for large projects with limited scope definition is cost plus fixed fee.

A procurement audit includes what went right and wrong for the purposes of creating historical records and improving future performance.

Changes in resources used would generally not be part of a fixed price contract.

If the item is called a commodity purchase, it means that it is readily available (like purchasing paper for a copy machine) therefore, it is unlikely that the seller misunderstood the Contract SOW. Errors in calculations could always occur, but sellers are particularly careful about errors since errors can severely impact them.

The only way to change the cost plus fixed fee contract is to negotiate a change to the contract, normally in the form of change orders.

No contract statement of work can be developed, and expertise cannot be found internally. CPIF would be an incentive to the vendor to perform on or

ahead of schedule.

It is best to first remind the seller that they are legally bound to continue.

When the seller has more expertise than the buyer, the contract statement of work should describe performance or function rather than a complete list of work. In any case, the contract statement of work should be as detailed as possible.

Submittal is another name for deliverables that are sent during contract administration.

The only way to change the **Cost Plus Fixed Fee (CPFF)** contract is to **negotiate a change to the contract**, normally in the form of **change orders**. Change orders should include an additional fee **if additional work is added** to the contract.

The intent of the contract can be determined by remembering that **words are more binding than numbers**.

Terms and conditions should be the result of a **risk analysis**. This means the project manager has been assigned and has completed the risk management process **BEFORE** the contract is drafted. **Contracts are risk mitigation tools!**

A procurement audit includes **what went right and wrong** for the purposes of **creating historical records** and **improving future performance**.

The contract change control system includes a method for **controlling** cost on the contract.

The first thing you should do is refer to the **contract SOW** to determine what it states, then ask for **a change order** if needed.

From the seller's perspective, the status of a project when the project team has completed ALL the work specified in the contract SOW & the final deliverable has been sent to the customer is that the project is in the **Closing Process** group. This is because formal acceptance **has not been achieved** and other closure activities **have not been performed**. Such closure activities are so critical that a project cannot be finished without them.

Once signed, a contract is legally binding UNLESS it is in **violation** of applicable law.

All contracts, like all projects, have changes. The first step to handling changes that arise on the contracted project is to **analyse the impacts to the project**, just as it would be on a project without contracts or purchase orders. The **change procedures** in the contract must also be **followed** and all changes should be made **formally**. Changes are **requested** through the **Procurement** process and are handled as part of the project **Integrated Change Control** efforts.

A project manager **does not have the authority to issue change orders**, but must request them from the **contracting officer**. A product or service from seller that meets the project manager's needs, but not the quality specifications or other requirements of the contract, should be **refused** or send it back to the seller.

If **NO** contract SOW can be developed and expertise cannot be found internally, then **CPIF** would be an incentive to the vendor to perform on or ahead of schedule.

Negotiations are more effectively centred on **risks** to lower the price than on profit margins.

The best way for a cost estimate for the project, but it is early in the project creation process and there is very little project information, is to provide an **Order of Magnitude** estimate.

Performance reporting involves collecting and disseminating information in order to provide stakeholders with information about how resources are being used to achieve project objectives. This process includes status reporting and progress reporting and forecasting.

It is not common for alternatives to be discussed at the bidder conference. They may be included in bids or proposals and discussed later.

In the middle of the project, a seller tells you that he cannot get the resources to complete the project. In this situation, the seller has NOT breached the contract; he has not failed to meet a deliverable. It says he is having trouble meeting it. Until a breach occurs, you do not need to take legal action. The best thing to do would be to prevent the breach. You could help the seller find other resources. They may be found internally, or you may have a better understanding of the availability of resources in your area.

If you don't have enough labour to audit invoices, you may want to use T&M, FP, or Fixed Price Incentive Fee (FPIF) contract, but NOT Cost Plus Fixed Fee (CPFF). In a CPFF contract the buyer pays all costs. The seller could be charging the buyer for costs that should not be allocated to the buyer. Because of the size and dollar amount of these type of contracts and because the risk to the buyer is great, CPFF contracts need the most auditing.

When the seller on your project abruptly goes out of business, the best thing of do is to hire a new seller immediately under a T&M contract. This is because a T&M contract is usually quick to execute since the contract and scope are brief.

The contract change control system includes a method for controlling cost on the contract.

A breach of contract occurs when part of the contract is not performed.

The customer on a project tells the project manager that he has run out of money to pay for the project. In this situation, the project manager should enter administrative closure.

A procurement audit is essentially a lessons learned. Since all work and closure activities are completed, any results will not change the status of the project from being complete.

The project management is not about making every decision with ALL the team members, but rather involves meeting with the appropriate (responsible) team member.

The procurement process should lead toward formal acceptance of the product of the project.

A decision tree allows you to make an informed decision today based on probability and impact analysis. You can decide based on the expected monetary

value of each of your options. It allows you as well to take into account future events for today's choices.

The only other factor to help determine risk reserves that would come after risk response strategies would be the determination of secondary risks.

Monte Carlo analysis helps determine the probability of completing the project on any specific day, because it computes probabilities of events happening on specific days.

Risk response planning must include the involvement of all risk response owners and possibly others.

Risk response owner does implement contingency plans.

The project manager might be looking for such a trigger and then make sure everyone's plans are in place.

Understand that **NOT ALL** risk is transferred using a contract or the transference of a risk does **NOT remove all** impacts of the risk.

The best way to describe the outputs of Risk Identification is an **understanding of a list of risks & triggers** that are important to be able to **qualify** and/or **quantify** them.

The risk response owner is assigned to carry out **responses** and must keep the project manager **informed** of **ANY** changes.

Contingency Plan is best describes as **planned responses to risk events**.

Risk management cannot proceed **WITHOUT** a prioritized list of risks. The cause of poor risk management is because of **lack of a prioritized list of risks.**

Functional managers **should be included** in the Communication Management Plan, requirements gathering, risk and other areas of project management.

A trend report shows performance over time. A forecasting report looks only to the future. A status report is generally static (relating to a moment in time).

The lack of needed information is causing a manager to suggest more meetings. Too many meetings are a problem on projects. The concept of information distribution is to determine who needs what information and plan how to get it to them.

For a new project manager just hired, to gain the cooperation of others, the the best form of power is formal. Otherwise is reward or expert.

The rule of seven : if you have seven data points in a row on the same side of the mean, statistically the mean has shifted, calling for action to correct the problem.

Inconsistency and nonpredictability are indications that the process is out of control.